ADRIANA BIEDROŃ

COGNITIVE-AFFECTIVE PROFILE OF GIFTED ADULT FOREIGN LANGUAGE LEARNERS

Słupsk 2012

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Akademia Pomorska w Słupsku

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Recenzenci
prof. UŚ dr hab. Danuta Gabryś-Barker
prof. UAM dr hab. Mirosław Pawlak

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Przygotowanie do druku
Magdalena Lindmajer-Borkowska

Projekt okładki
Katarzyna Braun

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Wydawnictwo Naukowe Akademii Pomorskiej w Słupsku
ul. K. Arciszewskiego 22a, 76-200 Słupsk
tel. 59 84 05 378, 59 84 05 375; faks 59 84 05 378
www.wydawnictwo.apsl.edu.pl e-mail: wydaw@apsl.edu.pl

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INTRODUCTION

Foreign language aptitude is a powerful factor which accounts for the largest among all individual variables proportion of individual-difference variation in the outcomes of learning a foreign language. This construct is related to the domain of human cognitive abilities and similar to the psychological construct of intelligence, in that it concerns a wide variety of cognitively-based learner differences and remains an effective predictor of success in different learning situations (Dörnyei, 2005, p. 34). The sources of research on foreign language aptitude can be traced back to differential psychology which tried to investigate the cognitive uniqueness of individuals responsible for a large portion of educational outcomes. The discipline termed as *individual difference research* which emerged as a result of those studies has gained growing popularity among second language acquisition (SLA)[1] researchers in the last decades (Dörnyei, 2005). Owing to new discoveries in the fields of cognitive psychology, genetics and neurology in the last two decades, which afforded scientists new possibilities of research, the construct of foreign language aptitude has been gradually updated and reconceptualised.

Although foreign language aptitude is traditionally associated with linguistic talent or giftedness, empirical research on exceptionally gifted foreign language learners is surprisingly scarce and virtually non-existing in Poland. Among various reasons for this situation terminological problems come to the fore. Since the publication of the well--known review of literature on cognitive aspects of SLA by Skehan in 1998, no contemporary definition of linguistic giftedness taking into account advances in such scientific disciplines as neurolinguistics, psycholinguistics and cognitive psychology has been offered. A notable exception is a breakthrough study by Abrahamsson and Hyltenstam (2008, 2009), which cast new light on the problem of exceptional linguistic giftedness; however, it only initiated a debate on the problem in question, which, undoubtedly, needs further empirical investigation. Due to the complexity of the phenomenon, it

[1] The terms *second* and *foreign language learning*, as well as *acquisition* and *learning* are used interchangeably in this book.

seems that only a joint effort of SLA researchers, neurolinguists and psychologists can solve the problem of exceptional linguistic talent.

The main aim of this volume is to contribute to the ongoing discussion on foreign language aptitude, and, in particular, to focus on cognitive and personality characteristics of gifted foreign language learners. In the light of contemporary research, foreign language aptitude is viewed not as a monolith, but as a conglomerate of a number of cognitive variables (cf. Dörnyei & Skehan, 2003). Accordingly, it is referred to as a set of different abilities in the present volume; however, the classic term *foreign language aptitude* (FL aptitude) is used.

No attempt to analyse the phenomenon of linguistic giftedness can be successfully completed without psychological knowledge of human cognitive abilities and talent development. The contemporary models of giftedness define it in broad terms of intellectual and non-intellectual qualities, as well as biographical details (cf. Gagné, 2000). In line with this theoretical paradigm, the study reported in this book took into account cognitive factors, namely FL aptitude, intelligence and working memory, non-cognitive characteristics, that is personality factors, as well as learning styles and biographical data. The choice of variables submitted to analysis was based on three theoretical and empirical paradigms: (1) the theory of FL aptitude (cf. Carroll, 1993; Robinson, 2007; Skehan, 2002); (2) the theory of cognitive giftedness development (cf. Gagné, 2000; Kerr, 2009; Renzulli, 1986); and (3) the research on accomplished foreign language learners (cf. Abrahamsson & Hyltenstam, 2008, 2009; Birdsong, 2007; Bongaerts, Mennen, & van der Silk, 2000; Ioup, Boustagui, El Tigi, & Moselle, 1994; Smith, Tsimpli, Morgan, & Woll, 2011).

The present book consists of six chapters, the first five of which are intended as a review of relevant theoretical background and the last one presents and discusses the findings of an empirical study conducted on gifted foreign language learners. Chapter One explains basic terms in human cognitive ability research as well as presents the concept of FL aptitude in the broader context of research on human cognitive abilities. The most influential hierarchical and multi-primary-factor models of intelligence, defined as a general cognitive ability, are introduced, with emphasis on Carroll's (1993) *Cognitive Abilities Model*. In the following section, Wechsler's (1939) model of intelligence is introduced with the aim of presenting the rationale for and methodology of cognitive ability measurement. Next, the biological and environmental sources of cognitive diversity are delineated. The present author's intention was to emphasise that the construct of FL aptitude is best described from both psychological and linguistic perspectives.

The main concern of Chapter Two is to present an overview of empirical research on FL aptitude starting from the early period in the 1920s-1930s to the present day. The contemporary view of the construct is based on Carroll's model as well as his famous instrument – the *Modern Language Aptitude Test* (*MLAT*) (Carroll & Sapon, 1959),

which exerted a decisive influence on further research and theory development. The presentation of Carroll's model is followed by the description of other models of FL aptitude and research findings in the 1970s and 1980s, with emphasis on controversies that arose over the concept during the communicative approach era, which resulted in a long-lasting stagnation in FL aptitude research. Nevertheless, the main focus of the chapter is on the contemporary models of FL aptitude which incorporate advances in psycholinguistic and cognitive science research on human cognitive abilities, namely Skehan's (2002) *Processing Stage Model* and Robinson's (2002b) *Aptitude Complex Model.* Subsequently, the chapter presents and discusses selected aspects of research on FL aptitude, including Sternberg's (2002) dynamic model, as well as the theoretical perspective on the impact of native language ability and the age factor on FL aptitude. The chapter closes with an overview of empirical research on FL aptitude in Poland.

Chapter Three explores the findings of selected empirical research on different aspects of FL aptitude, with emphasis on one of the most promising concepts in FL aptitude research, that is working memory. It accords with the contemporary line of research which attributes special importance to two groups of individual differences: analytical abilities connected with intelligence and memory abilities including attentional processes (cf. Dörnyei & Skehan, 2003; Robinson, 2007). Working memory capacity underlies noticing ability and is a crucial factor in SLA. Consequently, Chapter Three focuses on analytical abilities, memory abilities, and the factor of attention and noticing ability. Phonological abilities are discussed with regard to the limitations of working memory capacity. Two subsystems of working memory that are especially significant in SLA, namely the phonological loop and the central executive (Baddeley, 2003) are thoroughly discussed, research findings testifying to the significance of the impact of working memory on the process of learning a foreign language are analysed, and the neurological source of variation in memory is outlined. The chapter finishes with a discussion of the complex relationship between intelligence, working memory, noticing ability and analytic abilities in SLA.

The aim of Chapter Four is to present the most controversial aspects of FL aptitude theory, namely personality variables and other non-purely cognitive factors. The focus of this chapter is on these factors that include a cognitive aspect, specifically openness to experience, conscientiousness, extraversion, agreeableness and neuroticism (the *Five Factor Model*, McCrae & Costa 2003[2]), locus of control, style of coping with stress, emotional intelligence, creativity and motivation, as well as learning styles, including second language tolerance of ambiguity. Learning styles constitute an open-ended category which includes cognitive aspects, personality dimensions, sensory preferences and modality (Dörnyei, 2005). Emphasis is placed on the factor of openness to experience,

[2] Only openness to experience and conscientiousness include the cognitive aspect, but the whole 'Five Factor' cluster was analysed as an integrated model of personality.

which is the most cognitively-based factor of all personality characteristics. In accordance with the line of research which advocates the need for multidimensional studies of individual differences, the *dynamic systems theory* is presented as an alternative paradigm to describe non-cognitive factors in gifted foreign language learners and to supplement classic statistical analysis (cf. Dörnyei, 2009, 2010).

The last theoretical chapter presents the key problem of the volume, that is the research on linguistically gifted foreign language learners. The terms *giftedness* and *talent* are defined, methods of identifying and characteristics of gifted individuals are presented, and the empirical studies on gifted and talented foreign language learners are thoroughly discussed. The case studies of exceptional foreign language learners that are the most often referred to in the literature are described, followed by the description of group studies on accomplished adult foreign language learners. The main focus of the chapter is on Abrahamsson and Hyltenstam's (2008, 2009) multidimensional study which sheds new light on the problem of FL aptitude. Finally, the focus of attention is shifted to the neurological discoveries regarding functional and anatomical differences between brains of learners representing different levels of FL aptitude.

Chapter Six, finally, presents and discusses the findings of a study aimed at examining the relationship between FL aptitude and cognitive factors, personality factors and learning styles in 44 gifted adult L2 learners. The study positions itself among those previous studies that have focused on very advanced foreign language learners who seem to be able to attain a native-like level of L2 proficiency after the critical period (cf. Abrahamsson & Hyltenstam, 2008). The empirical study consists of two parts: the quantitative and the qualitative, the latter of which includes three case studies of the most talented L2 learners. Finally, the research problems and limitations are presented. The book closes with some concluding remarks, suggestions for further research and pedagogical implications. Additionally, a tentative definition of a linguistically gifted foreign language learner is suggested in the concluding section.

Little research addressing the problem of linguistic giftedness has been conducted, and, in particular, very little is known about the cognitive and personality characteristics of exceptionally talented foreign language learners. Because of the lack of research on predictors of FL aptitude, the existence of inconsistent criteria for the selection and methods of investigation and evaluation of gifted L2 learners, and the lack of a contemporary definition of a gifted foreign language learner, the present study should be treated as a contribution to the discussion aimed at shedding some light on this complex phenomenon.

CHAPTER ONE

HUMAN COGNITIVE ABILITIES − BASIC CONCEPTUAL ISSUES

Introduction

FL aptitude is a concept deeply rooted in SLA research tradition, but its evolution has always been significantly affected by the development of cognitive psychology. Recently, the knowledge of human cognitive abilities has expanded owing to new discoveries in related sciences such as cognitive science, genetics and neurology. The discussion of the role of FL aptitude in SLA would be seriously impoverished if applied linguists excluded these important advances from their research studies.

Before exploring the construct, it appears necessary to define basic concepts connected with it, as well as to present its biological and environmental determinants. The chapter will first introduce the basic terms, namely *capacity*, *ability*, *aptitude* and *performance* in order to clarify the terminological confusion. FL aptitude is a set of cognitive abilities, which is not a self-contained unit, but constitutes a part of a general cognitive ability model. Accordingly, the following sections will present the discussion of the concept of intelligence, defined as a general cognitive ability, as well as the most influential hierarchical models of intelligence, that is those proposed by Spearman (1927), Vernon (1950), Cattell (1971), Jensen (1998) and Carroll (1993), and multi--primary-factor models, including those developed by Thurstone (1938), Guilford (1967), Gardner (1983) and Sternberg (1985), with particular emphasis on Carroll's (1993) *Cognitive Abilities Model* which is the most relevant to FL aptitude research. Carroll's (1959) model of FL aptitude is going to be addressed at greater length in Chapter Two. This will be followed by the presentation of the methods of intelligence measurement. At the onset, some space will be devoted to a brief presentation of Binet's (Binet & Simon, 1905) model and test of intelligence. Subsequently, the *Wechsler Intelligence Scale* (1997), which is considered to be the most influential test of intelligence, will be discussed. The focus of the chapter will then be shifted to the biological basis of human cognitive abilities, including genetic and neurological sources of diversity, fol-

lowed by an overview of environmentalists' arguments concerning cognitive ability development in humans.

1.1. Cognitive ability

There is no agreement as regards the definition of cognitive ability. In the psychological literature the term is used with at least three different meanings: *capacity*, *ability* and *performance*. Capacity is a potential human ability. It describes what a human being would be able to do if environmental conditions for his/her development were optimal. Ability reflects the actual potential – what a person is able to do provided environmental conditions and the psychophysical state of his/her body are optimal and the stress level is minimal. Finally, performance stands for the actual level of a task performance, that is the behaviour that can be observed and measured in a given situation. Everybody develops only part of his/her capacities; what is more, only part of them is available for observation and measurement (Nęcka, 2003).

Carroll (1993), an American human cognitive abilities specialist, differentiated the terms *ability*, *aptitude* and *achievement*. He identified ability with performance or potential for performance: "As used to describe an attribute of individuals, ability refers to the possible variations over individuals in the liminal levels of task difficulty […] at which, on any given occasion in which all conditions appear favourable, individuals perform successfully on a defined class of tasks" (1993, p. 8). Carroll emphasised stability of abilities: "An ability can be regarded as a trait to the extent that it exhibits some degree of stability or permanence even over relatively long periods of time" (1993, p. 7). By adding an adjective 'cognitive', Carroll limited abilities to those which are performed on cognitive tasks, that is require the processing of mental information.

Aptitude is a notion close in meaning to ability. To use the words of Dörnyei: "Although some scholars distinguish between ability and aptitude, in typical practice the two are used synonymously" (2005, p. 32). The difference between the terms is that they are used in a different context rather than with a different meaning. Carroll defined aptitude as "A cognitive ability that is possibly predictive of certain kinds of future learning success" (1993, p. 16). He regarded aptitude as a sort of ability, namely a latent trait that is relatively stable and relatively resistant to training, and which refers to the potential for achievement provided instruction is optimal. Therefore, an ability is an aptitude if it predicts the degree and rate of learning. Although Carroll distinguished achievements from aptitudes, he admitted that in some cases measures of achievement can be viewed as measures of aptitude to the extent that they may predict future learning progress.

An updated definition of L2 learning aptitude proposed by Robinson goes beyond purely cognitive factors and extends the term to other individual differences: "Aptitude for learning from opportunities for practice draws on more than cognitive abilities and

involves affective and conative factors, which may also be consistent determinants of an individual's engagement with the L2" (2007, p. 256). Taking into consideration advances in research on such cognitive abilities as working memory, noticing or learning from recasting in the last decades (cf. Robinson, 2002b), it becomes evident that the concept of FL aptitude has changed a lot since its origins and is continually evolving. As Dörnyei (2005, p. 33) rightly remarks, FL aptitude has become an umbrella-term related to a number of cognitive factors creating a composite gauge regarded as the general capacity to master a foreign language. Nevertheless, the concept of FL aptitude is traditionally used in the literature to refer to FL aptitude testing in the general sense, which makes it conceptually similar to another general term – intelligence (cf. Carroll, 1959; Robinson, 2007; Skehan, 2002), which is the focus of the following section.

1.2. Intelligence – a general cognitive ability

There is still no consensus among researchers as regards the definition of intelligence. Sternberg and Detterman (1986) collected experts' views on this term, which revealed that there are three broad groups of definitions of intelligence including: (1) the ability to learn on the basis of previous experience; (2) the ability to adapt to a new environment; and (3) the metacognitive ability, which stands for the awareness of one's mental processes and the ability to control them (cf. Hornowska, 2004; Nęcka, 2003).

In 1997, the journal *Intelligence* published a contemporary 'mainstream' definition of intelligence supported by 52 experts. Intelligence was defined as a very general cognitive ability, which includes the ability of reasoning, planning, solving problems, abstract thinking, understanding complex problems, fast learning and learning from experience (Gottfredson, 1997). Thus, its main characteristic is the ability to cope with novelty and complexity (cf. Nęcka, 2003). What makes the matter even more complex, is the observation that this concept is culture-bound. An analysis of definitions of intelligence in the United States as well as European, Asian and African countries revealed that conceptions of intelligence are varied; especially definitions in Asian and African countries are very different from western concepts (cf. Sternberg, 2004). For example, in India the concept of intelligence can be traced back to philosophical psychology which places emphasis on the analysis, training and development of human mind in order to reach religious enlightenment and release from rebirth. The closest translation of *intelligence* is *Buddhi* which means awareness or consciousness and refers to such spiritual processes as waking up, recognising and understanding. Consequently, in contrast to western concepts, intelligence in Indian philosophy is treated as a process or state, the accomplishment of which depends on effort and motivation of an individual (Baral & Das, 2004, p. 272).

In most western theories general intelligence is recognised as a higher-order factor of human abilities (cf. Carroll, 1993). The theoretical perspective suggests that there are various types of abilities which are different from general intelligence or even a number of types of intelligences (Sternberg, 2002). Most classic as well as modern models of intelligence define it as a set of separate, but correlated abilities. Basically, all intelligence theories can be divided into two groups: *hierarchical models* and *multi-primary--factor models*.

1.2.1. Hierarchical models of cognitive abilities

The most influential theory of human intelligence was *g* theory, referred to as a *two--factor* theory, proposed by Charles Spearman in 1927. A discovery that different ability tests correlate with each other convinced Spearman that there might be one common factor underlying all the variables. By means of factor analysis – a statistical method invented by himself – he analysed intercorrelations between intelligence tests scores in order to identify the sources of individual differences underlying the observed patterns of correlations between these tests. The factor analysis revealed the existence of two factors: the general *g* factor, which saturates all intelligence tests, and a specific *s* factor (or rather a group of *s* factors), present only in single tests. Spearman declared that *g* is a sort of 'mental energy', that is a basic ability of the nervous system to perform tasks. The amount of mental energy which can be allotted to tasks is constant in a nervous system. Therefore, if a task requires more energy, performance on other tasks will deteriorate, but, if the task ceases to absorb energy, it can be allocated to the neglected tasks which can now be performed better. As a result, an individual will always expend the same amount of energy. This 'mental energy' can be associated with the contemporary notion of attention and working memory (cf. Robinson, 2003). According to Nęcka (2003), a leading Polish intelligence researcher, this hypothesis grants Spearman a pioneering position in cognitive psychology which accounts for individual differences in intelligence, memory capacity and attention control.

Spearman's two-factor theory was extended in many hierarchical models of intelligence, of which the most often referred to include: Vernon's (1950) *Hierarchical Model of Intelligence*; Cattell's (1971) *Hierarchical Model of Cognitive Abilities*; and Jensen's (1998) *Two-Level Model* of cognitive ability. Vernon's (1950) model was the first truly hierarchical model of cognitive abilities. It includes the *g* factor, which dominates two lower-order factors: *verbal/educational* and *spatial/mechanical*, which, in turn, dominate various minor group factors, which, in turn, dominate very narrow and specific factors.

Cattell (1971) divided intelligence (*g*) into *fluid* (*Gf*) and *crystallised* (*Gc*). He defined fluid intelligence as the ability to perceive complex relations among symbols and to manipulate them irrespective of their meaning. This intelligence is independent of the

previous experience of a person. The best measures of *Gf* are considered to be abstract tasks, such as number series, matrix problems and abstract analogies. Cattell defined crystallised intelligence, which derives from *Gf*, as the accumulation of knowledge and skills important in a certain socio-cultural context. Ideal tasks measuring *Gc* are tests based on previously-acquired knowledge, such as vocabulary span, reading comprehension and general information. In this estimation, the *g* factor is superior to *Gf* and *Gc*. This model is universally accepted in contemporary psychology (cf. Nęcka, 2003; Sternberg, 2004). *Gf* is a biological endowment – a genetically inherited factor, which, as a result of proper 'investments', such as education and acquisition of knowledge, crystallises to form particular skills. Research results provided evidence that both factors are highly correlated and that *Gf* deteriorates with age, whereas *Gc* develops with gaining knowledge and experience (Hunt, 1998). Cattell, in his *Investment Theory* (1971), assigned a big role to *Gf* in *Gc* development. As the theory states, fluid, inborn abilities are invested into learning the results of which are evident in crystallised abilities. This explains why *Gc* tests, for example measuring lexical knowledge, constitute good measures of *Gf* (Nęcka, 2003). The differentiation between general *g* and fluid *Gf* was challenged by Gustaffson (1984), who, by means of factor analysis, provided evidence that *Gf* is identical with general *g*.

Jensen (1998) regards the *g* factor as a distillate permeating all individual differences in intelligence tests. He attributes individual differences in intelligence to the efficiency of the neural system. Jensen constructed a two-level theory of intelligence. Level I abilities involve the simple registration, storage and recall of sensory inputs − abilities connected with short-term memory tasks. Level II abilities reflect Spearman's *g* factor involving higher mental processes such as reasoning, manipulation of stored inputs, abstraction and problem solving. To conclude, it would seem that there is still no consensus regarding the specificity of the *g* factor; however, a hierarchical model with the *g* factor at the top and a number of other factors submitted to it is the most commonly--accepted model in intelligence theory (Nęcka, 2003, p. 44).

1.2.2. Carroll's (1993) Cognitive Abilities Model

Professor John B. Carroll (1993) in his well-known book *Human cognitive abilities*, introduced a hierarchical model of human abilities based on data obtained between 1927 and 1987 from 130 000 people. He applied a factor analysis which revealed the existence of a three-stratum model: Stratum I includes specific abilities, for example spelling ability and speed of reasoning; Stratum II includes group-factor abilities, for example fluid and crystallised intelligence; and Stratum III reflects Spearman's *g* factor. Carroll recognised 2272 first-order factors, 542 second-order factors and 36 third-order factors. A further step was to group the factors into broad domains; twenty such domains were

recognised including: *general abilities, reasoning abilities, abilities in the domain of language behaviour, memory abilities, attention and concentration abilities, auditory perception abilities* and *visual perception abilities*, among others. As regards the general intelligence factor *g*, *Gc* and *Gf*, they are included in the domain of *general abilities*. The distinguishing aspect of this model is that it not only includes the multiplicity of cognitive factors, but also that it contains non-cognitive factors. As Carroll states, "The first nine of these groups are regarded as representing true cognitive abilities in the sense of being relatively fixed, long-term attributes of individuals respecting the kinds of cognitive tasks they can and cannot perform with varying degrees of success, at a particular stage of development" (1993, p. 137). Other groups include personality characteristics: *interpersonal behaviour, interest and motivation factors*, *personality and affective factors*, and social factors termed as *educational & social status background factors*. It may come as a surprise that knowledge is also present in the taxonomy represented in two domains: *factors pertaining to knowledge of different subject-matters* and *factors pertaining to school achievement.* To sum up, we may say that Carroll's model, which is in some respects similar to Sternberg's (1997) model, constitutes probably the most complex, multileveled and multifactor paradigm of human abilities.

In the domain of language, which was of special interest to Carroll, 367 minor factors are recognised and subsumed under five higher-order factors: *verbal comprehension, language development, spelling ability, phonetic coding* and *vocabulary*. Carroll considers these factors essential in the domain of language; however, his model of language aptitude considerably exceeds the language domain because it includes the reasoning ability and memory. As he argues, "The line between this domain and many others, such as that of reasoning, is difficult to draw. Many factors appear to depend on both language abilities and other abilities, such as reasoning and memory" (1993, p. 145). His famous model of FL aptitude (1959)[3] embraces four factors: *grammatical sensitivity, phonetic coding, inductive reasoning* and *associative memory*, of which only the first two belong to the language domain and are referred to as primary-order factors.

Two groups of factors in the domain of language are distinguished by Carroll as the most significant: *language development* and *verbal comprehension*. The *language development* factor is defined as reflecting general development in spoken native language skills. It is by no means a unitary trait – it contains different components and is dominated by a third-order general intelligence factor. Therefore, language development, according to Carroll, is accompanied by the development of other cognitive abilities and it is likely that there are different trajectories of language development that start at a very early age. It is measured by native-language vocabulary tests, as well as information (knowledge) tests, for example, the Wechsler Intelligence Scale (Wechsler, 1997). Analogically to language development, the *verbal comprehension* factor is dominated by the

[3] Carroll's model of language aptitude is described in Chapter Two, section 2.1.1.

general factor *g*, or the crystallised intelligence factor *Gc*. Given this, it can be concluded that the verbal factor is highly correlated with *g* and *Gc*. Such a correlation is well described in psychological literature (cf. Nęcka, 2003). An important assumption of Carroll's theory is that all language abilities tend to be highly correlated and that their correlation is attributed to the influence of a general higher-order factor of language ability. In addition to FL aptitude, Carroll recognises a number of other factors included in the domain of language abilities such as *lexical knowledge*, *reading comprehension*, *reading decoding*, *reading speed*, *cloze ability*, *spelling ability*, *phonetic coding*, *grammatical sensitivity*, *communication ability*, *listening ability*, *oral production*, and so on. By and large, all primary abilities tend to be subsumed under more general cognitive factors. Carroll emphasises the relationship between language abilities and the intelligence factor: "measures of vocabulary are among the best predictors of general intelligence" (1993, p. 193), and: "It is probable that the level of general cognitive development that is or can be attained by an individual at a given age tends to set limits on the level of language development that can be attained at that age" (1993, p. 194). On the other hand, he depicts language abilities as "enormously complex and diverse and we have seen that there appear to be a series of somewhat separate factors of language ability, reflecting that complexity and diversity" (1993, p. 194). In conclusion, it may be stated that Carroll treats language abilities as separate from the general intelligence factor, but highly correlated with it[4].

1.2.3. Multi-primary-factor models of cognitive abilities

Simultaneously to hierarchical models, which proposed two or three levels of factors hierarchically subsumed under the *g* factor, alternative multi-primary-factor models emerged. The most important are Thurstone's (1938) *Theory of Primary Mental Abilities* and Guilford's (1967) *Structure-of-Intellect Model.* Both theories opt for a number of equal primary factors in human intelligence.

An influential model of intelligence was proposed by Thurstone (1938). His *Theory of Primary Mental Abilities* was different from hierarchical models in that it did not include the superior *g* factor. Thurstone distinguished seven primary mental abilities given equal status: *verbal comprehension*, *verbal fluency*, *number*, *perceptual speed*, *inductive reasoning*, *spatial visualisation* and *memory*. Although not popular nowadays, Thurstone's theory formed the basis for cognitive ability theories especially influential in SLA research, that is those proposed by Gardner (1983) and Sternberg (1985).

Gardner's (1983) model of multiple intelligences proposed that there is no single intelligence factor, but rather a set of independent multiple intelligences. *Multiple Intelli-*

[4] The relationship between intelligence and FL aptitude is described in Chapter Three, section 3.1.3.

gences theory includes ten[5] primary abilities: *linguistic*, *logical-mathematical*, *spatial*, *musical*, *bodily-kinaesthetic*, *interpersonal*, *intrapersonal*, *naturalist*, *spiritual* and *existential*. The existence of the last two is speculative. Basically, the theory aims at identifying a person's profile of natural competencies and trying both to develop these and improve weak points. This theory has been gaining increasing popularity, especially among educators and foreign language pedagogues. Nevertheless, it has met with strong criticism from professional intelligence researchers and, consequently, is rarely treated as a truly scientific theory of human ability for a number of reasons. First of all, since its emergence in 1983, no empirical tests of the theory have been published. Secondly, the theoretical basis of the theory is highly selective and not related to research into intelligence. Thirdly, the inclusion of successive intelligences by its author casts doubt as to whether they are intelligences, or rather specific abilities or interests. Moreover, the theory lacks psychometrically strong assessments, without which it cannot be validated (Sternberg, 2004; Nęcka, 2003).

Sternberg, a persistent opponent of the traditional, psychometric notion of intelligence and specific abilities (1985, 1990, 1997, 1998, 2002, 2004) proposed a *Triarchic Theory of Human Intelligence*. To some extent it is similar to Gardner's theory of Multiple Intelligences (1983), but it proposes that there are three particularly important aspects of abilities: *analytic abilities* used in analysing, judging, comparing and contrasting; *creative abilities* used in creating, inventing and discovering; and *practical abilities* used to implement our knowledge. This theory, as the author claims, might be useful as a basis for matching abilities, instruction and assessment. The theory comprises three subtheories: *the componential*, *the experiential* and *the contextual*. *The componential theory* describes processes involved in human abilities. There are: *metacomponent processes* including *executive processes* used to plan, monitor and evaluate one's activities, *performance processes,* which include encoding stimuli, inferring relations between stimuli and applying rules; and *knowledge-acquisition processes*, which encompass selective encoding, comparison and combination of information. Sternberg found that more intelligent people spend more time on metacomponential planning than less intelligent ones. The *g* factor might be placed within the group of *metacomponent processes*. *The experiential subtheory* refers to the levels of experience relevant to intelligence, namely novelty and automatisation. New activities and problems require acquiring new skills that are first controlled and only later become automatised. Automatisation constitutes a difference between a novice and an expert. Finally, *the contextual subtheory* approaches the components of intelligence from the adaptation perspective. People usually try to adapt to the existing environment or choose a new one (Sternberg, 1997). Thus, this model defines abilities as a conglomerate of knowledge, cognitive strategies

[5] Originally, there were seven intelligences. The last three: *naturalist*, *spiritual* and *existential* were added later (Gardner, 1999).

and experience. Sternberg emphasises the role of an accurate self-assessment of one's abilities. As he points out: "the intelligent person is one who figures out what his or her strengths and weaknesses are and then capitalises upon the strengths while compensating for and remediating the weaknesses" (Sternberg, 1997, p. 351). This controversial theory, not only indicates the dynamic, continuous process of ability development, but also minimises hereditary influences on human intelligence. An important educational implication of Sternberg's theory is that abilities are pliable and modifiable rather than fixed and, as such, can be taught[6]. Consequently, Sternberg criticises traditional intelligence tests as unfair and unsatisfactory measures of human intellectual potential. As he argues: "the general factor of intelligence is probably relevant only when a fairly narrow range of abilities is measured, as is typically the case with conventional tests" (2002, p. 34). However, most contemporary psychologists consider traditional testing of intelligence to be a practical and valid method of assessment (cf. Nęcka, 2003). The measurement of cognitive abilities will be the focus of the subsequent section.

1.3. Measurement of cognitive abilities

The development of knowledge on the subject of human cognitive abilities has been accompanied by its practical application. The main goal of testing intelligence and other abilities is to obtain a diagnosis of an individual's potential for military, educational, occupational, clinical and academic purposes. The first test of intelligence was proposed by Binet (Binet & Simon, 1905). Binet's model of intelligence was based on an assumption that measures of intelligence should focus on individual differences in higher processes, namely memory, imagination, judgement and comprehension. The Binet-Simon test of intelligence was recognised as a major contribution to the assessment of intelligence in Europe and the United States and its adapted versions gained enormous popularity among cognitive ability researchers (cf. Lautrey & Ribaupierre, 2004). Nevertheless, in the field of intelligence testing it is the *Wechsler Intelligence Scale* (1997) that has a leading position.

Since 1934 Wechsler had worked on designing and standardising Intelligence Scale to measure adult intellectual potential. Wechsler proposed an alternative to the dominating psychometric model – a functional model of intelligence. He challenged the traditional psychometric theory of intelligence by claiming that intelligent behaviour must include factors beyond purely intellectual abilities. He stressed the necessity of extending the concept of intelligence which he defined as a global factor including particular abilities and connected with personality. Therefore, he considered single abilities, or groups of abilities, to be a basis for intelligence measurement. Factor analyses of intelli-

[6] Sternberg's model of FL aptitude is described in Chapter Two, section 2.4.3.

gence tests reveal that a large part of variance remains unexplained. This unexplained part can be attributed to motivation, attitudes or personality factors. Wechsler ascribed a significant role to factors beyond the intellectual domain; the abilities to perceive and evaluate social, moral and aesthetical values. In 1939 his book *The measurement of adult intelligence* appeared. Since then, the Wechsler Intelligence Scale has become the most widely used tool to measure intelligence, which revolutionised the concept of measuring cognitive abilities (cf. Hornowska, 2004). His three assumptions: (1) intelligence is a complex factor consisting of different abilities; (2) introduction of deviant intelligence quotient; and (3) differentiation between verbal and performance scales, constitute valid grounds for contemporary intelligence measurement.

The scale consists of eleven tests and is divided into a verbal scale and a performance scale. Therefore, two intelligence quotients (IQ) are obtained, namely verbal and performance, as well as full scale IQ. In the interpretation of the results much importance is attached to disproportions between particular tests results in particular scales, which enables a researcher to conduct a deep, clinical diagnosis of intellect (Wechsler, 1997). Apart from the traditional two-factor solution, three-factor, four-factor and six-factor solutions have appeared. The most up-to-date six-factor solution includes the following factors: *Verbal Comprehension, Perceptual Organisation, Working Memory, Processing Speed, Auditory Memory* and *Visual Memory* (Tulsky, Ivnik, Price, & Wilkins, 2003). In the Polish version of the Wechsler Scale, adapted by Professor Jerzy Brzeziński and his co-workers in 1996, a three-factor solution was applied. The factors include: *Verbal Comprehension, Perceptual Organisation* and *Memory and Resistance to Distraction* (Brzeziński, Gaul, Hornowska, Machowski, & Zakrzewska, 1996).

Wechsler's measure of intelligence is based on deviant IQ. Every person represents a certain intensity (value) of a feature, in this case, intelligence. The scoring is based on a projection of the subject's measured rank on the Gaussian bell curve with a centre value (average IQ) of 100 and a standard deviation of 15. In a normal distribution, the IQ rank of one standard deviation above and below the mean (i.e. between 85 and 115) is where approximately 68% of all adults would fall. In order to know the deviant IQ of an individual we have to determine his/her standard deviation above/below the mean. This method enables us to conclude that a person whose IQ result is, for example, 130 is placed two standard deviations above the mean. That means that his/her result is better than results of 97.7% of a population. A person with the IQ result of 145, that is three standard deviations above the mean, is better than 99.9% of a population with respect to their intelligence quotient. The results below the mean are calculated analogically. In addition, the results are always interpreted according to age norms. Because each test in the battery includes a different number of tasks and a different number of points can be obtained, all the results are expressed on the same scale. A scale, called *scaled scores*, of 19 points with a centre value of 10 and a standard deviation of 3 was established. Thanks to this solution intra-individual comparisons are possible (Hornowska, 2004).

Needless to say, the Wechsler scales are regularly updated and modified. The recent (fourth) edition, WAIS-IV, was released in 2008. The battery includes tests of cultural knowledge, for example, *Vocabulary*, *Comprehension* and *Information*, therefore, in order to ensure test validity, it must be culturally adapted. The aim of cultural adaptation of a test is to achieve a language version that is conceptually equivalent in the target culture (Hornowska, 2004, p. 39). The test is also standardised and normalised to suit the conditions of the target country.

Furthermore, it is a fact that all ability tests have their limitations; accordingly, a researcher has to bear in mind that intelligence tests are constrained to actual performance of the subject and their prognostic value generally refers to domains where deduction and reasoning are important. No measures of intellect can be treated as sufficient predictors of academic or professional success, which is often an outcome of a variety of factors. As Kaufman (2000) cautions us, despite their high prognostic value, especially with respect to school achievement, all ability and aptitude tests better reflect the former rather than the future achievements of a person. Another important problem with testing intelligence is the choice of a qualified researcher. In order to obtain valid results, the interpretation must be done by a professional psychologist as not only the scores, but also other factors such as biographical data, education, health condition and observation of the behaviour of the person while performing the test, must be taken into consideration (*The Psychological Corporation*, 2002).

According to contemporary psychologists, there is no escaping the fact that there are significant genetic contributions to cognitive abilities. To use the words of Plomin: "genetic influence on IQ test scores is not only significant; it is also very substantial" (1997, p. 89). Advances in molecular biology during the past two decades have ushered in a new era in genetic research on cognitive abilities by creating possibilities for identification of specific genes responsible for specific abilities. On the other hand, there is a general consensus among researchers that environment interacts with genetic endowment contributing to individual differences in cognitive abilities (Scarr, 1997). The arguments of behaviour-genetic theorists and socialisation theorists will be discussed in the following sections.

1.4. Biological basis of abilities

The genetic source of variation in human abilities has always been surrounded by controversy. Basically, the debate between behaviour-genetic theorists and socialisation theorists refers to the never-ending *nature or nurture* question. The most radical genetic determinists such as Jensen (1997) and Plomin (1997) provide abundant evidence for the heritability of abilities. Most knowledge about cognitive abilities comes from quantitative genetic research studies on twins and adoption (Bouchard, 1997; Jensen, 1997;

Plomin, 1997). One of the most significant attempts to provide information about hereditary processes and the environment was the *Texas Adoption Project* (Loehlin, Horn, & Willerman, 1997). On the basis of their research, the authors declare that the major contributor to familial resemblance is in the genes. The heritability of IQ is approximately 70%. Parental rearing practices, which are the focus of *Socialisation Theory*, account for no more than 10% of the variation in intelligence. Other factors, such as socio--economic status, cultural background, parents' education and occupation or the number of books in the home account for little or no variation in the IQ of adolescents and adults (Jensen, 1997). Shared family environment has a significant effect, but only at an early age; as children grow up, the effect of the family environment becomes of minor importance. As the researchers conclude, genetic effects increase with age rather than decrease. Bouchard's review of literature on cognitive ability provided a basis for the following conclusion: "No plausible alternative to genetic influence exists to explain the IQ similarity in monozygotic twins reared apart" and "genetic factors are the predominant source of variation in adult measured intelligence in modern Western societies" (1997, p. 153). An assumption underlying this reasoning is that the process of upbringing takes place under a normal range of circumstances. A cumulative body of evidence suggests that *g* cannot be trained and improved. As it reflects individual differences in the neural mechanisms of information processing, it seems to be susceptible to biological, not to pedagogical influences (Jensen, 1997).

Jensen directs attention to the second possible source of variation, that is prenatal stage of development, when small, random (microenvironmental) events occur influencing neural development and resulting in differences in abilities, even between monozygotic (identical) twins. If such small events begin to snowball, it can lead to lowered abilities (Jensen, 1997). Randomness or luck might be considered the third source of variation. Another important assumption is that people seek environments fitting their genotype, which shapes their abilities. As Jensen points out: "People seek out different environments, including friends and activities that are congenial to their nature […]. It accounts for more of the total variance (i.e. individual differences) than was formerly thought" (1997, p. 42).

Quite often there are remarkable differences in abilities observed between one family member and the others. An exceptional talent cannot be explained by the additive effects of genes or differences in upbringing. Jensen presents examples of geniuses such as Beethoven, Ramanujan – a mathematical genius, or the great conductor Toscanini, whose parents, siblings and children revealed no talent at all. Their genius seems to 'come out of the blue'. As Jensen argues, such exceptional talents are a result of an unusual and rare combination of many genes (poligenes), which simultaneously influence a number of different abilities and traits. Such a combination is called *emergenesis* (Jensen, 1997, pp. 43-44). As both parents deliver only half of their genes each to their child, it is very unlikely that such a random half will include the rare combination of genes to

create a genius. It is noticeable that general IQ is not an emergenic trait, whereas exceptional abilities and talents are. However, an above-average level of intelligence is believed to be a critical condition for the development of an emergenic talent. Some psychologists claim that there is a threshold in IQ level, above which it does not have an influence on achievements. Worth mentioning is the observation that intelligence is not equally important in every domain of ability. For example, musical, mathematical and achievements in the field of humanities are connected with IQ, whereas some specific artistic abilities, for example sculpture, are not (cf. Sękowski, 2004).

Another biological basis of individual differences in cognitive abilities is connected with the neural system functioning. As regards the neural system, there are three sources of ability differentiation: neural conduction velocity, neural efficiency and brain volume. As Jensen (1998, 2002) convincingly argues, all the variation in mental performance has a biological basis. He elucidates that there is a negative correlation between the IQ and the reaction time of a person. That means that the higher the IQ level of a person is, the less time he/she needs to solve a problem. His arguments are based on correlations between magnetic resonance imaging (fMRI), electroencephalogram (EEG), event related potential (ERP), emission tomography (PET)[7], and studies of nerve conduction velocity and IQ. Jensen claims that besides the speed of neural conduction, IQ correlates with the efficiency of the process. In other words, intelligent people react not only faster, but also more regularly in comparison to less intelligent ones. This statement is well-evidenced in the literature (cf. Nęcka, 2003). A system that is more efficient, namely more resistant to distraction, produces more regular reactions, which, consequently, shortens the time of reaction as less time is spent on subsequent trials. The biggest advantage of such a very efficient system is a higher level of competence to solve difficult, complex mental problems. Briefly, a system more efficient in transmitting nervous impulses is a more intelligent one.

The fMRI study by Haier et al. (2004) demonstrated that general IQ appears to be based on the volume and location of gray matter tissue in the brain. Many studies have converged on the view that the frontal lobes are critical for fluid intelligence, special role being attributed to the lateral prefrontal cortex (Schoenemann, Sheehan, & Glotzer, 2005). Moreover, the fMRI method has provided evidence that individuals more adept at

[7] PET (positron emission tomography) is used for localisation of different neural functions by means of injection of radioactive tracers. More active brain areas have higher levels of blood flow and, consequently, of the tracer. By creating pictures of the tracer distribution, a neuroscientist can obtain a pattern of brain functioning. fMRI (functional magnetic resonance imaging) gives similar results to PET, but relies on measuring the magnetic resonance signal generated by the protons of water molecules in neurons. ERP (event related potential) is, unlike PET and fMRI, based not on localisation of neural activity, but on the timing of neural events. Electrodes placed on the skin of the scalp record activity of the brain. This technique is based on EEG (encephalography), but has an experimental design (Goswami, 2004, pp. 5-6).

resisting distraction on a demanding working memory task are characterised by both high IQ and increased prefrontal activity (Gray & Thompson, 2004). From the above facts it can be concluded that biological factors significantly determine differences in cognitive abilities. Nonetheless, behaviour-genetic theories have come in for criticism from socialisation theorists who emphasise the dominant influence of the environment on cognitive development.

1.5. Environmental influences

Human cognitive abilities can also be approached from *Socialisation Theory* perspective. Humanism, interactionism and constructivism state that the environment and its influence on cognitive development surpass genetic variance. Grigorenko and Kornilova (1997), adopting as a point of departure Vygotsky's (1896-1934) cultural-historical theory, claim that the mechanisms of cognitive development are highly flexible and social factors play a major role in the process. Vygotsky's (1978) *zone of proximal development* refers to the possible level of change in intellectual development in the process of learning. The process of maturation of cognitive abilities, which occurs in the zone, allows a child to reach subsequent stages of development. This process is possible with the help of a teacher. This theory resonates with Sternberg's *Triarchic Theory of Human Intelligence* (1998, 2002) in that it assumes the dynamic, interactive nature of cognitive abilities. Another viable argument of socialisation theorists is that only part of human potential can be observed and measured. In line with Ceci (1996; Ceci & Liker, 1986), heritability coefficients may be overestimated because they refer only to the actualised genetic potential. It is not known how much unactualised potential exists in a person and, consequently, what a person would be able to do provided conditions were favourable.

There have been numerous attempts to increase the IQ level by training or other kinds of intervention. For example, Eysenck and Schoenthaler (1997) argue that supplementation of diet by vitamins and minerals affects children's cognitive development. Supplementation seems to affect only fluid intelligence and the effects are more noticeable for younger than for older children. As a matter of fact, the benefits of supplementation are detectable only when there are deficiencies in the level of vitamins and minerals in spite of an adequate calorie intake; in the case of proper nutrition no increase in intelligence is observed. Although the results seem promising, there are still many doubts regarding such problems as, for example, which nutrients should be supplemented, whether the degree of improvement is proportional to the degree of deficiency, and, most importantly, whether this kind of intervention has long-term effects.

Jaeggi, Buschkuehl, Jonides and Perrig (2008) have attempted to increase fluid intelligence by training. The researchers claim that, in contrast to previous studies, there

occurs an observable transfer from training on a demanding working memory task to measures of *Gf*. This transfer is observed even if the trained task is completely different from the intelligence test itself. Moreover, the extent of gain in intelligence depends on the amount of training. Nevertheless, given the scarcity of studies on trainability of intelligence, especially fluid intelligence, it is not surprising that behaviour-genetic theorists recommend caution about interpreting their findings and offering generalisations on their basis (cf. Hunt, 1997; Scarr, 1997). The experiments devised to increase fluid intelligence by training or diet supplementation fit in with another intelligence theory − the so-called *Flynn effect* (Flynn, 2007).

The IQ level in the humankind seems to be rising. The *Flynn effect* (Flynn, 2007) accounts for the observed rise in the average IQ scores in many populations. The average rate of progress has been three points per decade since the early 20th century. Explanations for this phenomenon include such civilisation achievements as improved nutrition, smaller families, better education, more complex environment and technological development. However, it is disputed whether these changes in scores reflect real changes in intellectual abilities or rather methodological differences between past and present testing.

Summing up, the arguments advanced by the adherents of Socialisation Theory lack strong scientific evidence. As Hunt states: ”Most of the clash between culturist and behaviour-geneticist arguments […] is not a contest between scientific models; it is a clash between scientific models and world views” (1997, p. 538). Humanistic arguments are presented in the literature as subjective interpretations of personal experiences and arguments based on selected examples of situations in the world. In contrast, behaviour--geneticists present psychometric evidence based on research on 4 672 pairs of identical twins and 26 473 pairs of siblings reared together or apart (Loehlin et al., 1997). The IQ correlation for identical twins reared together is .90; for identical twins reared apart it is .79, whereas for biological siblings reared together it is .47. What is more, in the case of adopted siblings the correlation is as low as .02. The fact that the power of genes is significant and irrefutable must be accepted. Still, even the most radical adherents of genetic determinism admit the role of other, non-genetic factors in human ability development. What is more, not only IQ and other cognitive abilities determine academic and life successes, which are always a function of multiple and various factors. The question is not *if* the environment affects cognitive development, as it is evident that it does, but *what* sort of influence in this relationship occurs. Scarr’s (1997, pp. 36-37) assumption is that socialisation researchers should not be content with saying that intelligence and environment interact, which merely restates what is obvious. Socialisation Theory needs to be tested scientifically and to be freed from the demands of various kinds of advocacy.

Conclusion

This chapter set itself two main goals. The first one was to introduce basic terminology connected with human cognitive abilities, as well as to depict the concept of FL aptitude against the background of intelligence research. The second goal was to present the clash of the arguments advanced by behaviour-geneticists and environmentalists in the ardent *nature or nurture* discussion about the origins of human abilities. Given the fact that the psychology of human cognitive abilities is an extended domain, the description of which is beyond the scope of this book, it was decided to limit the presentation to the aspects which are viewed as the most relevant to the topic. The consecutive sections of the chapter presented an overview of the basic terms connected with the domain, the changing views on intelligence, the specificity of the Wechsler Intelligence Scale (1997) and the genetic/neurological *versus* environmental sources of cognitive diversity. Psychology provides many interesting insights into the individual differences research in SLA, the value of which cannot be overestimated (cf. Dörnyei, 2005, 2009). Therefore, the present author's intention was to emphasise the claim that the concept of FL aptitude is best described from both psychological and linguistic perspectives. The following chapter will focus on empirical research on FL aptitude, presenting the development of FL aptitude tests, FL aptitude models and controversies related to this concept, which eventually led to its reconceptualisation.

CHAPTER TWO

FOREIGN LANGUAGE APTITUDE − A REVIEW OF EMPIRICAL RESEARCH

Introduction

Similarly to the research on intelligence, early research on FL aptitude focused on testing this factor to predict the learner's rate of progress in learning a foreign language for specific purposes. Carroll's (1959) model of FL aptitude and his famous tool, the *Modern Language Aptitude Test* (*MLAT*), became a milestone in FL aptitude testing and the most often referred to paradigm by both past and contemporary researchers. In the same way, like the classic Wechsler Intelligence Scale (1939), which is regarded as the most efficient tool for measuring intelligence, the MLAT is still considered to be the best tool for measuring FL aptitude.

The opening sections of this chapter will present the beginnings of FL aptitude research and testing, with emphasis on Carroll's (1959) model and the MLAT. Next, the most popular tools, for example the *Pimsleur Language Aptitude Battery* (*PLAB*) (1966) or the *VORD* (Child, 1973) will be briefly described. This will be followed by the discussion of the research in the 1970s and 1980s and the criticism of the construct resulting mainly from the advent of communicative teaching. The focus of attention will then be shifted to contemporary models of FL aptitude, namely Skehan's (1998) *Processing Stage Model* and Robinson's (2002b) *Aptitude Complex Model*. Then, Sternberg's (2002) view on FL aptitude as a dynamic concept will be outlined. In the next two sections three modern FL aptitude tests, namely the *Cognitive Ability for Novelty in Acquisition of Language* (*CANAL-FT*) (Grigorenko, Sternberg, & Ehrman, 2000), the *Llama Language Aptitude Test* (Meara, 2005), and the *High-Level Language Aptitude Battery (Hi-Lab)* (Doughty et al., 2010) will be presented. The subsequent two sections are intended as an overview of the empirical research aiming to investigate the impact of native language ability and the age factor on FL aptitude. The chapter will end with a review of empirical research on FL aptitude in Poland from the 1970s to the present day.

2.1. The history of foreign language aptitude research and testing

Throughout the history of FL aptitude research, there have been numerous attempts to construct tests for the purpose of measuring this concept. The first of these date back to the first half of the twentieth century and regarded aptitude as a unitary concept. The first efforts to measure FL aptitude were made in the 1920s and 1930s. A number of foreign language prognosis tests appeared, which relied on ability and achievement in the individual's native language or included short exercises in an invented language. They were generally paper-and-pencil tests, which tended to have high correlations with intelligence tests, such as, for example, the *Luria-Orleans Modern Language Prognosis Test* (Luria & Orleans, 1928, as cited in Carroll, 1981). The underlying philosophy of the test constructors was that foreign language learning was an intellectual exercise drawing on specialised talents. This reasoning reflected the premise of the then popular *Grammar Translation Method*. After the Second World War, with the development of the *Audio-Lingual Method*, new tests were constructed for military purposes. Basically, they were similar to the earlier tests, but usually included tape-recorded material. For example, the *Army Language Aptitude Test* (*ALAT*) was devised in 1957 (Carroll, 1981). Nonetheless, the best-known test of FL aptitude is the Modern Language Aptitude Test (MLAT) (Carroll & Sapon, 1959) based on Carroll's (1959) four-factor model of FL aptitude.

2.1.1. Carroll's (1959) foreign language aptitude model

The contemporary concept of FL aptitude is based on the definition proposed by the founder of the notion Professor John B. Carroll, according to which: "[...] there exists such a thing as aptitude for learning foreign or second languages, [...] aptitude can be measured, [...] measurements of aptitude can be useful in a variety of ways in connection with the teaching and learning of foreign languages" (Carroll, 1981, p. 83). Carroll referred to FL aptitude as "[...] the individual's initial state of readiness and capacity for learning a foreign language, and probable degree of facility in doing so [...]" (1981, p. 85). FL aptitude was described as a latent factor that is fixed, innate, relatively stable, separate from motivation and interest, different from verbal intelligence, and manifests itself only indirectly in the process of learning and performance. Even though Carroll considered the concept to be relatively fixed and hard to modify, he seemed to be open to the possibility of dynamics and development of FL aptitude (1981, 1990). Carroll distinguished aptitude from achievement, but admitted that aptitude measures are partly measures of some kind of achievement because the results of both tests are dependent to some extent on past learning. It should be borne in mind that Carroll's vision of FL aptitude was clearly restricted to the rate and ease of learning, not to the ultimate achievement. As he explained, "It may be that all people, or practically all of them, can and do

achieve a satisfactory degree of mastery of a second language when the situation demands it, but it could also be true that they differ in the ease or rate of achieving that mastery" (Carroll, 1981, p. 86).

In terms of structure, Carroll (1981) described FL aptitude as consisting of four, relatively independent subcomponents:

1. *Phonetic coding ability* − the ability to make sound discriminations and, more importantly, to analyse and code unfamiliar sounds in a way that makes retention and successful retrieval after a time interval possible. This ability involves coding, assimilation and remembering of phonetic material. Carroll suggested that this ability is associated with mimicry ability, which requires a subject to mimic a strange sound accurately. He considered this ability difficult to modify through training;
2. *Grammatical sensitivity* − the ability to identify and understand grammatical functions performed by words in sentences. This ability is considered passive as it is concerned with the recognition of the function of a given material, rather than an explicit representation. It is connected with an awareness of grammatical relationships;
3. *Inductive language learning ability* − an aspect of general reasoning capacity enabling learners to make generalisations and extrapolate from input to produce new sentences. This ability is perceived as active because it refers to the ability to examine a corpus of language material, notice and identify patterns;
4. *Associative memory* − the ability to form associations in memory between stimuli and responses, for instance, native language lexical items and target language equivalents and to strengthen such connections. This ability is of special importance in vocabulary development, which is an essential part of foreign language learning (Carroll, 1981, p. 105).

In 1959, John Carroll and Stanley Sapon developed the Modern Language Aptitude Test (MLAT) as a result of a five-year research study conducted in 1953-1958 at Harvard University. The foundation of the MLAT were the results of factor analyses of a number of individual characteristics that were believed to contribute to foreign language learning. All of the detected factors, namely phonetic coding ability, grammatical sensitivity, inductive learning and memory are present in the scales of the MLAT[8] (Grigorenko et al., 2000). This test began a new era in FL aptitude research. As the authors describe it: "MLAT has been designed chiefly to provide an indication of a foreign language. It is particularly useful in predicting success in learning to speak and understand a foreign language, but it is also useful in predicting success in learning to read, write, and translate a foreign language" (Carroll & Sapon, 2002, p. 3). The MLAT is a battery valid for literate native and near-native speakers of English and predicts the

[8] According to some researchers inductive foreign language learning is not reflected in the MLAT (cf. Parry & Child, 1990).

rate and ease of learning of both modern and ancient languages. The examinee's raw score is transferred to the tables of percentile norms.

The MLAT is designed to measure certain abilities of an individual, which are prerequisites for success in learning a foreign language. It is impossible to deduce from the score what part of these abilities is inherited and to what extent it has been affected by the previous learning experience. On the other hand, according to the founders, FL aptitude components are not susceptible to training "and even if they are, they do not transfer to increased efficiency or success in learning foreign languages" (Carroll, 1993, p. 673). What is more, language training has little effect on scores; at least the MLAT does not reflect previous language learning which might, nevertheless, have an effect on the subsequent foreign language learning outcomes. Like all cognitive aptitude tests, the MLAT is "a measure of the individual's *present status* with respect to this particular ability, but as such it is a useful predictor of future success" (Carroll & Sapon, 2002, p. 23). Success in foreign language learning depends in most part on a special cognitive talent, or a collection of talents. This cluster of abilities is largely independent of intelligence, motivation and attitudes. Therefore, FL aptitude, although connected with more general cognitive abilities, constitutes a distinct aspect of cognitive development.

The battery (Carroll & Sapon, 2002) consists of five subscales, which can be described as follows:

- Part One: *Number learning*. This part measures one aspect of the memory component of FL aptitude, but additionally it reflects a special auditory alertness factor, which plays a role in auditory comprehension of a foreign language. Moreover, it partly measures inductive learning ability, a component of FL aptitude the most weakly represented in the MLAT;
- Part Two: *Phonetic script*. This part measures the sound-symbol association ability, that is the ability to learn correspondences between speech sounds and orthographic symbols. It is also supposed to measure memory for speech sounds. This measure correlates highly with the ability to mimic speech sounds and sound combinations in a foreign language;
- Part Three: *Spelling clues*. This part partly measures the examinee's native vocabulary knowledge and partly some kind of sound-symbol association ability, but to a lesser extent than Part Two;
- Part Four: *Words in sentences*. This part measures grammatical sensitivity and has particular relevance to the ability to learn the grammatical aspects of a foreign language. No grammatical terminology is present, so no metalinguistic knowledge is required from the examinee; however, the result may reflect the formal training of grammar;
- Part Five: *Paired associates*. This part measures the rote memory aspect of FL aptitude.

As far as the intercorrelations of the parts are concerned, the coefficients of intercorrelations are low, which indicates that the separate parts measure different, unique aspects of FL aptitude.

The authors (Carroll & Sapon, 2002, pp. 20-21) suggest various uses of the MLAT in the selection and placement of learners:

- *Selection.* The MLAT predicts the speed and ease of learning, not the ultimate attainment, given sufficient time; therefore, it is not a suitable tool to predict if a learner is able to learn a foreign language. Instead, it is designed to predict if a learner can learn a foreign language in typical foreign language courses in the usually allotted time;
- *Guidance*. The MLAT can be used to gain an estimate of a learner's probability of success in learning a foreign language provided sufficient motivation and interest. However, it is suggested that if the score is very low, the learner is unlikely to succeed under any condition;
- *Placement*. Learners representing different aptitude levels can be assigned to different sections to match their abilities;
- *Diagnosis of learning abilities*. The MLAT is believed to be an efficient tool for diagnosing learning difficulties. Low scores on different parts of the MLAT may indicate different learning problems. For example, low scores on Part 2 mean that the learner will have difficulty learning the sound system of a foreign language, whereas low scores on Part 4 indicate problems in learning grammar.

As the authors claim, the individual's aptitude for learning a language is the same for all language families. Studies of the validity data (Carroll & Sapon, 2002) demonstrate that the predictive validity of the MLAT is not correlated with a specific language. Although the highest validities were noted for Indo-European languages using the Roman alphabet, the authors conclude that the MLAT is as valid for such languages as French or German, as for Chinese or Japanese. Different degrees of success in learning can be accounted for by differences in motivation, interest, teaching method and other factors. It is worth mentioning that studies of predictive validity of the MLAT under different learning conditions and in different teaching methods have provided evidence that there is no systematic fluctuation of validity depending on teaching methodology (Carroll & Sapon, 2002, p. 26). Other variables, namely age and gender, appear not to affect the MLAT score in a consistent way; however, girls seem to achieve higher scores, especially at higher levels of linguistic proficiency. The MLAT has become the basis for many adaptations for special groups or speakers of other languages. For example, Carroll and Sapon (1967) devised a version for children and Gardner (1965) developed a version for the blind. There have also been versions devised for speakers of Italian, French, Spanish, Turkish and Japanese, among others. As Carroll (1981) acknowledges, his test has often been used in SLA research as a control variable in predicting course marks, learning rates and other variables.

Beyond question, the four-component view of FL aptitude proposed by Carroll (1959) on the basis of his findings as well as his famous measurement device, the MLAT (Carroll & Sapon, 1959), have become a foundation for all subsequent FL aptitude research, resulting in the development of other FL aptitude tests, such as those devised by Pimsleur (1966), Horne (1971), Child (1973), Petersen and Al-Haik (1976), Grigorenko et al. (2000), Meara, Milton, and Lorenzo-Dus (2002), and Doughty et al. (2010), among others.

2.1.2. Pimsleur's (1966) Language Aptitude Battery

Pimsleur (1966) proposed his model of aptitude as composed of three factors:

1. *Verbal intelligence*, comprising the ability of logical reasoning about verbal material;
2. *Auditory ability*, which is the ability to receive and process acoustic information;
3. *Motivation* − an extra factor, which constitutes the major distinction between Pimsleur's and Carroll's views on aptitude.

Verbal intelligence is conceptually similar to Carroll's (1959) *Grammar sensitivity* and *Inductive language learning ability*, whilst *Auditory ability* resembles the construct of *Phonetic coding ability*. In 1966 Pimsleur constructed the Pimsleur Language Aptitude Battery (PLAB) regarded as a reliable and influential instrument comparable to the MLAT and particularly appropriate for the junior high school level. The battery (Pimsleur, 1966) consists of six subscales, which can be described as follows:

- Part One: *Grade point average*. This part includes the examinee's past academic achievements in English, history, mathematics and science;
- Part Two: *Interest in foreign language learning*. This part measures the degree of interest in studying a foreign language;
- Part Three: *Vocabulary*. This part measures the examinee's native vocabulary knowledge in a multiple choice format. The examinee must choose the correct synonym form from four alternatives;
- Part Four: *Language analysis*. This part measures inductive language learning ability. The examinee is presented with a list of phrases in an artificial language and their English equivalents, and then asked to choose the correct translation of an English sentence from four alternatives;
- Part Five: *Sound discrimination*;
- Part Six: *Sound-Symbol association*. Parts Five and Six measure phonetic coding ability. Both are listening tasks in which the examinee must indicate which word he/she has heard.

Besides the inclusion of motivation in the battery, there are some other differences between the MLAT and the PLAB. The PLAB places greater emphasis on the auditory

factor, whereas the MLAT puts more emphasis on memory. Another difference is the item *Grade point average* in the PLAB, which includes data about the past academic achievements of a student. The test also contains the language analytic ability factor measured by performance on a test in an artificial language. The PLAB does not, however, include an effective tool for measuring memory. Phonetic coding ability is represented in the subtests *Sound discrimination* and *Sound-Symbol association*, whereas inductive language learning ability, which is poorly represented in the MLAT, is measured by the subtest *Language analysis*. Concurrent validities for the PLAB range from .44 to .79 for the total score (Carroll, 1981, p. 94).

Although the MLAT and the PLAB have become "by far the most widely used and referred to" (Dörnyei, 2005, p. 35) FL aptitude tests in FL aptitude research, the process of their construction has come in for criticism. Carroll and Sapon (1959) as well as Pimsleur (1966), in line with the rules binding in the study of cognitive abilities in the 1950s and 1960s, constructed the tests following a trial-and-error, assessment-driven process of selecting a set of tasks that effectively discriminated between groups of learners with respect to their abilities. One of the most serious objections was that the process of construction was not grounded on any theoretical framework; instead, the choice of the tasks was based on intuition about their discriminative power (Dörnyei, 2005). Even with these factors taken into account, the MLAT and the PLAB are still considered to be the most reliable tools for predicting foreign language learning outcomes (cf. Ehrman, 1998; Sawyer & Ranta, 2001; Sparks & Ganschow, 2001). In support of this statement, Ehrman (1998) reports on a study examining the biographical, motivational, attitudinal, personality and cognitive aptitude variables among 1000 adult students. The MLAT general score proved to have the highest predictive validity. As far as the subscales are concerned, Part 3, that is *Spelling clues* was the strongest predictor of success. Ehrman assumes that this part might be an indicator of general intelligence, encompassing fluid intelligence, since the task requires cognitive restructuring, as well as crystallised intelligence, highly correlated with vocabulary knowledge. As she concludes, "The MLAT remains the best predictor of the variables examined" (Ehrman, 1998, p. 31). Moreover, the MLAT appears to be the strongest predictor of extremes, that is extremely good and extremely weak foreign language learners. What is more, the MLAT score correlates significantly with the number of languages previously learned by the participants (Ehrman, 1998).

2.1.3. Other classic tests

There have been numerous attempts to create other FL aptitude tests, which were usually designed for government agencies or the military such as the *Army Language Aptitude Test* (*ALAT*) (Horne, 1971), the *York Language Aptitude Test* (Green, 1975), the *Defence*

Language Aptitude Battery (*DLAB*) (Petersen & Al-Haik, 1976), devised for military purposes, the *Aptitude Test for Studies in Modern Languages* (Trost & Bickel, 1981), the *German Aptitude Test* (Miller & Philips, 1982), and the *VORD* (Child, 1973), also designed for the army. The most popular tests, namely the Army Language Aptitude Test (ALAT) (Horne, 1971), the VORD (Child, 1973) and the Defence Language Aptitude Battery (DLAB) (Petersen & Al-Haik, 1976) are briefly described below.

Army Language Aptitude Test (ALAT) (Horne, 1971)

This test was developed and validated in the late 1950s to predict foreign language learning outcomes, in particular regarding the ability to speak and read Western Indo--European languages. The development and validation of the ALAT was described by Horne (1971). The test contains 57 items based on an artificial language of the Western Indo-European type, but with syntax similar to English. The test does not include a memory aspect (Parry & Child, 1990).

VORD (Child, 1973)

The VORD was constructed to measure the ability to learn grammar systems of languages structurally different from English and similar to Turkish. It relies mainly on grammatical analysis. The battery consists of several items that aim to measure the capacity to analyse nominal and verbal morphology as well as the syntactic organisation of a sentence. The test reflects two main aspects of FL aptitude: grammar sensitivity and inductive language learning ability (Child, 1998; Parry & Child, 1990).

Defence Language Aptitude Battery (DLAB) (Petersen & Al-Haik, 1976)

The battery, similarly to the PLAB, stresses the auditory factor as well as the capacity to infer the structure of an artificial language. The DLAB includes items that are intended to measure the ability to form language concepts from pictures, make sound-symbol associations, master grammar and learn foreign language sounds through utterance identification, recognition of vowel patterns and recognition of stress patterns (Grigorenko et al., 2000).

All the above-described tests emerged from psychometric tradition, are theoretically and empirically based and generally regarded as valuable tools for measuring FL aptitude. They were found to have similar predictive validity (Parry & Child, 1990). The

correlations between different tests subscales and tests of language proficiency range between .27 and .73 (Grigorenko et al., 2000). However, there is empirical evidence that none of the instruments could equal the MLAT in predictive validity. For example, Petersen and Al-Haik's (1976) test, the DLAB, which supposed to differentiate higher aptitude students to compensate for the plateau effect of the MLAT, turned out not to be higher in its predictive validity than the MLAT. It may come as a surprise that the author of another test, the VORD, having examined and compared it to the MLAT, admitted that "MLAT was the best overall instrument for predicting language-learning success" (Parry & Child, 1990, p. 52). In conclusion, it may be stated that the research on FL aptitude in the second half of the 20th century was substantially motivated by Carroll's (1959) model of FL aptitude. Research on FL aptitude in the 1970s and 1980s will be presented in the next section.

2.2. Research in the 1970s and 1980s

Research on FL aptitude in the 1970s, 1980s and the beginning of the 1990s was relatively scarce due to general tendencies in language teaching methodology emphasising the communicative approach and minimising the role of individual differences. The most significant research studies were, for example, those conducted by Niżegorodcew (1975), Wesche (1981), Wesche, Edwards and Wells (1982), Schneiderman and Wesche (1986) and Skehan (1986, 1989), but they generally continued and elaborated on Carroll's (1959) work. An important position that directed attention to the problem of individual differences was *Individual differences and universals in language learning aptitude*, edited by Diller in 1981. The author's purpose was to re-examine the concept of FL aptitude from psycholinguistic (Carroll, 1981; Krashen, 1981a; Wesche, 1981), neurolinguistic (Obler, 1981; Walsh & Diller, 1981) and philosophical (Leiber, 1981) perspectives.

A fundamental issue taken up by Wesche (1981) was the interaction between learner individual differences and foreign language instruction. She conducted research in which learners representing different profiles, that is analytic-oriented or memory-oriented, were matched with different teaching methodologies. Having interpreted the results, she concluded that students perform better if the learning context matches their learning profile. Moreover, she analysed FL aptitude components with respect to learning problems that learners might display and suggested practical solutions. Wesche also proposed that it would be useful to distinguish auditory ability from phonetic coding ability. The former seems to be the result of hearing loss – a problem which can interfere with the SLA process. Her study was a milestone in FL aptitude research as it demonstrated the practical, diagnostic value of aptitude tests in tailoring courses to students' needs, as well as directed attention to potential problems of students exposed to different types of instruction.

A significant attempt to explain the neurological basis of the human faculty of language was made by Walsh and Diller (1981). They suggested, in line with Carroll and Sapon (1959) and Pimsleur (1966), that "cognitive abilities continue to rise markedly after puberty, especially scores on language aptitude tests, which continue to rise at least into one's mid thirties" (Walsh & Diller, 1981, p. 16). The rise was particularly observable in grammatical sensitivity or grammatical reasoning. The assumption they made was that "plasticity of local neuronal circuitry is the factor, which enables cognitive development to continue into adulthood" (Walsh & Diller, 1981, p. 16).

The problem of differentiation of the activation of brain regions in SLA, which is still, after thirty years, surrounded by controversy was addressed by Obler (1981). She postulated right hemisphere participation in SLA, particularly active during the early stages of learning: "thus these right hemisphere skills appear to be necessary in L2 acquisition" (Obler, 1981, p. 58). Hence, she opted for differential lateralisation of the language in a bilingual. Also, the probability of different lateralisation with reference to the level of proficiency was raised. At first, the weaker L2 is more right-hemisphere organised, but, as the level of proficiency increases, it starts to be more left-lateralised (like the L1). It should be remarked that contemporary neurological research using the method of fMRI has generally confirmed this line of reasoning, which is described in the literature under the term *convergence*[9] (cf. Indefrey & Gullberg, 2006). Despite the validity and practicality of research on FL aptitude, the concept met with resistance from the adherents of communicative approach, which inhibited its development. The controversies surrounding the concept will be the focus of the following section.

2.3. Controversies surrounding the concept

The study of FL aptitude was perceived as invalid and unjustifiable for a number of reasons. In 1981, Carroll expressed his concern about the individual differences research in the following way:

> I am aware that the concept of aptitude – especially if it is conceived as native aptitude – is somewhat out of fashion these days, but I persist in believing that aptitude is a valid concept, highly worthy of scientific examination and study, and sufficiently powerful to serve as a basis for practical uses of aptitude measurements (Carroll, 1981, p. 83).

[9] Convergence is a process whereby the representations of two languages in the brain become more similar as a function of increasing proficiency or time (Indefrey & Gullberg, 2006, p. 4).

As Skehan (1989, 1998) and Dörnyei (2005) explain, a concern for variation among learners threatened the power of universalist position on the one hand, and the communication-oriented approach, on the other.

Much critique of individual differences research was, in fact, based on an assumption that it is unfair and undemocratic to differentiate people with respect to their abilities because it lessens the value of individual effort. As Dörnyei and Skehan explain: "[...] aptitude is perceived as anti-egalitarian, in that if a fixed, immutable interpretation of aptitude is taken, it is seen as potentially disadvantaging many learners, with no hope offered of overcoming the handicap of low aptitude" (2003, p. 593). This argumentation, based on rather emotional than scientific reasoning, met with a reply from SLA researchers. Skehan (1989), for example, tried to elucidate that the knowledge of the capabilities of our learners enables us to design courses effectively and to modify teaching strategies to respond to mixed-ability classes needs.

Neufeld (1979), a persistent critic of aptitude, argued that everyone is equipped with a general language learning ability; therefore, attempting to measure differences in FL aptitude is baseless. In his opinion, the construct is neither fixed nor innate and all differences in SLA outcomes should be ascribed to social factors. He also stressed the fact that it cannot be determined with certainty what is actually measured by means of aptitude tests. In contrast to most researchers (cf. Skehan, 1998), he interpreted the cases of people who successfully learned a foreign language after the critical period as arguments in support of the hypothesis that everyone has the potential to master a foreign language to a native-like level.

Another argument promoted by the opponents of the concept stressed the superiority of other factors, such as motivation and attitude (Gardner, 1985; Gardner & Lambert, 1972), personality and attitude (Hubbard, 1975), cognitive style (McDonough, 1981), and the degree of acculturation (Schumann, 1978) over aptitude in predicting achievement. These arguments have never been empirically proved; on the contrary, a body of evidence has accumulated that it is aptitude that contributes the most to foreign language learning outcomes, having only one contestant – motivation. Much of the discussion about the significance of individual differences concerns the percentage share of individual differences in SLA outcomes and can be briefly summarised as "the correlational challenge" (Dörnyei & Skehan, 2003, p. 589). The correlations between FL aptitude and proficiency scores reported by Carroll (1981) and Skehan (1989) were very high: .40-.60 and .50-.70, respectively. A similar contribution was reported by Ehrman and Oxford (1995), who found that aptitude measures the most strongly correlated with proficiency, explaining 25% of the variance. In 1998 Ehrman reported predictive validity correlation across a number of studies between .42 and .62 for most languages. The conclusion is that two individual differences, namely FL aptitude and motivation "have generated the most consistent predictors of second language learning success" (Dörnyei & Skehan, 2003, p. 589). According to Dörnyei and Skehan (2003), correlation between FL apti-

tude and language achievement ranges from .20 to .60, with a median value around .40. Thus, aptitude is a strong predictor of SLA outcomes. As Dörnyei and Skehan argue: "[...] no other potential predictors of second language learning success consistently achieved such levels" (2003, p. 589).

There are also other, more down-to-earth, factors that contributed to the unpopularity of research on FL aptitude. One of them was the interest of big publishing companies producing many new course-book series for commercial purposes. These course-books authors assumed that all learners are the same and learn at the same pace, downplaying individual variation (Dörnyei & Skehan, 2003). Hence, business imposed artificial homogeneity on second language learners.

Finally, Krashen (1981a, 1981b, 1982) marginalised the role of FL aptitude claiming that it may be relevant only to formal learning based on structured input and classroom activities. As he argued: "one characteristic of the ideal second language class is one in which aptitude will not predict differences in student achievement [...] because efficient acquisition is taking place for all students" (Krashen, 1982, p. 171). In Krashen's *Monitor Model* (1981b) one of the key assumptions is the differentiation between acquisition and learning. Acquisition, understood as an unconscious, natural process, is considered superior to learning and, as such, should be promoted in a foreign language classroom. Krashen states that FL aptitude tests predict achievement only in learning-oriented, formal classroom and form-focused instruction. Although Krashen's *Acquisition-Learning* hypothesis became a kind of a 'dogma' in the theory of SLA, the distinction between these two types of learning has not been without its critics. To quote Skehan (1989, p. 40), "[...] the acquisition-learning distinction has not been sustained either theoretically or empirically, so that the basis for the attack on aptitude loses force". Krashen's theory was also empirically challenged by Reves (1982) who demonstrated that aptitude functions as an effective predictor in both acquisition-rich, more naturalistic and in acquisition-poor, formal contexts. Aptitude tests generate the best prediction in both contexts. Thus, almost thirty years ago, Reves arrived at a conclusion which resonates with the present view of the role of FL aptitude in different contexts of SLA (cf. DeKeyser, 2000; Robinson, 2007). Contemporary researchers criticise Krashen's hypothesis for its detrimental effect on FL aptitude research. As Dörnyei and Skehan (2003, p. 594) claim, "For many years, this seemed the kiss of death for aptitude, since it associated the aptitude construct very strongly with the sorts of activities that were anathema to communicative classrooms". In view of contemporary research on FL aptitude and the developments in SLA theory, it can reasonably be assumed that the influence of FL aptitude on learning outcomes is now widely acknowledged and does not require empirical validation.

Although Krashen's contribution to SLA research cannot be overestimated, his view on individual differences under different learning conditions did not stand the test of time (cf. de Graff, 1997; DeKeyser, 1998, 2001, 2003; Ellis, 1997; Hulstijn, 2003; McLaughlin, 1990; Pawlak, 2006; Robinson, 1996, 2002b, 2007, 2009; Schmidt, 1990;

Williams, 1999). Unfortunately, Krashen's and other criticisms concerning FL aptitude, although generally proved erroneous, contributed to diminishing the popularity of the concept and resulted in excluding its measures from various research studies.

2.4. Contemporary models of foreign language aptitude

In recent years interesting and challenging reconceptualisations of aptitude have emerged. The two most important are Skehan's (1989, 1998, 2002) and Robinson's (1996, 2002a, 2002b, 2007, 2009) concepts; both consider FL aptitude a set of cognitive abilities and both describe FL aptitude from the perspectives of psycholinguistics and cognitive science.

2.4.1. Skehan's (1998) Processing Stage Model

Contrary to the previous models, which considered FL aptitude a self-contained area, Skehan (1998) proposed a concept of aptitude, which consists of components, which could be related to the stages of information processing in SLA. In this model phonetic coding ability corresponds to input processing, language analytic ability, including Carroll's (1959) grammatical sensitivity and inductive language learning, could be related to central processing, and memory-as-retrieval corresponds to output and fluency. Skehan's (2002) updated model includes *attentional control* and *working memory* constructs significant in contemporary research on FL aptitude. Skehan identifies four broad stages of SLA processing: *Noticing*, *Patterning*, *Controlling* and *Lexicalising*. This model of FL aptitude is consistent with a cognitive view on SLA (Dörnyei & Skehan, 2003, p. 596). Table 2.1. presents Skehan's FL aptitude model.

Table 2.1. SLA stages and aptitude constructs. Adopted from Skehan (2002, p. 90)

SLA Processing Stage	SLA Processing Substage	Aptitude Component
NOTICING	1. noticing	auditory segmentation attention management working memory phonemic coding
PATTERNING	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

CONTROLLING	6. becoming accurate, avoiding error	automatisation proceduralisation
	7. creating a repertoire, achieving salience	retrieval processes
	8. automatising rule-based language, achieving fluency	automatisation proceduralisation
LEXICALISING	9. lexicalising, dual-coding	memory, chunking, retrieval processes

An important assumption of this model is that the first stage, Noticing[10] (cf. Schmidt 1990, 1994a, 2001), is crucial for learning a foreign language. At first, people have to pay attention to some aspect of a language and to notice it. This stage, apart from auditory segmentation and phonemic coding, includes working memory and attention management components. Hence, the aptitudinal component of phonemic coding ability is supplemented by noticing ability. Contrary to earlier models of input emphasising comprehension and negotiation of meaning (cf. Krashen, 1985; Long, 1985; McLaughlin, 1987; Pica, 1994; Spolsky, 1985), Skehan proposed an alternative model claiming that neither comprehensible input nor negotiation for meaning are sufficient for interlanguage development. In his model attentional resources are limited and, if meaning-oriented activities prevail, learners use the most of their processing resources to attend to meaning (cf. Van Patten, 1990). As normal communication is pervaded by the pressure of processing language in real time, interlocutors do not have time to analyse the linguistic input because their attention is directed to the content. In usual communication people typically rely on large 'chunks' of language, that is formulaic lexical items, in order to ease processing problems, to save time and to plan. In such conditions focus on form becomes optional due to the attention limitations. Only when such tools like 'time creating devices' and comprehension and production strategies fail, will people resort to an analytic mode. Therefore, semantic and syntactic processing are in conflict as far as attention is concerned because the attention span is too limited to serve both simultaneously.

Skehan (1998) states that second language use itself does not lead to second language change. What leads to this change, that is interlanguage development, is noticing. For noticing to take place attentional resources must be channelled via instruction. Learning conditions should be manipulated to maximise the chances for noticing of form. Such manipulations include input strategy development and consciousness raising. Speech planning is the strategy that is used to free attentional resources in order to make changes available for output. Skehan's input stage theory holds two main assumptions.

[10] Noticing is described in Chapter Three, section 3.3.

First, that people differ in their individual noticing abilities, which results from differences in their working memory capacity/attentional resources. Second, that processing limitations can be overcome by attracting learners' attention to salient language forms.

The Patterning stage involves the ability to detect and manipulate patterns in a foreign language. Patterns need to be analysed, processed, generalised and extended in order to be finally integrated. Skehan's model of aptitude at this stage is based on evidence for systematicity in foreign language development (cf. Larsen-Freeman & Long, 1991). During this process the learner systematically masters the progressively complexifying foreign language system. Firstly, the learner generalises or hypothesises about the target form on the basis of the perceived pattern or regularity. This reflects the *pattern identification substage*. Secondly, he extends the hypothesis and starts to understand its limitations, which leads to restructuring it according to the new aspects of the structure he notices. These processes are present at the *extending* and *complexifying* substages. Thirdly, the learner integrates the new structures into his/her interlanguage. This is the *integrating* substage.

At the Controlling stage, the learner learns to avoid errors and creates a salient language repertoire. At this stage, the process of fossilisation may occur, as the learner starts to automatise the language and achieve fluency. The processes occurring at the Patterning and Controlling stages may be influenced by individual differences in analytical abilities, restructuring capacity, automatisation, proceduralisation and retrieval processes.

The final, Lexicalising stage, corresponding to output, is associated with automatising, proceduralisation and fluency. At this stage, communication strategies allow the effective communication of meaning, but often at the expense of accuracy. The learner is able to produce a language form as a lexicalised element or to create a rule-based structure, but the latter option is chosen only if lexical retrieval fails. Such strategies are effective in the short term as they serve communication, but in the long term they can become proceduralised, which runs the risk of fossilisation. At this stage, memory processes, namely encoding, storage and retrieval are of key importance. Encoding involves memorising, storage is connected with structuring and prefabricated chunks, whereas retrieval of these chunks allows the orchestration of output into fluent language use. Learners differ in their reliance upon this fast-access memory system, preferring to operate either form-oriented or meaning-based systems (Skehan, 1998, p. 204).

An important problem taken up by Skehan is the impact of modifications of input and types of feedback on interlanguage development. Such manipulations like input flooding, input enhancement, negotiation for meaning or *recast* may be more or less efficient in particular cases. Recast, for example, as a very popular focus on form technique, depends on noticing ability, and, therefore, has its limitations in the case of learners with low working memory capacity (cf. Mackey, Philip, Egi, Fujii, & Tatsumi, 2002)[11]. Ske-

[11] Recasts are described in Chapter Three, section 3.2.3.

han is a supporter of the focus on form approach as a means of fostering syntactic awareness of adult learners to overcome the natural predisposition to focus on meaning and communication. Skehan ascribes a special role to memory as a source of individual differences affecting language learning outcomes, with special emphasis being placed on the operations carried out within working memory (cf. Berquist, 1998; Daneman & Carpenter, 1980; Harrington & Sawyer, 1992; Mackey et al., 2002; Miyake & Friedman, 1998; Miyake, Friedman, & Osaka, 1998; Osaka, Osaka, & Groner, 1993; Robinson, 2002a; Sagarra, 1998). The factor of working memory also constitutes a powerful variable in Robinson's (2007) Aptitude Complex Model.

2.4.2. Robinson's (2007) Aptitude Complex Model

Constructing his model, Peter Robinson (1995a) adopted as a point of departure Snow's (1987, 1994) cognitive-affective-conative triad of factors contributing to aptitude[12] (cf. Ackerman, 2003; Corno et al., 2002; Dörnyei, 2002, 2005; MacIntyre, 2002; Snow & Farr, 1987). In line with Snow and his followers, Robinson refers FL aptitude to the ability to work at a specific task and in a specific situation. The assumption underlying both Snow's and Robinson's theories is that a valid theory of FL aptitude must be constrained by a theory of academic tasks demands, aptitude treatments, situational context and types of instruction. As Robinson states "aptitude is variegated but not so variegated as to be infinite" (2007, p. 256). Snow (1994, p. 8) depicted aptitude as 'aptitude complexes', which are clusters of cognitive, affective and conative variables interacting with each other as well as with language learning contexts. Robinson (1995a, 2002b, 2007) upholds this line of reasoning; however, in contrast to Snow, he focuses only on cognitive factors.

Both researchers based their models on the pedagogical assumption that by profiling individual differences and matching the individual profiles to particular types of instruction differences in aptitudes can be levelled out. As Robinson optimistically assumes, "if aptitudes and tasks are well-matched, such practice and learning should lead eventually to the degree of mastery that is needed to accomplish lifetime pursuits in those domains" (2007, p. 257). Therefore, the responsibility for choosing types of instruction that are appropriate to the individual learner is "a major aim of pedagogically oriented language aptitude research" (Robinson, 2002b, p. 113). Robinson's (2007) 'aptitude-treatment interaction' research resulted in two hypotheses summarising his research findings, namely the *Aptitude Complex Hypothesis* and the *Ability Differentiation Hypothesis*. The first one refers to variation in foreign language learning outcomes as a function of different FL aptitudes operating under different learning conditions. The second one explains

[12] Snow's theory is described in Chapter Four, section 4.1.

child-adult and high-low aptitude differences in foreign language learning outcomes. According to Robinson (2002b, 2007), FL aptitude is not a homogeneous construct, but constitutes sets of abilities or aptitude complexes, which are differentially related to learning under different psycholinguistic processing conditions corresponding to different levels of awareness. Basically, adult foreign language learning under all conditions is *Fundamentally Similar* (Robinson, 2002b, p. 124), which means that there is no evidence for a dissociation between unconscious implicit acquisition and conscious explicit learning. All the differences in the learning outcomes are affected by individual differences in the information-processing abilities measured by aptitude and memory tests.

Robinson (1995a, 1996, 1997) examined the aptitude-awareness relationship during L2 learning under four different conditions of exposure: *implicit*, based on memorising examples, *incidental*, based on processing examples for meaning, *rule-search*, based on searching for rules, and *instructed*, based on formal rule teaching and applying rules to examples. The results revealed that the worst learning outcomes occurred in implicit learning condition. Nevertheless, interesting positive intercorrelations between implicit learners' grammar sensitivity subtest of the MLAT score, L2 learning success and metalinguistic awareness were noted. The conclusion was drawn that the learners under the implicit condition who were diagnosed as displaying high L2 aptitude were the most likely to look for structural regularities in the input. What is more, they were the most able to verbalise the rules. In each condition, the grammar sensitivity score, as well as the L2 learning outcomes of the metalinguistically aware L2 learners, were higher than the score of the less aware learners. Robinson concludes that a certain level of awareness facilitates L2 learning success and that FL aptitude correlates positively and significantly in all learning conditions, except the incidental, with the L2 learning outcomes (2007, p. 262). As the researcher explains (2002a, 2007), the incidental, that is meaning-focused, condition does not rely on conventional aptitude measures, like the MLAT, but draws on working memory for text (cf. Daneman & Carpenter, 1980). Processing input for meaning does not require rote learning, but the ability to switch attention to form or to switch attention between tasks, which is the function of working memory (Baddeley, 2003). Hence, Robinson (2007) suggests that the working memory component as a significant FL aptitude variable should supplement conventional FL aptitude tests.

Another important contribution by Robinson (2002b, 2007) is the research on the ability of learning from recasts. Recasts are defined as a kind of pedagogical intervention that aims to direct learner attention to form during meaning-oriented activities. Although recasts do not require high metalinguistic or analytic abilities, Robinson suggests that there may be more individual variation in learning from such focus on form techniques as recasting or input flooding than from input-processing instruction, which requires metalinguistic and analytic abilities typically demanded in western education. As research results reveal, there is a positive correlation between phonetic sensitivity, pho-

nological working memory, noticing of recast and L2 development (Mackey et al., 2002; Robinson & Yamaguchi, 1999). Consequently, Robinson (2007, p. 263) posits that these cognitive abilities are positively implicated in learning from recasting.

2.4.2.1. Aptitude Complex Hypothesis

Robinson, following the interactionist approach of Snow (1987, 1994) constructed his model as consisting of a number of 'aptitude complexes' that are differentially related to learning a language under different learning conditions. This assumption is termed as the Aptitude Complex Hypothesis (Robinson, 2007, p. 274). In line with this hypothesis, some learners might possess strengths in abilities facilitative under specific learning conditions, but less effective in other instructional exposure or teaching technique. The ultimate aim of his approach is to "make predictions about how to optimally match learners to instructional options" (Robinson, 2007, p. 274), that is to create an optimal environment for the individual learner needs. Robinson opts for various focus on form techniques as means of pedagogical intervention during communicative task activity. Via such techniques as recasting and input flooding to facilitate incidental learning in the case of more memory-oriented learners, and rule explanation in the case of more analytically-oriented individuals, communicative practice is optimised according to the aptitude profiles of learners.

There are four complexes of aptitudes partly reflecting the hierarchical structure of cognitive abilities (cf. Carroll, 1993). In Robinson's model (2002b) the primary, or first--order, abilities are directly measured by psychological tests and encompass such constructs as *working memory capacity*, *pattern recognition*, *grammatical sensitivity* and the *speed of processing*. They are implemented by cognitive resources such as *attention*, *working-*, *short-* and *long-term memory*. Second-order abilities are combinations of primary abilities to constitute cognitive constructs such as *noticing the gap*, *memory for contingent speech*, *memory for contingent text* and *metalinguistic rule rehearsal*. Second-order abilities are grouped to form four aptitude complexes, which can be summarised as follows (Robinson, 2002b, p. 117-119):

Aptitude complex 1 refers to learning from recasting. Two FL aptitude factors are involved in this set: aptitude for noticing the gap (NTG) between the learner's utterance and the correct language form and memory for contingent speech (MCS) important in holding the interlocutor's recast in memory. In the recasting technique, the learner is expected to compare his interlanguage form to the target form provided by the interlocutor to notice the difference and eventually to self-correct. Both ability factors, namely NTG and MCS, are combinations of domain-neutral primary abilities. These primary abilities, in the case of NTG, are perceptual speed and pattern recognition. In the case of MCS they are phonological working memory capacity and the speed of processing. Robinson suggests tests to

measure these abilities. For NTG a measure of inspection time (Anderson, 1992) is proposed as a measure of fast responding to stimuli and a measure of phonological sensitivity (Sasaki, 1996) is proposed as a measure of the ability to identify patterns. As a measure of working memory capacity, the listening span test is proposed (Mackey et al., 2002). The ability factors measured by these tests are hypothesised to predict the ability to learn from recasts. Learners high in both abilities, namely NTG and MCS, will benefit from implicit negative feedback provided by recasts more than those with low abilities in these areas. What is more, learners with low working memory capacity and speed of processing may have problems rehearsing recasts in working memory, even if they have noticed them accurately. If, in turn, the working memory capacity is high, but the noticing the gap ability is low, recasts may prove an inefficient technique.

Aptitude complex 2 reflects the aptitude for incidental learning from oral input flooding. There are two abilities that constitute this complex: memory for contingent speech (MCS) and deep semantic processing (DSP). The former is the same as in Aptitude complex 1, while the latter describes the ability to process the semantic contents of input. Regarding the primary abilities, DSP represents inferring word meaning and analogical reasoning. Robinson proposes the *Words in context* test (de Graff, 1997) as a measure of the ability to infer word meaning.

Aptitude complex 3, that is the aptitude for incidental learning from written input flooding, is analogous to *Aptitude complex 2*, but it includes memory for contingent text (MCT), instead of MCS. MCT refers to two primary abilities: working memory for text, measured by the *Text memory* (Harley & Hart, 1997) and the speed of processing.

Aptitude complex 4, reflecting the aptitude for explicit rule learning, consists of two factors: memory for contingent text (MCT) and metalinguistic rule rehearsal (MRR). The latter constitutes the ability to benefit from formal learning of structure, that is rule explanation, practising the rule and production activities. This set is measured by two subtests of the MLAT: *Words in sentences* representing grammar sensitivity and *Paired associates* representing rote memory abilities. Learners high in analytic abilities will benefit from formal instruction more than their less able classmates.

2.4.2.2. Ability Differentiation Hypothesis

The Ability Differentiation Hypothesis holds that among adults and high-IQ groups abilities are more differentiated than among children and low-IQ groups. Analogically, FL aptitude components will be better differentiated for adults and more able foreign language learners than for children and less able foreign language learners. For those learners with more differentiated cognitive ability profiles there will be more variation in the learning outcomes in any condition than for those with less differentiated abilities (Robinson, 2002b).

Robinson's (2002b) model is, in many respects, an extension of FL aptitude research tradition. The structure of abilities is hierarchical (cf. Carroll, 1959), the aptitude complexes are related to instructional setting (cf. Skehan, 1998; Snow, 1994; Wesche, 1981), and learners are roughly divided into memory-oriented and analytically-oriented categories (cf. Skehan, 1989, 1998). Nevertheless, the complexity and thoroughness of analysis of aptitude-instruction interactions contribute to the unprecedented value of the model. An important issue addressed by Robinson (2002b, 2007) is relating various cognitive profiles to different types of instruction demanding different levels of awareness. The aptitude-treatment approach regards this model especially highly from the perspective of pedagogy of foreign language teaching. On the other hand, matching complex learners' profiles to a teaching method and a type of instruction might be very difficult in an instructed foreign language classroom. A considerable advantage of the model is that it draws on the psycholinguistic and cognitive science research on human cognitive abilities taking into account such SLA theory advances as acknowledging the role of working memory, attention, noticing and the ability to learn from recasting as FL aptitude components. Emphasising the role of the working memory ability as a factor of high predictive validity in SLA grants Robinson's (2002b) model a leading position in contemporary FL aptitude research.

2.4.3. Sternberg's (1998) model of foreign language aptitude as a dynamic concept

In contemporary literature FL aptitude is retheorised as a dynamic concept, that is, subject to evolutionary development in interaction with the environment (cf. Sternberg & Grigorenko, 2000) and potentially trainable (cf. Sternberg, 2002). Abilities contributing to FL aptitude have their effects in interactions in foreign language situations (Corno et al., 2002; Grigorenko et al., 2000; Robinson, 2002b, 2007; Snow, Corno, & Jackson, 1996).

Sternberg's (1998) alternative view on human cognitive abilities proposes that abilities are forms of developing *expertise*. Generally, people should not be classified as more and less able, but rather as novices *versus* experts. Expertise, in Sternberg's view, is defined as having large, rich schemas of declarative and procedural knowledge. It is connected with the development of highly efficient, automatised problem predicting and problem-solving abilities, careful progress monitoring and high accuracy in reaching appropriate solutions. Consequently, Sternberg rejects the validity of any aptitude tests equalling them with tests of achievement and arguing that there is no qualitative distinction between these types of measures. According to Sternberg, abilities are pliable and modifiable rather than predetermined; therefore, they are developed in the process of education.

Sternberg ascribes a vital role to deliberate practice as a factor differentiating between a novice and an expert: "The fact that experts have tended to show more deliberate practice than novices may itself reflect an ability difference" (1998, p. 14). Success

encourages the more able to continue their study, whereas the less able are more likely to give up when faced with failure. Also, other factors, such as life experiences or parental encouragement may affect the process. Despite his strong belief in the modifiability of abilities, Sternberg does not reject the role of individual differences in developing expertise. Instruction and practice might increase the mean scores, but cannot eradicate individual differences entirely.

Sternberg (2002) transformed his Triarchic Theory, also called the Theory of Successful Intelligence[13] into FL aptitude theory. Therefore, analytic, abstract-thinking abilities are helpful in the development of verbal analogical reasoning and also work to the advantage of adult foreign language learners. Planning is a skill useful in choosing an appropriate learning strategy to solve a problem more quickly and effectively. Creative intelligence includes the ability to cope with novelty, which is especially important in learning a foreign language. The learning of subsequent languages draws on linguistic meta-knowledge that is transferred from one language to another. Despite his enthusiasm for a multiplicity of intelligences, Sternberg admits that "one of the significant predictors was always the analytical score" (2002, p. 34). As far as FL aptitude testing is concerned, he concludes that "The argument […] is not that conventional tests are wrong or somehow inadequate but rather that they are incomplete" (2002, p. 36). This means that apart from cognitive factors, personality and social aspects should be taken into account in FL aptitude research.

The most important implication of Sternberg's theory is that abilities can be taught and developed. Therefore, individual differences in FL aptitude should be matched to appropriate teaching methods (cf. Robinson, 2002b). This conviction is reflected in a method of testing proposed by Sternberg (2002), that is dynamic testing. In a dynamic test, learners are given feedback in order to improve their scores. This theory is compatible with Vygotsky's (1978) theory of the zone of proximal development According to this theory, children's ability to benefit from guided instruction during a test is a measure of the difference between their developed abilities and their latent capacities (zone of proximal development). This idea provided the basis for a FL aptitude test – the Cognitive Ability for Novelty in Acquisition of Language (CANAL-FT) (Grigorenko et al., 2000), which reflects Sternberg's main assumptions with reference to human abilities.

It seems that neurological research can confirm the possibility of the dynamic nature of FL aptitude. A neurological study by Tatsuno and Sakai (2005) suggests that there are differences in the activation of some parts of the brain involved in speech processing occurring as a result of practice. They demonstrated that activation of areas involved in processing English inflection in Japanese learners was much weaker in a subgroup of high-performing advanced learners. Activation showed a negative correlation with performance after years of practice, which might, according to the researchers, be ascribed

[13] Sternberg's Triarchic Theory is described in Chapter One, section 1.2.3.

to adaptation of the brain to a new task. The conclusion is that the efficiency of the neural organisation can improve with L2 acquisition.

Summing up, the possibility of the modifiability of FL aptitude seems to be reasonable and should not be rejected in advance; however, empirical evidence supporting this process is far from convincing. As a matter of fact, the problem whether FL aptitude is amenable to change as a result of instruction or training remains unsolved. There is still no consensus as regards the education of abilities. Contemporary genetics as well as developmental psychology state that genetics predominates over environment in the transmission of human intelligence (cf. Bouchard, 1997; Jensen, 1997; Scarr, 1997). Loehlin et al.'s (1997) analysis of monozygotic twins suggests that over three-fourths of the variance of adult IQ reflects the genetic influence provided the individual grows up in normal conditions. On the other hand, human ability can be approached from the environmentalist perspective, which advocates the interdependence of genetic and environmental effects (cf. Grigorenko & Kornilova, 1997; Sternberg, 1997). In line with this argumentation, the development of human ability is a constructive rather than a predetermined process. The human being makes sense of the world and develops in interaction with the environment; hence, the mechanisms of cognitive development are highly flexible. In conclusion, it may be stated that there exist conflicting views regarding the possibility of the modification and improvement of FL aptitude.

2.5. Contemporary tests of foreign language aptitude

Among many FL aptitude tests designed by contemporary researchers, three are worthy of note. The first is the Cognitive Ability for Novelty in Acquisition of Language (CANAL-FT) constructed by a team of psychologists and SLA researchers (Grigorenko et al., 2000). This test satisfies cognitive ability test requirements, namely it is based on a scientific theory and reflects FL aptitude research advances. A distinguishing characteristic of the second test, the Llama Language Aptitude test designed by Paul Meara and his team (2002, 2005), is that it does not require any L1 input so it can be used in all cultures. The third test that is going to be described in the following section is the High--Level Language Aptitude Battery (Hi-Lab) (Doughty et al., 2010). This test accords with the contemporary research on the role of working memory in the outcomes of learning a foreign language.

2.5.1. Cognitive Ability for Novelty in Acquisition of Language

The Cognitive Ability for Novelty in Acquisition of Language FL aptitude test (CANAL- FT) (Grigorenko et al., 2000), reflects Sternberg's (1998) Triarchic Theory of

Human Intelligence, described in Chapter One, section 1.2.3. As the authors assure, the CANAL-FT tests creative and practical abilities, not only analytic and memory abilities; what is more, it suggests appropriate forms of instruction and, finally, it is dynamic, which means that testing and instruction occur at the same time. Grigorenko and her co-workers delineate the characteristics of their test, which is: (1) based on a cognitive theory of knowledge acquisition; (2) naturalistic, which means that learning occurs naturally, by gradually introducing a simulated language embedded in a context; (3) dynamic, that is, it involves the ability to learn during the test; and (4) multifunctional in that it provides information about student's strengths and weaknesses to match adequate instruction.

The main presumption guiding the development of the CANAL-FT was that the ability to cope with novelty and ambiguity (cf. Ehrman, 1996; Ehrman & Oxford, 1995) is central in SLA. This ability is emphasised in the experiential aspect of human ability in Sternberg's (1998) Triarchic Theory of Human Intelligence. The test is based on an artificial language, *Ursulu*, which reflects aspects of different existing languages, but does not resemble any particular language. The language is presented gradually during the test, so that the participants have a chance to master it through cognitive processes of encoding, comparison, transfer of rules and information synthesis. Encoding, storage and retrieval of information are assessed through immediate and delayed recall tasks. The CANAL-FT score permits identification of preferred modes of learning (visual *versus* auditory), levels of processing (lexical, morphological, semantic and syntactic), and memory processes (immediate and delayed). The authors present four components of their CANAL-F Theory: (1) *Knowledge Acquisition Processes*; (2) *Levels of Processing*; (3) *Modes of Input*; and (4) *Memory Processes*. Item examples of the CANAL-FT are presented below:

> Section 1 *Delayed-recall*
> In the passage mentioning an increase in the cost of studying at universities, *twok* most likely meant a: (a) microscope; (b) textbook; (c) computer; (d) equipments; (e) camera.
> Section 3 *Immediate-recall*
> kiss = lutik; maki smelano = floweret; to oppose = fru prostoto
> In *Ursulu*, 'floweret' most likely means: (a) maki smelano; (b) unmake; (c) fru prostoto; (d) lutik (Grigorenko et al., 2000, p. 404).

Grigorenko et al. (2000) found that the CANAL-FT score correlates positively with the MLAT score as well as the number of languages spoken by a person. As a result of this, they conclude that the richer the language learning experience, the higher the performance on the CANAL-FT, which confirms Sternberg's (1998) view on FL aptitude as a dynamic, expertise-dependent set of factors. It appears that the CANAL-FT offers

extended information about the learner's cognitive profile and modes of information processing and stands out from the conventional FL aptitude tests, which only provide information about the potential rate of progress in learning a foreign language.

2.5.2. Llama Language Aptitude Test

This battery of tests (Meara et al., 2002; Meara, 2005) is loosely based on the work of Carroll and Sapon (1959). It is a test administered on a computer and consists of five (Meara et al., 2002) or four (Meara, 2005) subtests designed to measure different aspects of FL aptitude: *phonetic memory* (LAT A), *lexical-morphological analytical skills* (LAT B), *grammatical inferencing skills* (LAT C/F), *aural memory for unfamiliar sound sequences* (LAT D), and the *ability to form sound-symbol associations* (LAT E). In the 2005 version, the subtests B and C/F are based on picture stimuli rather than verbal. The test is based on linguistic material from a Central American language, with which the testee is unlikely to be familiar. This version no longer requires L1 input, so the test is suitable for use with testees of any L1. For example, in LAT B – *A vocabulary learning task* – the examinee must learn the names of as many of twenty objects displayed on the screen as he/she can in the time available, whereas in LAT D – *A sound recognition task*, which is a test of the ability to recognise patterns in a spoken language, the examinee first listens to words based on the names of flowers and natural objects in a British Columbian Indian language and then must recognise those, which he/she has heard before.

2.5.3. High-Level Language Aptitude Battery

The *High-Level Language Aptitude Battery (Hi-Lab)* (Doughty et al., 2010) is an innovative, computer-delivered test designed to predict high-level attainment in post-critical period SLA. In line with Abrahamsson and Hyltenstam (2008) and DeKeyser (2000), the authors of the test attribute the attainment of high-level proficiency in a foreign language in post-pubescent learners to a special aptitude for foreign language learning. They hypothesise that this type of FL aptitude encompasses cognitive and perceptual abilities which compensate for the post-critical period decline in language learning abilities. The main objective of the test constructors is to identify individuals with high FL aptitude who are able to reach advanced levels of foreign language proficiency. In accordance with Abrahamsson and Hyltenstam (2008), Doughty et al. (2010) assume that adult foreign language learners are not able to attain full native-like proficiency but only different levels of advancement. For the purpose of their study, the researchers (Doughty et al., 2010, p. 10) operationalised the construct of high-level language aptitude as "a measurable ceiling on language-learning ability, holding equal all other factors such as motiva-

tion, other individual differences, and opportunities for instruction and immersion". The authors' goal was to heed Carroll's (1990) suggestion about updating the measurement of FL aptitude by incorporating advances in the field of memory and attentional processes, as well as including a measure of inductive learning ability. Accordingly, the test contains the constructs hypothesised to underlie high-level FL aptitude such as memory, including short-term, long-term and working memory, perceptual acuity, speed, primability, induction, pragmatic sensitivity and fluency. These constructs were proposed by SLA researchers and cognitive psychologists. As a result, the test includes mainly psychological tests. For example, phonological short-term memory is measured by a non-word span task. Hi-Lab's non-word span task measures the ability to remember increasingly longer lists of short, pronounceable pseudowords serially presented on a computer, such as, for example, *fesh*, *teg*, or *mulp*. As Doughty and her team (2010) claim, the Hi-Lab is the first test to incorporate advances in the domain of memory functioning, in particular, working memory (Baddeley & Hitch, 1974). The test is still under construction and its predictive validity is yet to be established; however, the Hi-Lab seems to be the most ground-breaking instrument to measure FL aptitude constructed in the last decade.

It emerges that one common assumption underlying all the contemporary tests is that they are designed for adult foreign language learners, which fits in with the *Critical Period Hypothesis* (Lenneberg, 1967). As will be argued below, the factor of age as well as native language abilities are regarded as crucial developmental aspects determining FL aptitude.

2.6. Native language abilities and the factor of age in foreign language aptitude

In 1973 Carroll formulated a hypothesis that FL aptitude might be a residue of the first language learning ability (p. 278). A link between aptitudes for L1 learning and L2 learning was demonstrated as a result of the *Bristol Language Project*, described by Skehan in 1998. The study was conducted by Wells (1981) on 125 children. The research results revealed that there was a considerable variation between the development in the L1 among children, which correlated with differences in FL aptitude in these children examined twelve years later. Skehan (1998) interpreted the results as a confirmation of Carroll's (1973) hypothesis referring to the effect of first language abilities on FL aptitude.

There is ample evidence in support of the relationship between native language abilities and FL aptitude. Sparks and Ganschow's (1991) *Linguistic Coding Deficit Hypothesis* is based on research findings that at-risk foreign language learners have linguistic coding difficulties, which have an effect on both L1 and L2 acquisition. As they posit, "Inefficiency of the language processing codes may produce interference resulting in

individual differences in FL acquisition. […] We suggest, then, that native language factors are likely to be implicated as the main variable in FL learning" (Sparks & Ganschow, 1991, p. 10). A large body of research by Sparks and his colleagues (Ganschow, Sparks, Javorsky, Pohlman, & Bishop-Marbury, 1991; Ganschow & Sparks, 1995; Sparks et al., 1998; Sparks, Ganschow, & Patton, 1995; Sparks et al., 1997; Sparks & Ganschow, 2001; Sparks, Javorsky, Patton, & Ganschow, 1998; Sparks, Patton, Ganschow, Humbach, & Javorsky, 2006) has supported their hypothesis. As they hold it, native-language skills in the fields of phonology, orthography, grammar and semantics operate as the basis for L2 learning. Consequently, any problems with these language aspects will have a negative impact on both L1 and L2 learning.

Differences between good and poor L2 learners on both native-language measures and FL aptitude tests have consistently been found in a number of studies (cf. Olshtain, Shohamy, Kemp, & Chatow, 1990; Sparks et al., 1998; Sparks & Ganschow, 2001). Olshtain et al. (1990) examined the contribution of academic proficiency in an L1, motivation and attitudes toward English as a foreign language to success in learning English in two groups of socio-culturally different learners. The researchers found that academic proficiency in the L1 was the most significant factor in predicting success in learning a foreign language. Sparks et al. (1998) examined the differences in native language skills, FL aptitude, and foreign language marks among secondary school students identified as high-, average-, and low-proficiency learners. The results of the study revealed that there were differences among the three proficiency groups on both native language and FL aptitude measures. Finally, Sparks and Ganschow (2001) compared successful and unsuccessful college foreign language learners on measures of intelligence, FL aptitude, and native oral and written language. As regards intelligence, no significant differences were found, whereas FL aptitude and native language skills, in particular, phonology and syntax differentiated the successful from unsuccessful learners. In all those studies, L1 skills or academic proficiency in the first language were the most important predictors of success in learning a foreign language. Another significant contributory factor in FL aptitude is age.

Since Lenneberg (1967) presented his Critical Period Hypothesis (CPH), which claims that abilities to acquire an L2 after a certain age deteriorate, evidence for this phenomenon has accumulated (cf. Coppieters, 1987; DeKeyser, 2000; Harley & Hart 1997; Johnson & Newport, 1991; Long, 2005; Long, 2011; Munro, Flege, & MacKay, 1996; Patkowski, 1980). It is generally agreed that this deterioration is not abrupt, but rather continuous and refers mainly to grammar and pronunciation learning (cf. Bongaerts, 2005), but there is no consensus as regards the beginning of the decline. SLA researchers claim that there are multiple critical periods for different linguistic areas. In Long's (1990) differentiation of critical periods, the critical period for phonology occurs at the age of 5-6, much earlier than for syntax and lexis. As regards lexis, idiomatic use of formulaic language such as proverbs or prepositional verbs, and semantic inferencing

are the most difficult to master aspects of a foreign language (Abrahamsson & Hyltenstam, 2009; Long, 2011). In line with a prevailing tendency among the CPH advocates, Long (1990) attributes this decline to the loss of neural plasticity connected with brain maturation. Phonological abilities are believed to be the most susceptible to the critical period. Even those speakers whose proficiency level is assessed as native-like usually fail to achieve native-like pronunciation (cf. Abrahamsson & Hyltenstam, 2009; Long, 1990; Long, 2011; Moyer, 1999).

The discussion of native-like L2 learners has usually been related to the CPH. Starting to learn a foreign language after this period typically results in non-native attainment. According to Gregg, "truly native-like competence in an L2 is never attained" (1996, p. 52). Numerous studies on ultimate attainment have provided evidence for a negative correlation between the age of onset of acquisition and ultimate attainment of L2 proficiency (cf. Abrahamsson & Hyltenstam, 2008, 2009; DeKeyser, 2000; Moyer 1999)[14]. Recorded native-like proficiency is usually limited to certain phonetic or morphosyntactic aspects of a foreign language (cf. Birdsong, 2007, 2009; Bongaerts, van Summeren, Planken, & Schils, 1997; van Boxtel, Bongaerts, & Coppen, 2003).

Even though there is a cumulative body of evidence in favour of the critical period, there are researchers who doubt its existence (cf. Bialystok & Hakuta, 1994; Birdsong, 2005, 2006, 2007, 2009; Bongaerts, 2005, Marinova-Todd, 2003; Singleton, 2005; Singleton & Ryan, 2004; van Boxtel, Bongaerts, & Coppen, 2005). They interpret the existence of exceptional foreign language learners as evidence against the CPH. If there really was a critical period for language learning, "no second language learners starting after the terminus period should demonstrate achievement of native-like levels of ultimate L2--attainment" (Bongaerts, 2005, p. 259). Instead of the critical period, they attribute adult learners' success to social, psychological and educational factors or to the effects of bilingualism (cf. Birdsong, 2005). To support this argument, the opponents of the CPH describe a number of studies presenting evidence for high incidence of native-like attainment beyond the critical period in both pronunciation and morphosyntax (Birdsong, 2006, 2007; Bongaerts et al., 2000; Moyer, 1999; Marinova-Todd, 2003; van Boxtel et al., 2005). According to Birdsong (2006), more than twenty studies reported the incidence of native-likeness up to 45% among late L2 learners. This opinion remains in sharp contrast to the views of those researchers who consider exceptional foreign language learners evidence in support of the CPH due to the scarcity of this phenomenon. According to Abrahamsson and Hyltenstam (2008) and DeKeyser (2000), full native-like attainment in post-pubescent learners does not exist. If the incidence of native-likeness is close to zero, those rare cases of near-native achievement confirm the universality of the CPH. In other words, both sides of the debate regard the same cases as either evidence for, or against the CPH.

[14] These studies are described in Chapter Five, sections 5.3.2 and 5.3.3.

The most important and controversial hypothesis that contributed to the discussion on child-adult differences in learning a language is Bley-Vroman's *Fundamental Difference Hypothesis* (1988). This hypothesis states that adult L2 learners no longer have access to innate mechanisms for implicit language acquisition and have to rely on general cognitive mechanisms for explicit learning. An important implication of this statement is that all children, irrespective of their cognitive abilities[15], acquire their L1 perfectly. In contrast, as a large body of research indicates, for adults it is very difficult, if not virtually impossible to attain the native-like proficiency level unless one starts to learn a foreign language as a small child (cf. Abrahamsson & Hyltenstam, 2008, 2009; Long, 2005). As Kasper and Kellerman argue, "learners' interlanguage is deficient by definition" (1997, p. 5).

There are two contradictory approaches to the rare phenomenon of adult near-native attainment in an L2 within the CPH framework. The first one is that the innate acquisition system remains intact in a few individuals who still have access to implicit learning mechanisms; these individuals seem to have escaped the critical period (Carroll, 1973; Ioup et al., 1994; Selinker, 1972). The alternative approach represented by contemporary researchers attributes the phenomenon of near-native adult attainment to an exceptional FL aptitude (Abrahamsson & Hyltenstam, 2008, 2009; DeKeyser, 2000; Harley & Hart, 1997; Ioup et al., 1994[16]; Morgan, Smith, Tsimpli, & Woll, 2007; Obler, 1989; Sawyer & Ranta, 2001).

A significant contribution by DeKeyser (2000) was the verification of the hypothesis that "only adults with a high level of verbal ability are expected to succeed fully at second language acquisition" (p. 500). Because adults have no access to implicit learning mechanisms, they have to draw on verbal-analytic problem-solving skills, which are characterised by significant individual differences. His second goal was to verify Johnson and Newport's (1989) claim that ultimate attainment in an L2 reveals a strong positive correlation with the age of acquisition before the age of 17 years, but there is no such a correlation past this age. DeKeyser based his hypotheses on the research results on ultimate attainment by Birdsong (1992), Coppieters (1987), Johnson and Newport (1989), Patkowski (1980), and others. In all of those studies, the subjects were university language students and faculty members as well as other language professionals, which, according to DeKeyser, implies high verbal aptitude, which "may allow L2 speakers to perform morphosyntactically like native speakers" (2000, p. 507). The research hypotheses formulated by DeKeyser (2000) were confirmed. All of the child acquirers achieved a native or near-native level, whereas only adults with above-average aptitude overlapped with native speakers. Evidently, in the case of an early age of onset, aptitude was irrelevant. This means that only adult learners with high verbal ability are able to bypass

[15] Assuming their cognitive development is unimpaired.

[16] Ioup et al. (1994) consider both explanations possible.

the constraints of the critical period, whereas aptitude plays no role in ultimate attainment by children. This study confirmed Bley-Vroman's (1988) Fundamental Difference Hypothesis, but, first and foremost, it provided evidence in support of the CPH. As DeKeyser explains: "there really is a critical, and just not a sensitive or optimal, period for language acquisition" (2000, p. 518). However, it must be emphasised that DeKeyser relates the CPH only to implicit learning of abstract structures. DeKeyser places the critical period between the ages 6-7 and 16-17. An important conclusion of his study is that explicit learning is the only possibility for post-pubescent L2 learners to achieve a high level of proficiency, as they no longer have access to implicit learning mechanisms.

In contrast to DeKeyser's claim that child acquirers inevitably succeed in L2 learning, irrespective of their aptitude, Abrahamsson and Hyltenstam (2008, 2009) discovered that aptitude has small, but significant effects in child SLA. They observed a significant correlation between L2 grammatical proficiency and FL aptitude among early L2 learners (the age of onset of 1-11 years). This tendency was absent among native controls. What is more, most of the early L2 learners also failed to achieve full native-likeness when subjected to a scrupulous linguistic scrutiny[17]. The researchers conclude that even for child L2 learners an early age of onset is not a guarantee that they will achieve full native-like proficiency.

As Long (2011) convincingly argues, maturational constraints connected with the critical period are universal, biologically-based, predictable and unaffected by individual differences. Moreover, the evidence in support of the discontinuities in the development of morphosyntax, semantics and phonology is robust. Granena and Long (2010) examined the relationship between FL aptitude, the age of onset and age in three domains, namely phonology, morphosyntax and lexis. The results revealed that there are correlations between the age of onset and performance in all the three domains, with the steepest decline observed in pronunciation (age 3-6 years) and in lexis (age 9 years), whereas in grammar the critical point occurs later, at the age of 12 years. As expected, the age of onset is negatively correlated with the ultimate attainment. Interestingly enough, FL aptitude correlates with the ultimate attainment only if the age of onset is over 16 years, and only in pronunciation and lexis, but not in morphosyntax (Long, 2011). These results are difficult to interpret and suggest that many questions related to the critical period remain unanswered.

There is a large body of neurological research offering evidence in support of the CPH (cf. Indefrey & Gullberg, 2006; Uylings, 2006). Absolutely native-like patterns in L2 learners are rarely found, especially in syntactic processing; the area of semantics seems to be less affected by the age of acquisition. Event-related potential (ERP) studies confirmed that there are significant differences between even very proficient L2 speakers and native speakers. The largest differences were observed for syntax, whilst the

[17] This study is described in Chapter Five, section 5.3.3.

smallest for prosodic phrasing and controlled syntactic processing. It appears that successful L2 learners use those processes to compensate for inadequacies in other domains (Mueller, 2006).

Another aspect addressed in the discussion of age effects on FL aptitude is the cognitive ageing of the brain. In his review of literature, Birdsong (2006) identifies three main components of cognitive ageing, namely decreases in cognitive speed, deficits in working memory and decreases in the ability to focus attention. Cognitive ageing results from brain volume decrease. This process starts as early as in young adulthood, at around the age of twenty, and affects L2 more than L1 processing, as a result of weaker automaticity in the former (Segalowitz & Hulstijn, 2005). The decline is continuous and linear; however, it is subject to individual variation. A number of fMRI studies have revealed that brain volume decreases with advancing age (see Raz, 2005, for a review). In all the cases, the observed decline was linear and consistently continuous. What is interesting, gray matter volume declines linearly starting in childhood, whereas white matter increases until the early twenties, then reaches a plateau which continues until the sixties, and, finally, after this age, declines linearly. In a study on 53 adults between the ages of 20 and 27 years, Raz et al. (2003) found that the shrinkage of brain volume is varied for different parts of the brain and starts in young adulthood (e.g. cortical structures), middle age (e.g. hippocampus), and in older age (e.g. entorhinal cortex).

An additional area of deterioration connected with ageing is the dopamine system. This system is involved in higher-order cognitive functions, such as attention and working memory implicated in L2 learning. Dopamine is also involved in the motivation to learn and learning reinforcement, defossilisation, proceduralisation, which is the creation and strengthening of linguistic rules and in many other processes (cf. Schumann, 2004b). The decline in the dopamine system results in deficits in executive function, verbal fluency, working memory, attention and perceptual speed. The decline in dopamine receptors starts in the early twenties and continues across the lifespan. This process inevitably affects ultimate L2 attainment and might account for some variance among L2 adult learners (Birdsong, 2006).

Summing up, the evidence supporting the CPH is abundant. It seems that most of the controversies and doubts that have arisen with respect to this problem are connected with the difficulty in establishing definite time thresholds for various linguistic aspects in L2 learning. New hypotheses and discoveries in SLA connected with such issues as multilingualism, language attrition, acquisition of L3s, effects of an L2 on an L1 and the ageing of the brain have made the matter even more complex. With respect to exceptional cases of near-native L2 learners, it appears that the most plausible explanation is the one offered by DeKeyser (2000) and Abrahamsson and Hyltenstam (2008), which states that rare cases of near-native proficiency in adult L2 learners should be attributed to high FL aptitude. The next section will focus on research on FL aptitude conducted in Poland.

2.7. Research on foreign language aptitude in Poland

Research on FL aptitude, which was not popular among Polish SLA researchers in the past, has been gaining more interest recently. The first attempts to measure the construct of FL aptitude were made by Ozga and Tabakowska (1973) and Niżegorodcew (1975, 1979). Ozga and Tabakowska's (1973) study aimed to correlate the results of a test of language rule induction with proficiency test results. The study reported a medium correlation between the proficiency and the FL aptitude scores of the subjects. A more elaborated longitudinal study was conducted by Niżegorodcew (1975, 1979) on a group of secondary school students. Her aptitude battery included the following subtests: *inductive language ability*, *sound discrimination*, *associative memory*, *aural sequence memory*, *visual sequence memory*, *L1 vocabulary (synonyms)*, *contextual inference (sentence completion)* and *phonemic coding ability*. She also included the *Raven Standard Progressive Matrices* (Raven, 1981) and general academic achievement (Polish, mathematics, history and biology) in her independent variables to predict success in learning English. As a result of her analysis, the author concluded that the best predictors of success in learning a foreign language are *inductive language learning*, *visual-sequence memory*, *associative memory* and *contextual inference*.

A few interesting studies were conducted in Poland in the last decade. A study on phonetic abilities was conducted by Baran-Łucarz (2004, 2009). She analysed the correlation between pronunciation accuracy and field independence on a group of 96 first-year English philology students in a pre- and post-formal instruction situations. As a result of multiple regression analyses, the author assumed that field independence is a predictor of phonetic abilities in a pre-instructional setting; however, formal instruction and training can reduce its impact. A closer look at the profiles of 'excellent' pronunciation learners led the researcher to conclude that their success should be attributed to an ideal combination of cognitive traits, among which field independence, high musical intelligence and talent, and right brain dominance seem to be the most important. These inborn qualities have to be supported by strong intrinsic motivation, extensive exposure to authentic spoken language, explicit phonetic knowledge, strategy training, self-efficacy and a belief in internal control of one's success in learning a foreign language. The afore-mentioned factors can, to a certain degree, counterweigh the lack of phonetic giftedness (Baran-Łucarz, 2009).

Rysiewicz (2007) investigated the relationship between FL aptitude, intelligence measured by the *Raven Standard Progressive Matrices* (Raven, 1981) and the *Lexicon* (*Leksykon*, Jurkowski, 1997), and English achievement test on a sample of 227 seventh grade pupils. The FL aptitude battery constructed by the author included thirteen subtests. Factor analysis for the construct of FL aptitude generated a four-factor solution. The four abilities of FL aptitude were defined as *verbal fluency*, *language analysis*, *associative memory* and *text comprehension*. The predictive validity of the abilities was

analysed at the next stage of the study. Using a multiple regression analysis as a basis, the author concluded that the best predictor of foreign language proficiency was the L1 vocabulary. Good predictors were also three components of FL aptitude: *verbal fluency*, *language analysis* and *text comprehension*. The final conclusion was that proficiency in learning a second language relies heavily on L1 lexicon and inductive abilities.

Rysiewicz (2008) made an effort to adapt the Modern Language Aptitude Test (MLAT) by Carroll and Sapon (1959) for Polish adult learners. He applied two methods of test adaptation: translation and paraphrase. All four components of FL aptitude, as proposed by Carroll (1981), are represented in the Polish adaptation of the MLAT; however, the author decided not to include Part 1 *Number learning*, which measures one aspect of the memory component of FL aptitude, as well as a special auditory alertness factor. Instead, he added a part which intends to test the inductive ability, which is poorly represented in the original test. The inductive ability test is based on an artificial language.

There are two tests of FL aptitude constructed and commercially available in Poland: the *Language aptitude test for secondary school students* (*Test predyspozycji językowych dla uczniów gimnazjum*, Kuliniak, 2002) and the *Language ability test* (*Test zdolności językowych*, Wojtowicz, 2006). Both include similar tasks based on the understanding of written discourse, L1 vocabulary knowledge and grammar tests based on an artificial language. The batteries include such tasks as filling gaps in a text with a phrase or word, choosing the best summary of a text, recognising prefixes and suffixes in foreign words, finding synonyms and antonyms, and guessing the meaning of phrases in a foreign language. The grammar scales include translation of an artificial language, analysis and modifying reproduction of a conjugation in a foreign language and constructing analogous grammatical form in the Polish language. Kuliniak's test reliability is .88, whereas the validity coefficient (correlation with foreign language school marks) is .57. Wojtowicz's test reliability is .90; the validity coefficient (correlation with foreign language school marks) is .49.

Another study on phonetic ability was conducted by Pastuszek-Lipińska (2008), who investigated the influence of music education on second language acquisition in musicians and non-musicians. A hundred and six participants − 53 musicians and 53 − non-musicians were asked to reproduce foreign language sentences in six languages. The study focused on segmental (vowels and consonants) and suprasegmental (intonation, rhythm, stress and rate) aspects of a language. Musicians outperformed non-musicians in the study. On the basis of her study, the author concluded that the influence of musical expertise extends beyond music processing to speech processing.

Turula (2009) contributed to the discussion on FL aptitude formulating a hypothesis that analytic abilities, contrary to Skehan's (1998) statement, surpass memory abilities in L2 learning, in particular, at high levels of linguistic proficiency. She conducted a study on 60 L2 learners at three different levels of proficiency: 20 learners at level B1-B2, 20

at C1 and 20 at C2. The purpose of the study was to examine their analytic abilities in skeletal sentence interpretation task. Her conclusion was that at near-native levels of linguistic proficiency the most important cognitive factors are analytical abilities and syntactic working memory.

Finally, Biedroń and Szczepaniak (in press) tested short-term and working memory abilities in gifted foreign language learners (accomplished multilinguals). Twenty seven accomplished multilinguals were compared to 36 mainstream philology students. The following instruments were used in the study: three memory subtests of the *Wechsler Intelligence Scale* (*Digit-Span*, *Digit-Symbol Coding*, and *Arithmetic*, which constitute a Memory and Resistance to Distraction index); two short-term memory tests of the *Modern Language Aptitude Test* (Part 1 (*Number learning*) and Part 5 (*Paired associates*)), and a working memory test, the *Polish Reading Span* (*PRSPAN*) designed by the authors of the study (Biedroń & Szczepaniak, 2012). The results of the accomplished multilinguals were compared to the results of first-year English philology students (mainstream). The analysis revealed that short-term memory and working-memory abilities in the accomplished multilinguals were higher than in the mainstream philology students. Moreover, the accomplished multilinguals obtained higher scores than the mainstream philology students on memory tests that are based on linguistic material than on tests based on numerical material. According to the researchers, the two components of working memory (the phonological loop and the central executive) are significant factors in determining the outcomes of learning a foreign language.

Conclusion

The purpose of this chapter has been to present an overview of empirical research on FL aptitude starting from the beginnings of the construct in the 1920s-1930s throughout its evolution to the present day. FL aptitude is a concept, which on the one hand, is deeply rooted in SLA tradition due to the famous Carroll's (1959) model and strongly affected by cognitive psychology research, on the other. Beyond doubt, Carroll's (1959) remarkable work and its findings can hardly be overestimated in FL aptitude research; therefore, his view on the concept, his FL aptitude model and his renowned testing tool, the MLAT, were thoroughly described in the first sections of this chapter. Following this, other models and tests of FL aptitude, as well as research devoted to FL aptitude in the 1970s and 1980s were presented. A section was dedicated to the controversies which arose around the concept during the communicative approach era, which resulted in a long-lasting stagnation in FL aptitude research, especially evident in Polish individual differences research. It was the present author's intention to underscore that the contemporary view of the construct of FL aptitude and research devoted to it are deeply rooted in those past viewpoints and heavily influenced by Carroll's (1959) model.

However, the main focus of the chapter was on the contemporary models of FL aptitude, namely Skehan's (2002) Processing Stage Model and Robinson's (2002b) Aptitude Complex Model, which recognise the contributions of psycholinguistic and cognitive science research on human cognitive abilities. The major strength of Skehan's model is relating stages of SLA to FL aptitude components in a way which firmly situates the construct in the mainstream SLA research. Robinson's model accords with the 'aptitude-treatment interaction' research. The main advantage of this model is relating cognitive profiles of foreign language learners to different types of instruction demanding different levels of awareness. Both models involve the factor of working memory, which reconceptualises the original, Carroll's (1959) FL aptitude model by adding extra abilities, such as noticing ability.

The following section was devoted to Sternberg's (2002) model of FL aptitude which reconceptualises the construct with respect to both its complexity and dynamics. The subsequent section was intended as an overview of three modern FL aptitude tests, namely the Cognitive Ability for Novelty in Acquisition of Language (CANAL-FT) (Grigorenko et al., 2000), the Llama Language Aptitude Test (Meara, 2005) and the High-Level Language Aptitude Battery (Hi-Lab) (Doughty et al., 2010). Next, the focus of attention was shifted to an overview of the empirical research aiming to investigate the impact of native language ability and the age factor on FL aptitude. Finally, the last section was devoted to research on FL aptitude in Poland. It seems that although Polish researchers have attempted to investigate this concept recently, FL aptitude in Poland remains fairly unexplored.

The main orientation underlying the contemporary research is that FL aptitude is not a monolithic, but a hybrid concept and that there are multiple aptitudes for learning a language (cf. Grigorenko et al., 2000; Robinson, 2002b; Sternberg, 2002). In keeping with this position the following chapter will present FL aptitude defined as a complex set of different cognitive abilities. It is intended as an extension of the present chapter with the focus on empirical research on three particular aspects of the investigated construct, namely analytic, memory and noticing abilities.

CHAPTER THREE

FOREIGN LANGUAGE APTITUDE − FOCUS ON SPECIAL ABILITIES

Introduction

This chapter presents the findings of selected empirical research on different aspects of FL aptitude, with emphasis on one of the most promising concepts in FL aptitude research, that is *working memory* (WM). There are solid grounds for supposing that WM is "one of the greatest accomplishments of the human mind" (Conway, Jarrold, Kane, Miyake, & Towse, 2008, p. 3) and a significant source of individual variation in performing cognitive tasks. WM is closely related to general intelligence, which underlies analytic abilities, which, in turn, explain a large part of variance in learning a second language in all learning conditions.

The first part of the chapter will be devoted to the presentation of the place of analytic abilities in FL aptitude models, empirical studies on analytic abilities in different learning conditions, the relationship between analytic abilities and metalinguistic abilities, and between analytic abilities and intelligence. In the subsequent sections, the focus of attention will be shifted to the role of memory ability in SLA. Firstly, the division of memory will be presented, followed by a review of research on WM. The main emphasis will be placed on Baddeley's (2003) model of WM, which is the most influential to FL aptitude research, and, in particular, the *phonological loop*, which is considered to constitute a language acquisition device. In addition to Baddeley's (2003) model, the theory of WM capacity as being determined by executive attention (Conway et al., 2008; Kane, Conway, Hambrick, & Engle, 2008) is going to be presented. Next, the neurological foundations of individual differences in memory will be outlined. The last section will be devoted to noticing ability – a factor which relies on attentional resources driven by the component of WM termed as *central executive.*

3.1. Analytic abilities

Analytic abilities have been identified as a source of individual variation in all relevant FL aptitude models (cf. Carroll, 1959; Robinson, 2002b; Skehan, 1998, 2002). Carroll (1959) recognised two aspects of analytic ability, that is inductive language learning ability and grammatical sensitivity. In 1998, Skehan, referring to SLA processing stages, subsumed Carroll's division under the term *analytic abilities*, which correspond to the central language processing stage of SLA. This stage appears to be correlated with measures of general intelligence (cf. Sasaki, 1996).

Analytic ability is defined as "the capacity to infer rules of language and make linguistic generalisations and extrapolations" (Skehan, 1998, p. 207). As Skehan argues, in contrast to mother tongue learning by children, adult learning does not have access to inner mechanisms which enable linguistic data to be processed automatically. Instead, adults have to draw on general intellectual ability. As he explains: "It appears that the abilities implicated in searching for and internalising patterns in language are strongly connected with general cognitive abilities" (Skehan, 2002, p. 82). Other abilities, namely input processing, assimilation of new material and retrieval, are more peripheral and less related to general cognitive abilities. Skehan hypothesises that these abilities are specifically linguistic, whereas analytic abilities are generally intelligence-dependent.

Analytic abilities, next to memory abilities, play a central role in Skehan's model of FL aptitude. They are significant during the *Patterning* and *Controlling* stages of SLA and encompass such aptitude components as grammatical sensitivity, inductive language learning ability, restructuring capacity, automatisation and proceduralisation. Robinson (2002b) included the analytic component of FL aptitude in his *Aptitude Complex model* as primary cognitive abilities and secondary ability factors. Primary *pattern recognition* ability is connected with *noticing the gap* ability and primary *grammatical sensitivity* relates to *metalinguistic rule rehearsal* ability. The latter abilities constitute an aptitude complex for explicit rule learning, which creates a suitable context of SLA for analytically oriented learners[18]. The componential view of aptitude resulted in research on individual differences in 'learner types' (Skehan, 1989, p. 34). In 1981, in the *Canadian Public Service*, Wesche (1981), for example, conducted an experiment in which learners were matched with a teaching approach which reflected their ability orientation, namely memory or analytic preference. In turned out that this led to an improvement in both attitudes and L2 outcomes. Accordingly, Skehan (1989) hypothesises that there are two different orientations in language learning: analytic *versus* memory.

Research over the last decades has confirmed the predictive validity of the construct of analytic abilities. One study that pursued this line of enquiry was conducted by Harley

[18] Models of FL aptitude proposed by Skehan (1998) and Robinson (2002b) are presented in Chapter Two.

and Hart (1997, 2002). Their study investigated the relationship between FL aptitude and second language outcomes as a function of different age of L2 exposure. They found evidence to support their hypothesis that there is a positive correlation between early immersion learners' memory abilities and their learning outcomes, whereas in the case of late immersion starting in adolescence, the learning outcomes correlate with the analytic abilities of the learners. They interpret this finding in light of the critical period hypothesis (Lenneberg, 1967) for language acquisition (cf. Skehan, 2002). Harley and Hart (1997, p. 395) conclude that "when intensive L2 exposure begins around adolescence, language learning will tend to depend on different cognitive abilities from those that early learners rely on, with analytical language ability being more intimately involved in L2 success for later learners". This tendency has been observed not only in formal, but also in natural environments. The following section will discuss the role of analytic abilities in different learning conditions.

3.1.1. Analytic abilities and learning conditions

There is a cumulative body of evidence that learning under all conditions: explicit, implicit, incidental, and in formal and informal contexts alike is affected by individual differences in analytic abilities. Research by Ehrman and Oxford (1995) provided evidence for the high predictive validity of MLAT scores in both the communicative and audiolingual approaches. Their results resonate with those by Robinson (1996, 2007), de Graff (1997), Williams (1999) and DeKeyser (2003), who all opt for the relevance of FL aptitude in foreign language learning by adolescents and adults under all learning conditions. Foreign language learning in all contexts is also influenced by aptitude factors. FL aptitude seems to directly influence L2 learning in a formal context and indirectly in an informal context (cf. Gardner, 1985; MacIntyre, 2002). In 1997 Robinson provided evidence that MLAT scores correlate the most strongly with learning outcomes in implicit learning conditions. According to Skehan (1998, 2002), FL aptitude is even more influential in informal than in formal contexts as the learner not being instructed is forced to find regularities in the input on his own. As he argues, in informal environments a learner's capacity to process and analyse input, make generalisations and assimilate new material may be under pressure "with the result that aptitude based differences will assume even greater significance" (Skehan, 2002, p. 78).

DeKeyser (2000) found that adult immigrants who achieved near-native scores on a grammaticality judgement test in English were diagnosed as having high analytic abilities. This relationship did not occur in the case of immigrants who arrived in the USA as children and who all achieved native or near-native level scores on the grammaticality judgement test (cf. Reves, 1982). DeKeyser's assumption is that adult learning in both explicit and implicit conditions is a conscious process and does not result from qualita-

tively different, unconscious learning conditions. Differences in learning outcomes in all conditions result mainly from individual differences measured by traditional tests such as the MLAT and memory tests (cf. DeKeyser, 2003; Robinson, 2002a).

The main presumption guiding Ranta's study (2002) was the effect of communicative language teaching on levelling out individual differences among foreign language learners. A study was conducted on francophone children participating in an ESL programme aimed at the development of interpersonal communication skills. She found that language analytic ability, as measured by error correction in the first language, correlated with success in an L2. As Ranta argues: "These results suggest that CLT as instructional treatment cannot wipe out the effect of aptitude differences among learners" (2002, p. 159). In contrast to the views of the adherents of the aptitude-treatment interaction approach, according to which the effects of individual differences are believed to be minimised by matching the learner profile with appropriate teaching instruction (cf. Robinson, 2002b, 2007; Snow, 1994; Wesche, 1981), Ranta's study accords with a more radical view of the role of analytic ability, regarding it as a factor contributing to L2 learning outcomes under all conditions, including in communicative classrooms and informal environments (cf. DeKeyser, 2003; Ehrman & Oxford, 1995). The next section will present another complex issue in the research on FL aptitude, namely the relationship between analytic abilities and metalinguistic abilities.

3.1.2. Analytic abilities and metalinguistic abilities

Another aspect worth investigation is the relationship between analytic ability and metalinguistic ability. Ranta (2002), in line with Ryan and Ledger (1984, p. 157) who define metalinguistic ability as: "The ability to decenter, to shift one's focus from the most salient attribute of a message (its meaning and contextual setting) to structure", claims that both concepts are partly overlapping. Therefore, the MLAT subcomponent measuring grammar sensitivity also constitutes a measure of metalinguistic ability. Despite correlations found between FL aptitude tests and metalinguistic tasks, the two notions, that is FL aptitude and metalinguistic ability, are structurally and qualitatively different. FL aptitude is a trait referred to as human cognitive ability, whereas metalinguistic ability is not really an ability but rather a set of skills developed throughout life (Ranta, 2002, p. 162).

Although there is much evidence that adult foreign language learning, contrary to child first language acquisition, draws on cognitive abilities rather than innate knowledge (cf. Birdsong, 1999; DeKeyser, 2000; Robinson, 2002b; Skehan, 2002), differences in metalinguistic abilities among children have been observed. For example, Bialystok (1987) reported differences among kindergarten children on a grammaticality judgement test. Moreover, large differences among adults in metalinguistic abilities in their mother

tongue have been described (e.g. Gleitman & Gleitman, 1970). Therefore, metalinguistic abilities are not only a developmental outcome, but also a function of the onset of literacy, early bilingual exposure and the specificity of the environment (Ranta, 2002).

Skehan's (1986) research on children demonstrated that there is a relationship between children's first language aptitude and foreign language analytic ability measured in them as adolescents. In a longitudinal study, termed as the *Bristol Project* (Skehan, 1986), tests of aptitude and language proficiency were conducted in a group of adolescents who were previously tested as children with respect to L1 developmental indices. As the test scores correlated, it was hypothesised that analytic ability might be indicated by such features as the mean length of utterance and the range of noun phrase complexity at 42 months (Skehan, 1998). Based on these data, it might be concluded that the development of both analytic and metalinguistic ability is not only a matter of rate, but also of ultimate attainment; what is more, even young children display a significant variety in this domain.

There is evidence available that metalinguistic ability can be enhanced. Jessner (2008) and Herdina and Jessner (2002) claim that there is a heightened level of metalinguistic awareness in multilingual learners. They define metalinguistic awareness as the ability to focus on linguistic form and to switch attention between form and meaning. Therefore, this definition is similar to Ryan and Ledger's (1984) concept of metalinguistic ability. Metalinguistic awareness develops at the higher level of creativity and reorganisation of information (Jessner, 2008, p. 277). Studies by McLaughlin and his colleagues (McLaughlin & Nayak, 1989; Nayak, Hansen, Krueger, & McLaughlin, 1990) and Kemp (2001) provided evidence for the superiority of multilinguals in grammatical awareness over less experienced foreign language learners with that ability increasing with the number of languages they have learned. There seems to be a general consensus among FL aptitude researchers that analytic abilities are related to intelligence (cf. Skehan, 1998). However, as will be argued in the next section, this relationship is far more complex and depends to a considerable extent on the methods of operationalisation and measurement of the concepts.

3.1.3. Analytic abilities and intelligence

A body of research by Sasaki (1996) cast some light on the controversial relationship between FL aptitude and intelligence. Traditionally, FL aptitude and intelligence have been treated as separate (Gardner, 1985; Gardner & Lambert, 1972; Skehan, 1982). However, the contribution of a general factor, which seems to underlie all other cognitive abilities, to foreign language learning proficiency has been recognised by some researchers (Bachman, 1990; Bachman & Palmer, 1982; Carroll, 1993; Flahive, 1980; Oller, 1983; Spolsky, 1989; Wesche et al., 1982). Bachman (1990), for example, sug-

gests that information-processing ability is related to general cognitive abilities or intelligence. Oller (1983), in turn, having investigated the relationship between general intelligence and first language ability, concludes that language proficiency is correlated with intelligence and all other capabilities related to language in a higher-order structure. Carroll's (1993) Cognitive Abilities Model presents language abilities as primary cognitive abilities subsumed under a general cognitive ability factor. Moreover, as Dörnyei (2005) points out, both the MLAT (Carroll & Sapon, 2002) and the PLAB (Pimsleur, 1966) include an L1 test of vocabulary, which is a fundamental component of the measurement of intelligence.

Flahive (1980) reported high positive correlations (between .59 and .84) between proficiency in a second language and non-verbal intelligence. This result suggests that not only verbal intelligence, but also abstract reasoning ability may contribute to foreign language learning outcomes. In another study by Wesche et al. (1982), a positive correlation was found between MLAT scores and intelligence test scores. The highest correlation was established between the MLAT total score and reasoning ability (.65). Factor analyses indicated the existence of one second-order general factor, identified as general intelligence, and three first-order specific factors characterised as first language verbal knowledge, number/reasoning/spatial intelligence and aptitude. A correlation was found in a higher-order structure. Sasaki interprets this result as a confirmation that "aptitude and intelligence share a more abstract level of general cognitive ability" (1996, p. 24).

An important question to investigate was to what extent and in what aspects FL aptitude is dependent on the general factor and in what aspects it is independent of it, that means, in what aspects it is language-specific. Sasaki's (1996) study attempted to resolve this problem by investigating the relationship among three measures: second language proficiency, FL aptitude and two types of intelligence (verbal and reasoning). In line with the hierarchical view of cognitive abilities (e.g. Carroll, 1993), Sasaki assumed the existence of a second-order latent factor of general cognitive ability and several first--order cognitive abilities. The hypothesised general factor represents an abstract level of cognitive ability that subsumes FL aptitude, verbal intelligence, reasoning and other cognitive abilities relevant to SLA. First-order factor analysis of the aptitude and intelligence scores confirmed separation between these factors. However, second-order factor analysis corroborated the existence of a factor, namely analytic ability, accounting for the variance in some of the aptitude variables as well as in the intelligence quotients. Other aptitude factors, specifically phonetic coding ability and memory, did not correlate with intelligence. Sasaki concluded that intelligence and analytic ability are interrelated, whereas phonetic coding ability and memory factors are separate components of FL aptitude, independent of the general factor (cf. Skehan, 1998). These hypotheses were challenged by Grigorenko et al. (2000) who correlated the results of their FL aptitude test − the Cognitive Ability for Novelty in Acquisition of Language (CANAL-FT) − with fluid and crystallised IQ scores. As a positive correlation was established, the authors

drew the conclusion that there is a first-order correlation between FL aptitude and IQ to the extent that the concepts overlap (cf. Sawyer & Ranta, 2001).

Summing up, analytic abilities constitute an important component of FL aptitude and affect learning a foreign language in all learning conditions; however, their significance may vary as a result of the type of instruction, age or learner profile. In the present author's opinion, a very popular belief among SLA researchers (cf. Skehan, 1998) that analytic abilities are related to intelligence, whereas memory abilities are independent of it, indicating they are language-specific, needs thorough empirical investigation. While the relationship between general, as well as performance (non-verbal) and verbal IQ and FL aptitude is, in general, well described (cf. Dörnyei, 2005; Sasaki, 1996), there is a marked lack of research on the relationship between different FL aptitude components and other both higher-order and primary cognitive abilities. The analysis of correlations between tests of different abilities from the Wechsler Intelligence Scale and FL aptitude components can provide interesting insights into the domain of FL aptitude. An inspection of the Wechsler subscales indicates that many of the abilities tested are reflected in FL aptitude models. For example, the verbal subscale *Similarities* tests inductive reasoning (discovering common features and classifying), the ability to perceive relations between notions, abstract logical thinking, analogical reasoning, associative thinking and differentiation between important and unimportant details, whereas *Object Assembly*, a performance subscale, tests the ability to create a whole by discovering relations between elements, as well as pattern recognition, anticipating, intellectual flexibility, complex information processing and field dependence/independence. What is more, analytic abilities are related to WM, which plays a central role in reasoning, comprehension and intellectual functioning in general. Accordingly, memory abilities will be the focus of the next section.

3.2. Memory abilities

Memory is probably the most significant factor in the theory of FL aptitude, often called 'memory ability' in the contemporary literature (Dörnyei, 2005; N. Ellis, 1996; Sawyer & Ranta, 2001; Skehan & Wen, 2009). Memory, according to Carroll (1993, p. 302), is an ability that varies across individuals affecting, to a considerable extent, human performance in a variety of tasks. Contemporary cognitive science offers a standard hierarchical taxonomy of memory, defined in both temporal and functional terms. In terms of temporal taxonomy, memory is divided into *working* (*short-term*) and *long-term memory* (Schumann, 2004a, p. 4). The terms short-term and WM are sometimes used interchangeably because of the alleged difficulty in making a distinction between them (cf. Robinson, 2007; Schumann, 2004a). However, most researchers discriminate between these two terms (cf. Baddeley, 2003; Baddeley, Gathercole, & Papagno, 1998; Conway

et al., 2008; Engle, Laughlin, Tuholski, & Conway, 1999, Kane et al., 2008). The term short-term memory (STM) is used to describe a sort of static memory that is held for a short period of time (less than 20 seconds). In contrast, WM involves the temporary storage and manipulation of information that is necessary for the performance of a wide range of cognitive tasks (Baddeley, 2003, p. 189). Hence, WM is seen as "fundamentally a form of memory, but it is more than memory, for it is *memory at work*" (Conway et al., 2008, p. 3). WM comprises a number of components that perform several cognitive functions that encompass mechanisms for the storage of information and mechanisms for executive control of information. It is the mechanisms of executive control that differentiate WM from STM (Conway et al., 2008). Long-term memory (LTM) is designed for more durable storage. According to Robinson (2003, p. 631), LTM is a store of instances of encoded input, which create representations matched to new instances of input in WM during parsing and comprehension. These representations also serve as speech production plans guiding retrieval processes in the articulation of a message. STM is capacity limited, whereas LTM is not. They also differ with respect to durability; the information held in STM disappears rapidly, whereas information in LTM can be stored for a long time.

Functionally, memory is divided into *declarative* (explicit) and *non-declarative* (implicit). The first type encompasses memories for facts and events, whereas the second one includes memories for habits, motor and perceptual skills and emotional learning (Fuster, 1995; Schumann, 2004a). Declarative memory can be subdivided into *semantic memory*, which is the memory for facts and knowledge of the world and *episodic memory*, which are recollections of past events or experiences. Declarative memories can be recalled consciously and verbalised. Neurologically, they are subtended by the hippocampus and the neocortex (Crowell, 2004). Non-declarative memory is subdivided into *conditioning*, *procedural memory* and *priming* (Fabbro, 1999). Neurologically, it is subserved by the basal ganglia and the neocortex (Graybiel, 1998). Non-declarative memories cannot be accessed through conscious effort. This memory is relatively inflexible and only available in contexts that are identical to the original learning situation[19] (Aglioti, 1999). Non-declarative memory is evolutionary older. It precedes declarative memory phylogenetically[20] and ontogenetically[21]; moreover, it is better preserved in the elderly, not being as prone to deterioration as declarative memory. The afore-mentioned differences between declarative and non-declarative memory founded a basis for Krashen's (1981a, 1981b) non-interface position exerting a consequential influence on foreign language teaching methodology. Figure 3.1. presents Schumann's (2004a) model of memory.

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[19] This phenomenon is called *transfer appropriate processing* (Morris, Bransford, & Franks, 1977).
[20] Connected with evolutionary development.
[21] Connected with foetal development.

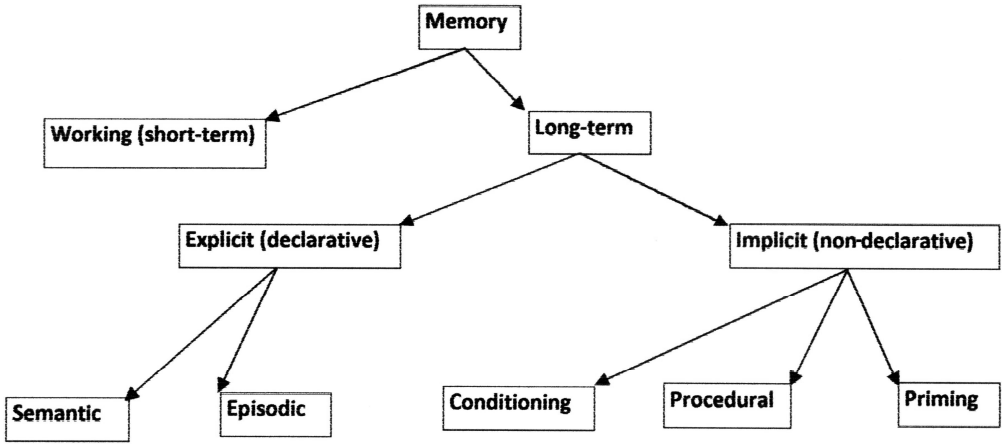

Figure 3.1. Hierarchical classification of memory (Schumann, 2004a, p. 4)

Broadly speaking, there are three basic issues that are addressed in the SLA memory research: (1) the relationship of selective attention and awareness to memory during noticing; (2) the role of memory under different conditions of learning; and (3) the aspect of the effect of individual differences in WM capacity on SLA, which is the most relevant to the theory of FL aptitude. In SLA literature memory and attention are closely interrelated[22]. As Robinson elucidates, "Attention to and subsequent memory for attended language input are both essential for SLA, and are intricately related. Attention is the process that encodes language input, keeps it active in working and short-term memory, and retrieves it from long-term memory" (2003, p. 630). According to Robinson (2003), short-term working memory[23] is the currently-activated part of LTM; what is more, awareness and WM are isomorphic. Before information is encoded in LTM, it must first enter focal attention and short-term, working memory, where rehearsal processes operate. The rehearsal mechanisms result in noticing[24] (cf. Schmidt, 1990) and send information from STM to LTM. Those processes give rise to awareness. Rehearsal processes are of two kinds: *maintenance rehearsal*, requiring data-driven, instance-based processing and *elaborative rehearsal*, requiring conceptually driven, schema-based processing (cf. Hulstijn, 2001, 2003). The first type refers to the storage of unanalysed forms, 'chunks', in WM. The latter requires activation of schemas in LTM, necessary in analysing the input.

Positive correlations were found between individual differences in WM and the subsequent learning in all learning conditions. However, inducing selective attention to form via input enhancement facilitated more learning when compared to the unstruc-

[22] The factor of attention is going to be addressed at greater length in section 3.3.1. of this chapter.
[23] Short-term, working memory is a term used by Robinson (2003).
[24] Noticing is described in section 3.3. of this chapter.

tured learning condition based on memorising. According to Robinson (2003), the former activates the learning process based on a conceptually driven mode of processing and elaborative rehearsal, which leads to better learning results then the latter, data--driven maintenance rehearsal, activated while performing simple memory tasks. Nevertheless, as Robinson (2003) concludes, irrespective of pedagogical intervention, differences in memory ability affect performance in all conditions of learning. The following section will describe the most significant to the theory of FL aptitude component of the system of memory, namely WM.

3.2.1. Working memory

WM is operationalised as "the ability to mentally maintain information in an active and readily accessible state while concurrently and selectively processing new information" (Conway et al., 2008, p. 3). The division of the memory system was first proposed by Hebb (1949), who suggested that there are two memory systems: LTM, involving durable changes and STM, which was attributed to temporary electrical activity. In the 1950s and 1960s empirical research provided evidence for the dual memory system (cf. Brown, 1958; Peterson & Peterson, 1959). The first reference to WM, as it is conceived today, was made in 1960 by Miller and his team (Miller, Galanter, & Pribram, 1960). In their opinion, WM was associated with executing plans. They postulated that people create hierarchically structured plans which they carry out. Plans were considered internal knowledge representations that could be activated in WM. Contrary to previous discussions of a limited-capacity system of WM that emphasised storage, Miller et al. (1960) emphasised both storage and processing. In 1968 Atkinson and Shiffrin proposed that information from the environment enters a temporary short-term storage system, which serves as an antechamber to the more durable LTM. Their model is regarded as the most influential one, as the temporary system also serves as a WM, which operates not only in long-term learning, but also in other cognitive activities such as reasoning and comprehension (Baddeley, 2003, p. 190). The science of neuropsychology has provided evidence for the duality of the memory system. Baddeley and Warrington (1970), for example, demonstrated that damage to the medial temporal lobes led to grossly impaired capacity for new learning, which reflected damage to the LTM system, while the performance on STM tasks was untouched. These results contributed to the construction of a new model of memory functioning.

The multicomponent WM model that is now accepted universally was formulated by Baddeley and Hitch (1974). They originally proposed dividing memory into three subsystems: (1) the *phonological loop*, which processes verbal and acoustic information, (2) the *visuospatial sketchpad*, which processes visual information, and (3) the *central executive*, which is a supervisory attention-limited control system. Later, they proposed

a fourth factor, the *episodic buffer*, which stores information (Baddeley, 2000). In subsequent research on WM, the findings of correlation analyses have provided evidence that WM plays an important role in a number of complex cognitive abilities, such as language learning, reasoning, comprehension and cognitive control, and that WM measures are an indicator of intellectual ability (Kane et al., 2008). The concept of WM is crucial in research on individual differences because it plays a central role in intellectual functioning in general. It has been shown to be relevant to many everyday tasks, such as reading, making sense of spoken discourse, problem solving and mental arithmetic. Given its importance, it is now the focus of considerable research efforts in cognitive psychology and cognitive neuroscience (Conway et al., 2008, p. vii).

WM has limited capacity, which constrains cognitive performance. Individuals differ with respect to their WM capacity. People with greater WM capacity perform better on a variety of cognitive tasks, such as complex learning, reading and listening comprehension and reasoning than people with smaller WM capacity. The capacity depends on a number of variables, such as age, brain damage and disease in general. Older children outperform younger children, healthy adults outperform patients with frontal-lobe damage, and, generally, WM deteriorates with age. This variation, measured by span tests, is believed to affect human cognitive functioning (Conway et al., 2008). Many issues regarding WM have yet to be investigated fully. What causes variation in WM performance is one of them. Several candidates for the cause of the variation have been proposed, such as mental speed, inhibition of attention, goal maintenance, conflict resolution and executive attention, which is attentional control of interference in memory (Conway et al., 2008).

Besides the modular model of WM proposed by Baddeley (2003), there are other models emphasising the factor of executive attention as central in the WM system (Conway et al., 2008; Kane et al., 2008). Kane et al. (2008), for example, proposed a theory of WM capacity as being determined by executive attention, using individual differences among healthy young adults as a basis. As they argue: "Our executive attention theory holds that the control of memory retrieval in the face of interference is central to the attentional construct measured by WM tasks" (Kane et al., 2008, p. 31). Evidence from a number of studies indicates that high- and low-WM span subjects differ in recall accuracy or latency under high-interference but not low-interference condition (cf. Conway & Engle, 1994). The researchers postulate that sources of variation are multiple, including domain-specific skills and strategies and a domain-general attention capability. Attention capability accounts for the predictive validity of WM span tests and underlies other cognitive abilities, including fluid intelligence (*Gf*). The issue of whether WM is domain-general or domain--specific remains controversial, but many arguments support the idea that the source of variation in WM is domain-general (Conway et al., 2008; Kane et al., 2008).

Another problem worth investigation is the role of strategy use as a factor affecting WM capacity. Adopting as a starting point a hypothesis that individual differences in

strategy use might change WM span scores, Kane et al. (2008) analysed a number of studies addressing this issue. The data analysed by the researchers argued against the importance of strategy use in WM variation. In fact, strategy training increased rather than decreased span variability. The conclusion is that strategy use cannot account for the WM capacity variation (Kane et al., 2008, p. 30).

There is an ongoing discussion about the relationship between STM, WM and fluid intelligence (*Gf*) (Conway et al., 2008; Engle et al., 1999; Kane et al., 2008). The first to address the question of "To what extent are the terms STM and WM different terms for the same construct and to what extent do they refer to different but more or less related constructs?" were Engle et al. (1999, p. 309). Having tested 135 subjects for their WM capacity, STM and *Gf*, they concluded that WM and STM are separate, but substantially correlated constructs (correlation .68). The researchers found that the correlation was based on the shared feature representing storage, coding and rehearsal, although some shared variance was also likely to be due to executive attention. It was the increased demand on executive attention that was found to cause the unique, residual variance in WM.

The accuracy of measures of WM capacity and STM span is debatable. Kane et al. (2008) argue that although WM span tasks are reasonably good measures of executive attention, due to their dual nature, a measure of WM capacity does not need to be dual to measure the control of attention. A dual task requires subjects to maintain access to information outside of conscious awareness in the face of proactive interference. However, some STM span tasks seem to measure executive control; for example, some spatial STM tasks or STM tasks that include long lists of verbal items. Due to the fact that STM can hold only four items at a time and the phonological loop can hold items for only two seconds, tests with more than four items would require some degree of executive attention, which means that, in fact, they measure WM capacity. Given the foregoing, it would behove researchers to exercise great caution in analysing data and drawing conclusions regarding measurements of WM capacity.

Kane et al. (2008) found that only WM capacity, but not STM, predicted variance in *Gf*, which suggests that greater attentional demands of WM span tasks resulted in the correlation between WM and *Gf*. Researchers generally agree that variation in WM capacity causes significant variation in general cognitive ability and that executive attention is the central factor in this variation. No matter how highly correlated they are, WM and *Gf* are not the same (Conway et al., 2008; Kane et al., 2008; Oberauer, Süß, Wilhelm, & Sander, 2008). Although WM is generally considered to be domain-general, some studies report a low correlation between individual verbal and spatial WM abilities, which suggests that WM is domain-specific. In this regard, Kane et al. (2008) found that WM and STM are much more domain-specific in people in high-IQ groups than in lower-IQ groups, in that verbal and spatial WM abilities are correlated much less in high-IQ than in lower-IQ groups. They conclude that such differences between verbal and spatial WM abilities might result from testing subjects from a group in which gen-

eral cognitive ability is high and in which the range of ability is small, for example, the majority of university students. The researchers suggest that when the range of general cognitive ability is narrow, any variability in cognitive performance results from other factors, such as domain-specific abilities, skills or strategies. Kane et al.'s (2008) model of WM is presented in figure 3.2.

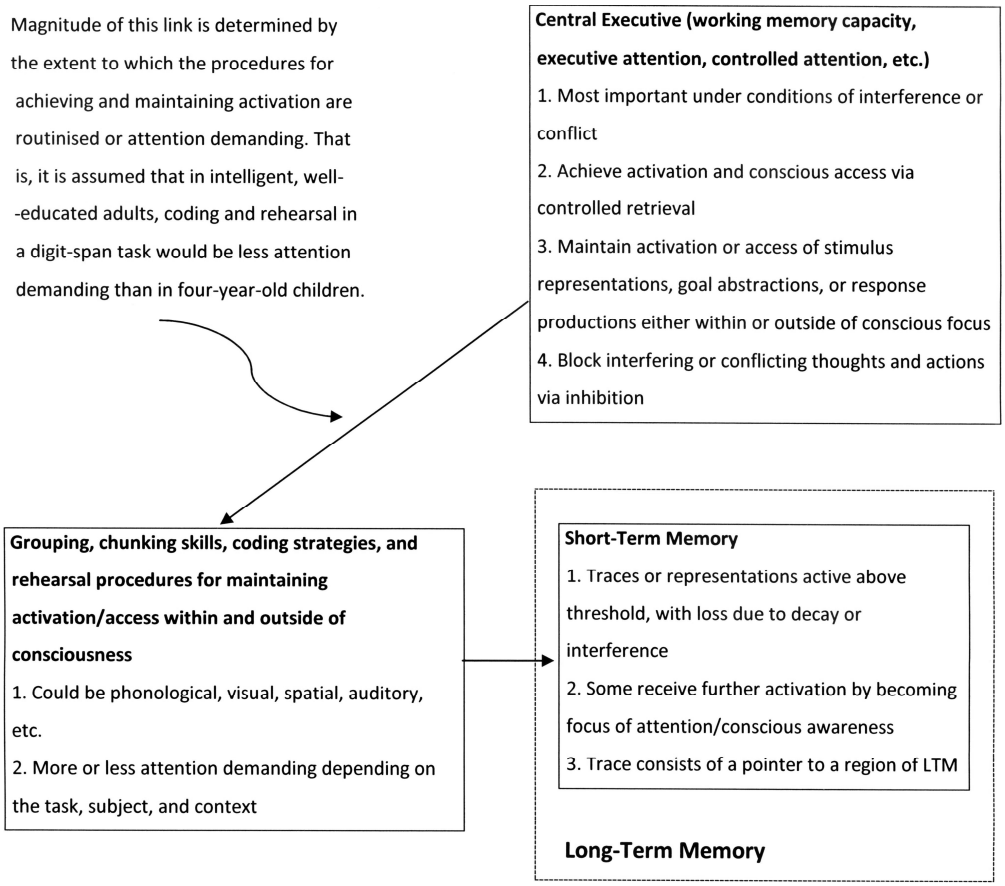

Figure 3.2. Measurement model of the WM system (Kane et al., 2008, p. 23)

3.2.2. Baddeley's (2003) model of working memory

According to Baddeley (2003), the system of WM encompasses two mechanisms: for storage of information and for cognitive control. The element of executive attention represented by the central executive is the most important part of the system. The following subsections will discuss the four components of Baddeley's (2003) model, namely the central executive, the phonological loop, which is regarded as a language acquisi-

tion device, the visuospatial sketchpad and the episodic buffer. The phonological loop will be addressed at greater length in the section devoted to the role of WM in foreign language learning.

3.2.2.1. The central executive

The central executive, according to Baddeley et al. (1998), is the system responsible for the attentional control of WM. Neurologically, it is situated in the frontal lobes. It performs executive processes, which are principal in determining individual differences in WM span. WM span measures are typically tests in which strings of sentences are aurally or visually presented to subjects who are required to remember the last word in each sentence for subsequent immediate recall (Daneman & Carpenter, 1980). Therefore, the subjects are requested to combine simultaneous storage and processing of information. WM span seems to be a good predictor of a variety of cognitive tasks, for example, reading comprehension. There is also a high positive correlation with standard intelligence tests (Baddeley, 2003).

The theory of the central executive was further explored by Kane et al. (2008) who proposed that the extent to which executive attention is engaged by a task is critically determined by the degree of interference or conflict presented by the context (cf. Oberauer & Kliegl, 2006). Working memory capacity refers to the attentional processes that create conditions for goal-directed behaviour by maintaining relevant information in an active state or retrieving that information under conditions of interference, distraction or conflict. Executive attention mechanisms are engaged to block or inhibit goal--irrelevant information. Executive attention processes, measured by WM span tasks, are believed to be primarily domain-general and only secondarily represent domain-specific rehearsal and storage processes. In contrast, STM span tasks primarily represent domain--specific storage and rehearsal skills and only secondarily executive attention processes. According to Kane et al. (2008), WM span tasks requiring subjects to maintain or recover access to target information under interference are generally better measures of a domain-general attentional capability than STM span tasks. Summarising, the researchers propose that WM capacity variation is driven by individual differences in the process of executive attention.

3.2.2.2. The phonological loop

Two ‘slave systems’ have been proposed for the storage of information: the visuospatial sketchpad and the phonological loop (Baddeley et al., 1998). The phonological loop is the most theoretically referred to aspect of WM; moreover, it seems the most relevant to

the theory of individual differences in SLA. The phonological loop is a temporary verbal-acoustic storage system, necessary in performing different cognitive tasks. It comprises two components: a *phonological store*, which represents material in a phonological code and which decays over seconds unless it is refreshed by the second component, the *subvocal rehearsal system*. This component registers and maintains visual information within the store provided the items can be named. Inner speech is used to refresh the decaying representations. If a subject is shown a string of letters or digits, for example, a phone number, he/she will subvocalise them as the retention depends on the acoustic and phonological properties of the items (Baddeley, 2003). It is evident that phonological similarity affects remembering items. The more phonologically similar the items are, the more difficult it is to memorise them for immediate recall. Thus, it is more difficult to remember sequences of letters with similar sounding names, such as *T, C, V, D, B, G* than dissimilar letters, such as *B, W, Y, A, S, R*. The same refers to words; a string of different words, like *pit, day, cow, soup* is more easily retained than a string of phonologically similar words, such as *man, cat, map, cab*. This effect, called the *phonological similarity effect* (Conrad & Hull, 1964, as cited in Baddeley et al., 1998, p. 161), disappears when subjects are given more time to memorise items, which enables them to use different mnemonic devices. This is interpreted as demonstrating that, contrary to encoding in STM, encoding in LTM is a process where meaning is more important than phonology. Moreover, word length is important, as it affects the effectiveness of remembering for immediate recall. The memory for monosyllabic words in a five-word sequence is 90%, whereas when the words contain five syllables it drops to 50%. This process is called the *word length effect* (Baddeley, Thomson, & Buchanan, 1975, as cited in Baddeley et al., 1998, p. 161). The memorising process can be easily disrupted. Articulatory rehearsal is a serial process – it is possible to say only one thing at a time (cf. N. Ellis, 2001). For example, it is easy to disrupt a subject's performance by asking him/her to repeat an irrelevant word while simultaneously memorising items. The process of item registration will be impaired because rehearsal or subvocalisation are disrupted. This phenomenon is referred to as the *articulatory suppression effect* (Murray, 1967, as cited in Baddeley et al., 1998, p. 161). Neurologically, the phonological loop is situated in the left hemisphere, with separate storage and rehearsal systems. Storage is associated with the cortical Brodmann area 44, whereas the rehearsal system is situated in Broca's area (Brodmann areas 6 and 40) (Baddeley, 2003, p. 192).

3.2.2.3. The visuospatial sketchpad

The visuospatial sketchpad is designed for the integration of spatial, visual and possibly kinaesthetic information into a unified representation that can be temporarily stored and manipulated (Baddeley, 2003, p. 200). Neurologically, the system is probably situated in

the right hemisphere. Apparently, it seems to be of little relevance to linguistic tasks, but it is suspected to participate in reading by maintaining a representation of a page, which enables the eyes to move accurately from the end of one line to the beginning of the next. Moreover, cases of people with Williams syndrome characterised by impaired visuospatial processing, who have problems with structures including spatial terms such as *above, under* or *shorter*, suggest that the ability to store and manipulate visuospatial information is involved in language comprehension.

3.2.2.4. The episodic buffer

The episodic buffer, the most recently introduced component of WM (Baddeley, 2000), is defined as a limited capacity system that depends heavily on executive processing; its main function is not to control, but to store information. It is called 'episodic' because it collects together information from different sources into chunks of episodes. The term 'buffer' refers to its ability to combine information from different modalities into a single, multi-faceted code. It is a store for the maintenance of integrated, multidimensional representations of objects and events. The other function performed by the episodic buffer is connected with conscious awareness (Baddeley, 2003). There is still no consensus among researchers as regards the function of the episodic buffer. Its role seems not to be transparent. Hence, any hypotheses as to its potential role in SLA have to be tentative. As Kane et al. argue:

> The episodic buffer currently offers little to research on WM variation. Baddeley has not yet clarified the buffer's importance to the predictive power of the WM span [...]. We are therefore sceptical that individual-differences research will soon clarify the nature or utility of this new component (2008, p. 40).

3.2.3. The role of working memory in foreign language learning

The hypothesis that WM is designed to support complex cognitive tasks (Baddeley & Hitch, 1974) was extended by Baddeley et al. (1998) who attempted to explore its evolutionary development and define its role in human cognitive functioning. Firstly, the role of the phonological loop seemed ambiguous. From the perspective of clinical experience it was evident that many people with serious short-term phonological memory deficits have no problems with everyday cognition tasks. They typically have normal production and comprehension abilities and no problem with remembering simple information. These observations undermined the argument that the primary function of

the phonological loop is to remember familiar words. Alternatively, it was proposed that the phonological loop plays a crucial role in learning the novel phonological forms of new words. Baddeley et al. (1998, p. 158) propose that the purpose for which the phonological loop evolved, is to store unfamiliar sound patterns while more permanent memory records are being constructed. Its role in memorising familiar words is secondary. They hypothesise that the system might have evolved in order to facilitate the acquisition of language.

Large differences in STM/WM capacity are present in early childhood. Children differ with respect to their abilities to remember a digit span, to repeat non-words, as well as their knowledge of native vocabulary. Children who perform well on verbal STM/WM tests also have better vocabulary knowledge (cf. Avons, Wragg, Cupples, & Lovegrove, 1998; N. Ellis, 1996). Non-word repetition, which measures the accuracy of repeating unfamiliar word forms, provides a measure of the phonological loop capacity. In a non-word repetition task there is no scheme to refer to in LTM, hence a subject has to rely on the representation of the non-word in the phonological loop. Consequently, the ability to repeat non-words influences the learning of new words. The conclusion is that there is a strong link between children's phonological loop abilities and their knowledge of native vocabulary (Baddeley et al., 1998).

The phonological loop is a limited-capacity system cooperating with LTM. The sensitivity of the task of learning of non-words to the phonological loop constraints can be reduced by partial reliance on LTM knowledge. In other words, the phonological loop is capable of exploiting prior learning. This explains why non-word repetition is highly correlated with vocabulary knowledge. It is easier to remember *wordlike non-words*[25] drawing on the knowledge of either similar words in the native language or generalised knowledge of the acoustic properties of the language. Therefore, the learning of new words seems to be mediated by both the phonological loop and long-term knowledge of the native language. LTM represents the residue of accumulated long-term phonological knowledge that is not easily modified by the input from WM. The acquiring of new words requires prolonged learning, especially in the case of the acquisition of a phonologically novel material by adults with a mature phonological system. It is possible that polyglots have the privilege to draw heavily on the knowledge of all the languages they know, which facilitates the learning of subsequent languages (Baddeley et al., 1998, p. 166).

Wherever possible, people use their phonological knowledge to facilitate their learning process, but when new forms are phonologically unfamiliar and no supportive knowledge is available, they have to rely only on the phonological loop to temporarily store the phonological material. Adult learners typically use different strategies and mnemonic devices to learn new words. One of the strategies to enhance phonological

[25] Wordlike non-words are words that closely resemble the phonological structure of a native language (Baddeley et al., 1998).

learning is *imitation* (Baddeley et al., 1998). Imitation, which emerges around 7 years of age and which also plays a role in SLA in adults, promotes the long-term phonological learning by increasing the period over which new forms are held in the phonological loop. Nevertheless, even the employment of learning strategies such as imagery, key--words or presenting of words in the context of short sentences, which might induce subjects to use semantic rather than phonological strategies, does not lessen the role of phonological memory, which is an effective predictor of vocabulary learning (Atkins & Baddeley, 1998).

Certain ground exist for supposing that the phonological loop is crucial in learning syntax. Service (1992), for example, discovered that children with good verbal memory acquired not only more of vocabulary, but also of the structure of the learned language. Similar results were found for adult learners of a foreign language (Atkins & Baddeley, 1998; Williams, 1999). In a similar vein, King and Just (1991) claim that individual differences in WM capacity measured by memory span tests (e.g. Reading Span test, Daneman & Carpenter, 1980) influence syntactic processing. Subjects with a small WM capacity for language should have greater difficulty in processing complex sentences than subjects with a large WM capacity for language (cf. Caplan & Waters, 1999; Gibson, 1998). Nonetheless, the link between WM capacity and syntactic processing is unclear. For example, Caplan, Waters and DeDe (2008) did not find that efficiency in handling syntactic structures is related to WM capacity as measured by standard tests. On the other hand, they confirmed that there is a relationship between WM capacity and other aspects of language processing, for example text memory and comprehension. The hypothesis is that WM might be fractionated into two systems specialised in learning different aspects of language (Caplan et al., 2008).

An important contribution by N. Ellis (1996, 2001, 2003) to the role of memory in SLA is a hypothesis that learning of both vocabulary and syntax are determined by individual differences in learners' ability to remember simple verbal strings of order, that means lists of digits, unrelated words or sentences. This reasoning is based on an assumption that much of language acquisition is based on the learning of sequences of phonological and lexical units, so-called *chunking*, a term coined by Miller (1956). Learners have to learn and analyse sound sequences in words and word sequences in phrases, idioms, collocations and discourse. The learned sequences form the database for the abstraction of grammar. Individual differences in *phonological STM*[26] influence learners' ability to learn the vocabulary and grammar of a foreign language. According to N. Ellis (1996) and N. Ellis and Sinclair (1996), rehearsal/repetition of novel foreign language utterances promotes the acquisition of syntax. Forced rehearsal of utterances results in superior performance in:

[26] N. Ellis operationalises phonological STM as the ability to repeat/rehearse phonological sequences (1996, p. 92).

- the ability to comprehend and translate FL words and phrases;
- explicit metalinguistic knowledge;
- acquisition of the FL forms and phrases;
- accuracy in FL pronunciation;
- grammatical fluency and accuracy.

The relationship between STM and LTM is reciprocal. Short-term representation and rehearsal lead to the establishment of long-term sequence information for language. Long-term sequence information makes chunking of STM contents possible, which, in turn, adjust to the consolidated in LTM patterns. Language fluency and accuracy depend on the efficiency of the memory system. The more frequent language sequences are stored in LTM and the more automatised the access to them is, the more fluent the language use becomes. Simultaneously, more attentional resources are freed to process the input. In other words, the better the learner's language knowledge is, the easier the process of learning becomes.

Although the idea of mere repetition as a means of enhancing both grammatical fluency and accuracy seems to be controversial (cf. Robinson, 1996, 2002b, 2007; de Graff, 1997; DeKeyser, 2001, 2003; Williams, 1999), N. Ellis emphasised and appreciated the role of WM and attention is SLA. N. Ellis and Sinclair upheld Baddeley's position that WM is crucial in SLA. As they explain: "[…] it seems likely that language acquisition is one of the things that working memory is for" (1996, p. 235). In line with N. Ellis, Service (1992) postulates that repetition and copying accuracy, together with the ability to compare syntactic-semantic structures predict success in learning a foreign language.

As has been argued above, WM, in particular the phonological loop, is a significant factor determining the outcomes of foreign language learning (Baddeley, 2003; Baddeley et al., 1998; Service, 1992; Skehan & Wen, 2009). Accordingly, WM is often treated as a key component of FL aptitude. For example, Miyake and Friedman (1998) emphasise its central role in language processing in both language production and language comprehension. Language processing is a linear process that requires the simultaneous integration and storage of incoming sequences of symbols (cf. N. Ellis, 1996). According to Miyake and Friedman (1998), Baddeley's WM theory matches this SLA model perfectly, in that it contains both the storage and processing components. In a similar vein, Skehan and Wen (2009, p. 21) argue that: "We believe that, in order to compensate for the limitations of the previous research paradigm of foreign language aptitude, WM with its dependence on later developments of cognitive psychology, may hold the very key to elaborating the concept of foreign language aptitude".

If deficiencies in WM result in delayed language development and generally poor language abilities in both children and adults (Gathercole & Baddeley, 1990), might a talent for learning languages be the result of an exceptionally efficient phonological loop? Research findings suggest that it is. Papagno and Vallar (1995) compared gifted polyglots and average foreign language learners with respect to their memory abilities.

The results showed that polyglots significantly outperform poorer learners in phonological memory tests, that is digit span and non-word repetition, which means that their abilities to learn new words are greater. The general intellectual abilities as well as non-verbal abilities of the two groups of learners were comparable. It may be concluded that having a good phonological working memory makes it easier to learn unfamiliar phonological material. The most important conclusion drawn by Baddeley et al. (1998, p. 166) as a result of Papagno and Vallar's work is that "The case of gifted language learners suggests that a natural talent for language learning may arise directly as a consequence of excellent phonological loop function".

In line with Baddeley and his colleagues, Skehan (1998) concludes that it is excellent memory abilities that underlie linguistic talent. He based his conclusions on the results of research on talented foreign language learners to the effect that such learners do not have exceptional intelligence but all possess exceptional verbal memory (cf. Ioup et al., 1994; Morgan et al., 2007; Obler, 1989; Sawyer & Ranta, 2001; Schneiderman & Desmarais, 1988b). In the words of Skehan "Exceptionally successful foreign language learners consistently seem to be characterised by the possession of unusual memories, particularly for the retention of verbal material" (1998, p. 233).

In Skehan's three-dimensional theory of FL aptitude, memory is defined as a set of different abilities contributing to individual differences in encoding and retrieval skills. Skehan upholds the theory of chunking (cf. N. Ellis, 1996, 2003; N. Ellis & Sinclair, 1996), which defines the role of memory in SLA as the capacity to encode, store and retrieve chunks in order to support fluent speech production. Memory is a 'fast-access' system, which allows output to be orchestrated into fluent speech. People learning a foreign language rely on one of two approaches: either a form-oriented approach linked to learning rules, or a meaning-based, memory-oriented and reliant on chunks system. The latter, termed as *language-as-memory-reliant* (Skehan, 2002, p. 86), requires capacious, efficient memory systems from which the pre-formed lexical items (chunks) are retrieved. This reasoning accords with the understanding of the role of rehearsal in contemporary SLA literature (cf. Hulstijn, 2003; Robinson, 2003).

Contemporary models of FL aptitude, which are described in Chapter Two, include memory as a relevant factor. Skehan (1998, 2002) proposes the Processing Stage Model of Aptitude, in which memory is used at basically all stages of SLA. In the first processing stage, *Noticing*, learners pay attention to some aspect of a language and rehearse it in WM. Noticing is considered to be an ability (cf. Robinson, 2002b) and the capacity to notice differs among learners. Skehan associates noticing with Carroll's phonetic coding ability (Carroll & Sapon, 2002), but he relates it primarily to WM capacity. In the second stage, *Patterning*, learners detect and manipulate patterns in the foreign language. At this stage, the learners analyse and generalise input. Skehan finds correlates to these processes in Carroll's grammatical sensitivity and inductive language learning. However, the processes of analysing patterns and extrapolating from input undoubtedly require WM and

LTM engagement. The learning of new items seems to be mediated by both the phonological loop and long-term phonological knowledge (Baddeley et al., 1998). In addition, stage three, *Controlling*, during which learners build a fluent linguistic repertoire by automatising and proceduralising information, relies on the retrieval of information from memory. Finally, stage four, *Lexicalising*, is also connected with the automatisation of language use and gaining fast access to linguistic knowledge. Memory storage and retrieval seem to be required for these processes. Skehan's model suggests that learners may possess different memory abilities that affect performance at the different stages of learning, which might affect the overall learning outcomes.

Robinson (2002b, 2003, 2007, 2009), includes memory in his Aptitude Complex Hypothesis. He proposes four aptitude complexes, each of which includes one or more of a variety of memory factors. For example, aptitude for learning from *recasting* contains the aptitude for *noticing the gap* and *memory for contingent speech.* When learning spoken language from a teacher, the learner first utters a word or expression. Then the teacher repeats it with correct pronunciation (he *recasts* the utterance). The learner holds the teacher's recast in memory (called *memory for contingent speech)* and compares the teacher's pronunciation with his own, simultaneously *noticing the gap* between them. These abilities depend on the capacity and speed of the learner's WM. Robinson's conclusions are similar to Skehan's. People differ with respect to their ability to remember, which affects their linguistic outcomes. Moreover, aptitude profiles for older learners might be more varied than for younger learners (Robinson, 2002b). Robinson's important contribution to the understanding of the role of WM in SLA is a postulate, based on empirical evidence, that it correlates significantly and positively with language proficiency in all learning conditions, including implicit and incidental learning. Therefore, his findings contradict the view of Reber (1993) that implicit and incidental learning conditions are, in general, insensitive to individual differences.

A cumulative body of evidence demonstrates a strong correlation between L1 WM capacity and L2 WM capacity, and between WM capacity and L2 proficiency (Berquist, 1998; Daneman & Carpenter, 1980; Harrington & Sawyer, 1992; Mackey et al., 2002; Miyake & Friedman, 1998; Miyake et al., 1998; Osaka et al., 1993; Robinson, 2002a; Sagarra, 1998). Miyake et al. (1998) found a positive relationship between WM, L2 linguistic knowledge and L2 listening comprehension. Harrington and Sawyer (1992), using a version of Daneman and Carpenter's (1980) Reading Span test, reported a positive correlation between L2 WM capacity and L2 reading proficiency. Miyake and Friedman (1998) found a positive correlation between L1 WM capacity, L2 WM capacity, and sentence comprehension. All the afore-mentioned studies, contrary to Engle et al.'s (1999) findings, reported no correlation between STM, as measured by digit span, and language proficiency or WM. Moreover, a positive relationship was found between L1 WM and L2 WM, which suggests that performance on WM measures may be language independent (Mackey et al., 2002). This finding is consistent with the general

view of WM as non-domain-specific in cognitive science (Kane et al., 2008). A suggestion that was in agreement with the afore-mentioned studies was offered by Skehan (1982), who did not find any correlation between STM and learning outcomes using a span test. Having analysed the results of research on WM (Harrington & Sawyer, 1992; Robinson, 2002a), Skehan (2002) argues that the Reading span test is an efficient tool for measuring WM capacity because it requires both storage and processing of information, thus involving the phonological loop and the central executive.

There is still no consensus as regards the problem whether cognitive individual differences are equally influential in all learning conditions. Mackey et al. (2002) and Zobl (1992) suggest that WM abilities, which require simultaneous input storage and processing, might be differently influential in different learning conditions. This position is challenged by Robinson (2003) who considers all conditions of adult learning, namely explicit, implicit and incidental 'fundamentally similar'. Learning in all conditions requires an active engagement of attention and rehearsal of input in WM, which is subject to individual variation; however, in the case of incidental learning, individual differences will have a delayed effect. According to Robinson, individual differences in WM capacity cause different learning outcomes. As he holds it: "measures of working memory capacity, which affects the extent and efficiency of focal attention allocation, are closely and positively related to second language proficiency and skill development" (2003, p. 660).

Dörnyei considers WM one of the most promising issues in research on FL aptitude (2005, p. 55). He upholds Baddeley's concept of WM, especially its verbal component, the phonological loop, which he considers "to be an ideally suited memory construct for SLA" (Dörnyei, 2005, p. 55). In addition to its STM component, it contains an attention component, which is a significant source of individual difference in SLA (cf. DeKeyser, 2003; Robinson, 2003). In line with Dörnyei (2005), N. Ellis (2001), Miyake and Friedman (1998), Sawyer and Ranta (2001), and Skehan and Wen (2009) all agree that WM capacity may be the concept that will revolutionise research on FL aptitude. If attention is necessary for learning and if it is limited by WM capacity, there must be a close relationship between WM capacity and learning outcomes (Sawyer & Ranta, 2001, p. 342). They hypothesise that WM is a system that integrates all other components of FL aptitude (Sawyer & Ranta, 2001). To use the words of Skehan and Wen (2009, p. 34-35):

> The prospect of incorporating WM as a key component in foreign language aptitude is possible, feasible and promising indeed. To recapitulate, three (pre)conditions have arisen to allow WM to be the best candidate component of foreign language aptitude: first, there are variations in WM capacity that are specific to individual L2 learners and these variations can be measured (by a whole range of WM span tasks); second, WM plays a very important role in various SLA stages and cognitive processes and such effects are constant and pervasive; third, different components of WM (the phonological loop and the central executive in particular) have been found to be highly

correlated with different aspects of L2 performance and developments (vocabulary, grammar acquisition) and specific L2 skills development (listening, reading, speaking, writing and interpreting). Given such a central role played by WM in second language acquisition and L2 development, it is high time we reopened the research agenda of foreign language aptitude by incorporating WM capacity as the most effective modification to the existing aptitude construct.

Summing up, there is cumulative evidence that individual differences in WM affect SLA. What is more, there is a consensus among researchers on the adequacy of Baddeley's model of WM, with its phonological loop and central executive components as subsystems that are decisive in learning a foreign language. However, the theory of WM capacity as being determined by executive attention (Conway et al., 2008) accords well with the central role assigned to the concepts of attention and noticing in many theories of SLA and thus it appears to be perfectly suited to inform the discussion of the role of the factors of memory and attention in SLA.

3.2.4. The neurobiological source of memory differentiation

Individual differences in memory capacity are caused by differences in brain functioning at the cellular level and at the structural level. At the cellular level, encoding, storage and retrieval are represented as modifications in the strength of synaptic connections, which continually change in response to interactions with the environment. The relay of information is based on the strengthening or weakening of connections between pairs of neurons. At the brain structure level, the memory processes occur at multiple loci, far beyond cortical regions where information is finally stored (Crowell, 2004, p. 75).

In adult L2 learners there are two main subcortical areas involved in information processing: the basal ganglia (BG),[27] which temporarily stores procedural knowledge and the hippocampus,[28] which temporarily stores declarative knowledge. All information is finally stored in the neocortex, after making a loop through the BG or the hippocampus. This process is called *memory consolidation* (Jones, 2004, p. 112). Once the information in the neocortex is stored, the learning is complete and activating the memory does not require subcortical areas any longer. It seems that there are significant differences between learners in the number of cycles (loops) needed to learn information, for example, a grammar rule. Some learners notice the difference between the form pro-

[27] Basal ganglia – neural structures embedded deep in the brain involved in learning, storing and retrieving procedural memories (Lee, 2004, p. 43-45).

[28] Hippocampus − a structure located bilaterally on the surface of the temporal lobes playing a crucial role in the formation of new declarative memories (Crowell, 2004, p. 79).

duced by them and the target form immediately and begin to generate correct forms. For others it can take months. These variations might be attributed to individual differences in memory processes at the cellular level called *long-term potentiation*.

According to Crowell (2004, p. 101), differences in FL aptitude in adults can be partially attributed to differences in long-term potentiation (LTP) in the hippocampus. LTP is an increase in the strength and efficacy of synaptic transmission (Crowell, 2004, p. 82). LTP depends on the genes responsible for activation of the transcription factors CREB on chromosome two and C/EBP on chromosome sixteen. These factors convert short--term memories into long-term memories. There are large individual differences in these genes. If the gene activating CREB is particularly active, memory is remarkably improved (Silva, Smith, & Giese, 1997). A learner who has a lower threshold for the LTP induction may be more gifted.

The hippocampus is a temporary store for LTM and a more permanent store for episodic memory and semantic knowledge (Crowell, 2004, p. 79). There is evidence that it is important in verbal learning and memory. In a study on verbal encoding and recall Johnson, Saykin, Flashman, McAllister and Sparling (2001) discovered that subjects with greater activation in the right hippocampus as compared to the left, received better scores on a verbal learning test. The authors interpreted this finding as evidence supporting the hypothesis that learners with greater memory capacity tend to employ more complex encoding strategies, for example, formation of associations between words. A similar effect was observed for learning grammar rules (Dolan & Fletcher, 1999).

The BG is employed in automatisation of the morphosyntax and phonology of a foreign language. It is connected with the hippocampus with which it can interact, which enables declarative memory to influence procedural memory. This possibility can be utilised in the process of defossilisation of errors. The process of automatisation of knowledge can result in fossilisation (Lee, 2004, p. 68). Fossilised errors are very difficult to eradicate because they are rooted in procedural memory, which is formed more slowly than declarative memory, is more robust, inflexible and better preserved. Accordingly, linguistic skills automatised through the BG are resistant to change. However, defossilisation is possible owing to brain plasticity. The restructuring of procedural knowledge with declarative information requires a signal from the hippocampus to the BG. The dopamine system involved in this process is essential for a change to occur – it drives the learner to keep trying or to give up. The dopamine system is connected with sustained motivation, positive appraisal and conscious attention (Schumann, 1997). The goal for learning is generated in the orbitofrontal cortex, the limbic system[29] and the amygdala[30], and is based on the positive appraisal of a skill or learning. If a learner appraises the learn-

[29] Limbic system – deals with emotional and visceral functions and motivations (Lee, 2004, p. 56).

[30] Amygdala – a structure in the temporal lobes important in assessing positive or negative value of a stimuli (Schumann & Wood, 2004, p. 26-27).

ing positively, dopamine is released, which enables him to remember. A positive appraisal results in conscious attention and noticing (Jones, 2004). If dopamine is produced, the goal is sustained. The dopamine neurons encode the rewarding situation and relay it to the regions responsible for motivation. Summing up, motivational input from the orbitofrontal cortex, the amygdala and the dopamine system is necessary to incorporate declarative knowledge of the hippocampus into procedural knowledge of the BG. Because motivation is of key importance in defossilisation, the learner must actively participate in the process. This sort of operation requires a high level of motivation, effort and FL aptitude (Lee, 2004, p. 72). The theories of memory and attention are related to the concept of *noticing* which will be the focus of the following section.

3.3. Noticing as foreign language aptitude

The significance of attention and related terms: *awareness*, *alertness*, *orientation*, *preconscious registration* (detection without awareness), *selection* (detection with awareness) and *consciousness*, traditionally associated with cognitive psychology, has been debated in the field of cognitive psychology and SLA alike, producing differing and often contradictory views of the problems in question (cf. Bialystok, 1979; Krashen, 1981b; McLaughlin, 1990; Reber, 1990, 1993; Robinson, 2003; Schmidt, 1990, 1993, 2001; Seliger, 1979; Stevick, 1980). All those afore-mentioned concepts are interconnected and often used interchangeably due to the difficulty in defining them (cf. Al--Hejin, 2004; Schmidt 1994a). As Schmidt has it: "like most psychological concepts [...] attention is not a unitary phenomenon, but refers to a variety of mechanisms" (2001, p. 3). Especially, the two most investigated in SLA concepts, namely awareness and attention are often treated as two sides of the same coin (Carr & Curran, 1994; Posner, 1994). In the field of SLA, Schmidt commenced the *Noticing Theory* (Schmidt & Frota, 1986), which advocates the essential role of attention and awareness in the process of learning a foreign language. Schmidt (1994a) identifies four facets of consciousness: *intention*, *control*, *attention* and *awareness*. From among these four factors he considers attention absolutely necessary in the process of SLA. As he writes: "there is no doubt that attended learning is superior, and for all practical purposes, attention is necessary for aspects of L2 learning" (Schmidt, 2001, p. 3). It is some of the issues in attention research that will be the focus of the subsequent section.

3.3.1. Attention

Attention, intertwined with memory, is an essential component in SLA (cf. Robinson, 2003; Schmidt, 2001). As Robinson (2003, p. 631) defines it, "Attention is the process

that encodes language input, keeps it active in working and short-term memory, and retrieves it from long-term memory". Attention is connected with memory, as its focus is a subset of STM, which is a part of LTM currently activated. In other words, attention is a process structured and constrained by memory. Attention has been the focus of research addressing such issues as the necessary levels of attention and awareness for encoding L2 input in WM, the nature of encoding, rehearsal and retrieval in memory, and the role of individual differences in attentional and memory resources in FL aptitude (Robinson, 2003). The most important function performed by the attentional network is selection of input (cf. Robinson, 2003; Tomlin & Villa, 1994; Skehan, 1998).

There is an ongoing discussion among researchers concerning the role and importance of attention and awareness in SLA. Tomlin and Villa (1994) argue that attention without awareness is sufficient for learning to take place. They propose four concepts of attention in SLA. The first describes attention as a *limited capacity system*. In view of overwhelming stimuli, the brain is forced to limit both the intensity of a stimulus and the number of stimuli being attended to at a time. This in turn leads to the second process, that is *selection*. The limited capacity system has to select some stimuli and reject others. The third notion, *control,* refers to automatic *versus* controlled processing of information. Some tasks require more control than others because they demand more effort and more attention. Finally, *coordination* among competing stimuli requires maintaining and redirecting attentional resources confronting two or more competing stimuli. In a similar vein, Robinson (2003) attributes a key role in SLA to selection, which is an aspect of control guided by the supervisory attentional system and executive control mechanisms. Attention serves the allocation policy, scheduling and switching between concurrent task demands, and strategy monitoring. Attention and noticing are selective of input, but they also perform an *inhibitory* function and suppress perception of most input to prevent interference (Robinson, 2003).

DeKeyser represents the most radical view on the role of awareness in SLA. As he claims: "there is very little hard evidence of learning without awareness" (2003, p. 317). He argues that only 55-70% of correct judgements on a grammaticality judgement post--test follow implicit learning conditions, whereas chance performance is 50%. Especially abstract and complex rules are difficult to notice and, therefore, should be taught explicitly. Similarly, Robinson (2007) argues that as tasks increase in complexity, individual differences in cognitive abilities increasingly affect performance.

A reasonable suggestion is offered by Simard and Wong (2001), who do not perceive the problem of attention and awareness in SLA as a necessity or the absence of necessity, but as different degrees of attention and awareness that may impact learning. They do not treat various aspects of consciousness, such as alertness, orientation, awareness and detection as separate, independent entities, but as processes interacting in graded amounts depending on the task type, individual differences and other factors.

3.3.2. Noticing ability

The concept of noticing is traditionally attributed to its founder Schmidt (1990), who hypothesises that there is no SLA without attention. Schmidt (2001, p. 3) describes the role of attention in SLA as follows:

> The concept of attention is necessary in order to understand virtually every aspect of SLA, including the development of interlanguages (ILs) over time, variation within IL, at particular points of time, the development of L2 fluency, the role of individual differences such as motivation, aptitude and learning strategies.

The processes of interaction, negotiation for meaning and all forms of instruction are associated with the concept of attention. According to the *Noticing Hypothesis*, SLA is driven by what learners pay attention to and notice in target language input (Schmidt, 2001, pp. 4-5). Noticing is recognised as a component of FL aptitude related to WM (cf. S. Carroll, 2006; Doughty, 2001, 2003; Dörnyei, 2005; Egi, 2004; Hanaoka, 2007; Iwanaka & Takatsuka, 2007; Long & Robinson, 1998; Mennim, 2007; Robinson, 2001, 2003; Sawyer & Ranta, 2001; Song, 2007; Spada, 1997).

Schmidt's definition of noticing evolved alongside with the development of research in the field of attention. Firstly defined as *aware detection/registration* of linguistic data and subsequent storage in LTM (Schmidt, 1994b), it was later reformulated after Tomlin and Villa (1994), as a process possible without awareness and restricted to a technical term equivalent to *apperception* (Gass, 1988), *detection with selective attention* (Tomlin & Villa, 1994), and *detection plus rehearsal in short-term memory* (Robinson, 1995b). In consequence, Schmidt (2001) separates noticing, which refers to the surface structure of utterances, from *metalinguistic awareness*, which refers to abstract rule formation, metalinguistic reflection, forming hypotheses and so forth. However, contrary to Tomlin and Villa (1994), Schmidt (2001) claims that *detection with selective attention* may not be sufficient for the learning of new material, which is far more efficient when it is accompanied by a certain level of awareness. *Noticing the gap* is one of FL aptitude factors, defined as aptitude for learning from recasting, in which the learner is supposed to learn from noticing the gap between the recast and his prior utterance (Robinson, 2007, p. 274). The noticing ability based on WM capacity is one of the factors in Robinson's (2002b) Aptitude Complex Hypothesis[31]. Robinson suggests a greater differentiation of patterns of abilities for some, especially older or higher aptitude learners. His hypothesis is based on Deary et. al.'s (1996) evidence that comparing high-IQ with low-IQ groups or children with adults performance on the subtests of the Wechsler Intelligence Scale gives more differentiated results for both adults and high-IQ groups than for children

[31] Robinson's Aptitude Complex Hypothesis is described in Chapter Two, section 2.4.2.

and low-IQ subjects. Therefore, it is possible that some higher-aptitude learners have, for example, high noticing-the-gap ability, whereas low memory ability. If both factors are high, recasting, according to Robinson (2007, p. 277), would be a particularly suitable option for focusing on form techniques.

Mackey et al.'s (2002) research on the correlation between WM and noticing of interactional feedback, which has already been referred to in this chapter in section 3.2.3., revealed that it was significant. Learners who displayed less noticing ability tended to have low WM capacity, whereas those who had better noticing score, had also high WM capacity. A more complex relationship was observed between the developmental level of the learner, WM capacity, phonological STM and his/her noticing ability. Phonological STM was operationalised as the ability to repeat phonological input correctly. The researchers reported higher noticing results for the learners who had better phonological STM, being at the same time at lower developmental levels. Moreover, learners with high WM capacity were more likely to benefit from recasts, but not immediately after the feedback but after a time interval. Using their research results as a basis, the researchers concluded that noticing of interactional feedback is not determined by WM capacity alone because other factors such as grammatical sensitivity, field independence or socio-psychological characteristics can also affect this process (Mackey et al., 2002, p. 202).

Researchers generally agree on the indispensable role of attention in cognitive registration of input in SLA. As Gass (2003, p. 244) argues: "it is widely accepted that selective attention plays a major role in learning". but the role of awareness in SLA is less unambiguous (cf. Robinson, 1995a, 2002a, 2002b, 2005, 2007; Schmidt, 1990, 1993, 2001; Tomlin & Villa, 1994; Truscott, 1998; Williams, 1999). Generally, noticing and its prerequisite – awareness, are considered facilitative, but not essential in SLA (cf. R. Ellis, 1990; Long, 1988; Mackey et al., 2002; Rosa & O'Neil, 1999; Robinson, 2003; Tomlin & Villa, 1994; Schmidt, 2001).

Conclusion

Contemporary models of FL aptitude attribute special importance to two groups of factors: analytic abilities and memory abilities with emphasis on attentional processes (cf. Robinson, 2002b; Skehan, 1998). Consequently, the present chapter has been divided into three parts. The first one focused on analytical abilities, the second one on memory abilities and the third one on the factor of attention and noticing ability. A conclusion that emerges from the review of empirical research presented above is that those FL aptitude components cannot be analysed in isolation from the factor of WM, which seems to affect SLA in many contexts and conditions. WM plays an important role in a number of complex cognitive abilities, such as language learning, reasoning, compre-

hension and cognitive control, and WM measures are an indicator of intellectual ability. Two subsystems of WM are especially significant in SLA: the phonological loop and the central executive. The phonological loop, equivalent with a language acquisition device, plays a crucial role in learning the novel phonological forms of new words. The central executive directs attentional processes that create conditions for goal-directed behaviour by maintaining relevant information in an active state or retrieving that information under conditions of interference, distraction, or conflict. WM capacity underlies noticing ability, which facilitates SLA in general.

Variation in WM capacity causes variation in general cognitive ability and executive attention is the central factor in this variation. General cognitive ability (IQ) underlies analytic abilities, which affect learning the structure of a foreign language. Moreover, there is evidence that WM capacity has an effect on learning syntax of a foreign language (cf. Caplan & Waters, 1999; Gibson, 1998; King & Just, 1991). Therefore, it might be hypothesised that analytic abilities are affected by WM capacity, as they require a reasonable amount of reasoning ability and general intelligence. Consequently, general cognitive ability can affect SLA to a higher degree than it has been established so far. Further research is needed to explain the complex correlation between the above--described factors. Summing up, most empirical research confirms Robinson's point of view (2003) that WM capacity is a powerful factor in many learning conditions and should be taken into account in FL aptitude research. As will be argued below, not only purely cognitive factors are contributors to FL aptitude, but also personality traits and other borderline characteristics, such as learning styles affect its development (cf. Dörnyei, 2005). In keeping with this position, the next chapter will focus on these personality factors and learning styles and strategies which can have an effect on FL aptitude.

CHAPTER FOUR

FOREIGN LANGUAGE APTITUDE – BEYOND COGNITION

Introduction

Modern psychological, neurological and educational theorists view affect and cognition as two complementary, inextricably linked facets of the human mind, neither of which takes priority over the other in mental processes. Damasio (1994), a neurologist, stresses the rationality of emotion. He emphasises the importance of *gut feelings* in making decisions, perceiving emotion and cognition as equal partners in the mind. The neural scientist LeDoux (1996) also argues that no mind can exist without emotions. After a long tradition of the separation of passion and reason, he suggests that it is time we brought emotion and cognition together. Goleman (1996), the founder of the *Emotional Intelligence* theory, highlights the importance of emotions in the human psyche. Arnold and Brown (1999) regard affect as an aspect of emotion, feeling, mood and attitude which condition behaviour. They perceive the affective side of learning as the most fundamental aspect of SLA. In their view, the cognitive and affective domains should not be referred to as opposites, but as two complementary facets of that one phenomenon which is human learning. As they explain: "Neither the cognitive nor the affective has the last word, and, indeed, neither can be separated from the other" (1999, p. 1). In a similar vein, Doliński (2000, p. 375), a psychologist, concludes that a complete separation of cognitive and affective processes is impossible either in real life, or in laboratory conditions. In fact, most of affective experience is intertwined with cognition. Therefore, the controversy about the primacy of either of the two aspects is slowly dying out and it seems reasonable to treat both notions as complementary. Larsen-Freeman and Cameron (2008) make a reference to the dynamic interplay between psycholinguistic, sociolinguistic and situational aspects termed as *intrinsic dynamics of the learner*, thus indicating that all these factors affect SLA. Finally, Dörnyei (2009, 2010) addresses the problem of the relationship between cognitive, motivational and emotional processes and their cumulative impact on human cognitive functioning. He proposes that the modular view of individual differences, which involves multiple discrete individual difference factors, has a limited value and suggests that it is possi-

bly more efficient to focus on higher-order trait complexes that act as integrated wholes (2010, p. 248). In keeping with this position, Dörnyei recommends *dynamic systems theory* as a paradigm that best accounts for individual differences.

The purpose of this chapter is to present the most controversial and ambiguous aspects of FL aptitude theory – personality variables. Because the term *personality* remains too broad and complex to be discussed here and the number of personality factors is uncountable, the present author decided to focus on these factors, which, on the one hand, are empirically well scrutinised in SLA and include a cognitive aspect, on the other. Therefore, after an introductory section presenting the place of affect in FL aptitude research together with Snow's (1987) *cognitive-affective-conative triad* of FL aptitude, the following personality factors will be discussed: the *Five Factor Model*, including *openness to experience*, *conscientiousness*, *extraversion*, *agreeableness* and *neuroticism*, as well as *creativity*, *motivation*, *locus of control*, *style of coping with stress*, *emotional intelligence* and *anxiety*. Emphasis will be placed on the factor of openness to experience, which is the most cognitively-based factor of all personality characteristics. Openness is linked to creativity, which is a prominent characteristic of gifted individuals as well as multilingual foreign language learners. In the following section, *learning styles* and *strategies*, as borderline characteristics between cognition and affect, will be presented in the light of their potential contribution to FL aptitude. Subsequently, the concept of *learner autonomy* as a quality of gifted individuals will be briefly outlined. Obviously, personality factors and learning styles and strategies are not included in the concept of FL aptitude on equal terms with such factors as WM or analytic ability; however, they are likely to affect linguistic giftedness in a non-linear way. The closing section will focus on this dynamic relationship termed as *dynamic systems theory*.

4.1. Personality factors in foreign language aptitude theory

Contemporary SLA researchers agree that cognitive and affective factors overlap in the field of language learning (cf. Dewaele, Petrides, & Furnham, 2008; Griffiths, 2008a; Hu & Reiterer, 2009; Laever, Ehrman, & Shekhtman, 2005; Moyer, 2007). The success of foreign language learning and language giftedness are associated with personality variables. The studies of *good foreign language learners* have identified a number of characteristics which facilitate SLA (cf. Dörnyei, 2005; Ehrman, 2008; Ehrman & Oxford, 1995; Griffiths, 2008a; Leaver et al., 2005; Naiman, Frölich, Stern, & Todesco, 1978; Rubin, 1975).

A widely quoted study by Ehrman and Oxford (1995) tested the relationship of such variables as cognitive aptitude, learning strategies, learning styles, personality, motivation and anxiety to proficiency ratings in foreign language learning of educated adults.

The purpose of the study was to find whether factors other than cognitive influence the ultimate achievement in learning. As the authors explained: "The name of our paper is 'Cognition Plus', because many individual difference variables besides cognitive aptitude directly influence language learning success" (Ehrman & Oxford, 1995, p. 67). The findings of the research revealed interesting tendencies. Among cognitive styles, the highest score obtained in the tested group was the one for the analytic style. High--average were the scores for spatial, categorisation, sequential processing and detail memory styles. There were no significant differences in sensory preferences; however, emotive/kinaesthetic and visual styles were more often chosen than auditory. The students scored within the high range on persistence, verbal risk-taking, as well as verbal learning preference. All of the students were very highly intrinsically motivated. The researchers used the *Myers-Briggs Type Indicator* (Myers & Briggs, 1976) to measure personality dimensions of their subjects. This personality model proposes four bipolar personality types, namely *extraversion-introversion*, *sensing-intuiting*, *thinking-feeling*, and *judging-perceiving*. The subjects turned out to be introverted, intuitive, judging and thinking-oriented. Other adjectives to describe the sample included: intimate, abstract, imaginative, intellectual, theoretical, original, accepting and tender, questioning, reasonable, logical, scheduled, planning and methodological. Their level of anxiety was low, self-esteem was high and ego boundaries were rather thick. As expected, affective and motivational factors showed the next, after FL aptitude, highest level of correlation with proficiency in a foreign language.

Sparks and Ganschow (1991) propose an alternative approach to the problem of the effect of affective variables on SLA. The researchers hypothesise that affective variables, such as, for example, a high anxiety level or low motivation are not the causes but the consequences of native-language skill and FL aptitude. Their suggestion is that poor foreign language learners are as motivated as good learners, but they perceive themselves as weaker learners both in an L1 and an L2. Thus, their anxiety in a foreign language learning situation is high due to their poor linguistic abilities (Sparks et al., 1998; Sparks & Ganschow, 2001). This point of view might be perceived as controversial; however, taking into consideration the complexity of affect, it cannot be discarded.

There is a marked lack of research on personality factors in FL aptitude studies (cf. Abrahamsson & Hyltenstam, 2008; Bongaerts et al., 1997; Ioup et al., 1994; Morgan et al., 2007; Moyer, 1999, 2007; Obler, 1989; Sawyer & Ranta, 2001; Schneiderman & Desmarais, 1988b; Skehan, 1998; van Boxtel et al., 2003). However, some researchers recognise the necessity of examining personality factors in gifted L2 learners. In studies by Bongaerts, Planken and Schils (1995), Bongaerts et al. (1997) and Bongaerts et al. (2000), a group of highly motivated and advanced foreign language learners were chosen specifically for their exceptional abilities by teachers who identified them as excellent speakers and writers of an L2 – English. The research provided evidence for their high proficiency; the selected subjects overlapped with native speaker controls with

respect to their pronunciation skills. As the researchers conclude, little is known about their personality. The researchers suggest that some specific personality factors might, in connection with exceptional aptitude, affect these outstanding abilities. As a result, Bongaerts et al. (1995) and Moyer (1999, 2007) emphasise the need for research on not only cognitive, but also affective factors in exceptional foreign language learners, which are capable of compensating for the late start (cf. Hu & Reiterer, 2009; Hyltenstam & Abrahamsson, 2003; Sparks & Ganschow, 2001).

If personality and affective factors are not separate from cognition, they should be taken into consideration in FL aptitude research. Indeed, FL aptitude theory refers to personality factors as important variables affecting SLA. The first complete FL aptitude theory that took into account personality and motivational (conative) characteristics was Richard Snow's (1987, 1994) cognitive-affective-conative triad of FL aptitude. This theory was further extended by Corno et al. (2002). Aptitude, according to Snow, refers to being equipped to work at a particular kind of a task in a particular kind of a situation. It is a term referring to the power to carry out some type of undertaking, which is not limited to abilities. Personality factors, such as achievement motivation, freedom from anxiety, positive self-concept and control of impulses, are aptitudes as well contributing to coping with challenges. Consequently, the aptitude construct must consider affective and conative processes as well as abilities. Affective constructs in Snow's theory encompass three types of affective variables: traits of temperament, moods and personality factors. Personality variables are mapped into five superdimensions, termed as the *Five Factor Model*, which is the focus of the following section.

4.1.1. The Five Factor Model

The '*Big Five*' personality traits are five broad factors or dimensions of personality (McCrae & Costa, 2003). The traits are also referred to as the 'Five Factor Model' (FFM). This model is considered to be the most comprehensive empirical model of personality. As Dörnyei points out: "current research is dominated by only two taxonomies focusing on personality traits, Eysenck's three-component construct [...] and the 'Big Five' model", and "At present the Big Five is gaining momentum to the extent that it seems almost ubiquitous in the current literature" (2005, pp. 12-13). Each factor consists of a cluster of more specific traits that correlate with each other. For example, extraversion includes such related qualities as sociability, excitement seeking, impulsiveness and positive emotions. Each of the five factors constitutes a continuum with two extremes (Corno et al., 2002; Dörnyei, 2005; McCrae & Costa, 2003):

1. *Agreeableness* is connected with altruism and affection. It is a tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others. High scorers are friendly, good-natured, likeable, kind, forgiving,

trusting and generous. Low scorers are cold, cynical, rude, irritable and uncooperative;

2. *Extraversion* is connected with energy and enthusiasm, and the tendency to seek stimulation and the company of others. High scorers are sociable, gregarious, active, assertive, passionate and talkative. Low scorers are passive, quiet, reserved, withdrawn, aloof and restrained;
3. *Openness* is connected with originality and flexibility, expresses an appreciation for art, emotion, adventure, unusual ideas, imagination, curiosity, and a variety of experience. Consequently, high scorers are imaginative, curious, flexible, novelty seeking, untraditional and interested in art. Low scorers are practical, conservative, conventional and down-to-earth;
4. *Conscientiousness* is connected with control and constraint. It is a tendency to show self-discipline, planned behaviour, act dutifully and aim for achievement. High scorers are meticulous, systematic, efficient, organised, responsible, reliable, persevering and self-disciplined. Low scorers, on the other hand, are unreliable, careless, disorganised, lazy and negligent;
5. *Neuroticism* is connected with negativism and anxiety. It is a tendency to experience unpleasant emotions easily, such as anger, anxiety, depression, or vulnerability; sometimes called emotional instability. High scorers are worrying, anxious, insecure, depressed and unstable. Low scorers are self-satisfied, calm, relaxed, unemotional, even-tempered and comfortable. Not surprisingly, anxiety involved in neuroticism also produces negative learning outcomes.

Although the factors included in the FFM refer to affect, there is a conative aspect to conscientiousness and a cognitive aspect to openness. Openness includes a cognitive aspect, which means that people who score high on general cognitive ability tend to display openness to new experiences and intellectual curiosity and flexibility (Corno et al., 2002). According to Snow et al. (1996), agreeableness and extraversion correlate with positive mood. Neuroticism, on the other hand, correlates with negative affectivity. Extraversion and conscientiousness are related to impulse inhibition[32]. The latter is also linked to self-discipline. Conative constructs in Snow's model involve motivational orientation, achievement-related attitudes and interests, and beliefs about self. Each of these factors fosters either the investment of effort or task avoidance.

According to Corno et al. (2002), emotional factors as predictors of SLA outcomes are a function of situational constraints. Measures of personality and interests alone do not predict success. Numerous studies trying to raise correlations by weighting measures of personality or motivation alongside ability in the prediction are disappointing. The optimum level of a personality trait or emotional state seems to vary from task to task.

[32] Impulse inhibition is described by Goleman (1996) as *gratification delay*. It is the psychological skill of resisting impulse. The skill of delaying gratification is the root of emotional self-control.

This line of reasoning accords well with Dörnyei's (2005) opinion on this question. Based on data from studies attempting to identify personality correlates of academic achievement, he refers to personality factors in the following way:

> Even if personality factors do not directly determine the degree of an individual's academic success, they certainly shape the way people respond to their learning environment [...]. Thus, personality traits can be seen as potent modifying variables and in this sense they are similar to learning styles in their function (Dörnyei, 2005, p. 30).

In view of Dörnyei (2005), the five factors are potential modifying variables in SLA. Openness to experience and conscientiousness seem to be positively correlated with language learning, anxiety involved in neuroticism produces negative learning outcomes, whereas extraversion is generally negatively related to learning outcomes; however, it is likely to facilitate strategic competence. Factors associated with introversion, such as the ability to concentrate, higher resistance to distracters and better study habits are likely to facilitate learning. In contrast, Dewaele (2009) presents evidence that psychological studies have consistently shown extraverts' superiority over introverts at STM and WM. Extraversion scores have been found to correlate positively with oral fluency measures in an L2, especially in stressful situations. Moreover, extraverts, due to their risk-taking ability, are more willing to use colloquial and emotion words than introverts. Finally, Dewaele (2009) found negative, but statistically insignificant, correlations between extraversion and foreign language course marks.

The factor of openness to experience, due to its relationship to intellectual functioning, seems to be the most powerful modifying personality variable in SLA. Its correlation with verbal intelligence is estimated at .30 (Nosal, 1999). Young (2007, as cited in Dewaele, 2009) found that open-mindedness (a concept similar to openness to experience) is a good predictor of foreign language learning outcomes. Openness is a relatively stable factor that is believed to have a strong genetic component; the influence of genetic factors on openness is estimated at .61 (Nosal, 1999). Additionally, it involves a great potential for creativity (McCrae, 1987), which is associated with multilingualism/multicompetence (cf. Cook, 2002).

As has already been stated, only a few studies devoted some attention to personality factors in FL aptitude. For example, an ongoing study on phonetically talented L2 learners conducted by Reiterer and her colleagues (2009) has provided interesting insights into the correlation between phonetic abilities and personality factors. The researchers found no correlation between pronunciation talent and extraversion, openness to experience or neuroticism, whilst a moderate positive correlation was found for conscientiousness and agreeableness. They attribute this observation to the separateness of phonetic aptitude, which does not require social capability, from other aptitudes affecting oral language (Hu & Reiterer, 2009).

The purpose of a study conducted by Biedroń (2010b) was to compare two groups of learners: 44 gifted L2 learners (highly proficient multilinguals) and 37 non-gifted L2 learners (first-year English philology students) with respect to personality factors defined according to the FFM. The analysis revealed that the factor of openness to experience is significantly higher in the gifted than in the non-gifted L2 learners. The other factors, namely neuroticism, agreeableness, extraversion and conscientiousness did not reveal statistically significant differences between the samples.

Certain grounds exist for supposing that affect is an important variable in SLA. Nevertheless, personality factors usually account for only 15% of the variance in academic performance (Dörnyei, 2005, p. 21). According to Dörnyei (2005, 2009), personality factors interplay with foreign language learning outcomes in a non-linear way (cf. Robinson & N. Ellis, 2008). Various learning contexts, approaches and tasks favour different personality factors. For example, the communicative approach will certainly be a facilitative environment for extraverts, whereas academic study seems to be an optimal condition for introverts. Analogically to aptitude factors in Robinson's (2002b) aptitude-treatment interaction model of FL aptitude, personality factors are context-dependent.

4.1.2. Creativity

Creativity is a characteristic that emerges from the trait of openness to experience being at the same time a factor connected with intellectual giftedness. Creativity is a multifaceted term referring to the ability to produce original and valuable outcomes, pursuing paths of inquiry that others have ignored, taking intellectual risks and persevering in the face of obstacles (Sternberg, 2001). Creativity is related to multilingualism, on the one hand and to giftedness, on the other. There is an alleged connection between knowledge of languages and enhanced creativity based on the assumption that people who speak more than one language are able to take a broader perspective, which can lead to innovative approaches and new solutions (Cook, 1992).

According to Sternberg and Lubart "Creativity is the ability to produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful, adaptive concerning task constraints" (2004, p. 3). Many different components must converge for creativity to occur. Sternberg presents six components of creativity: intellectual abilities, knowledge, styles of thinking, personality, motivation and environment. Creative functioning is connected with certain personality factors, such as, for example, self-efficacy, willingness to overcome obstacles, ability to take risks, ambiguity tolerance and task-focused, intrinsic motivation.

Kharkhurin (2009) argues that being bilingual is connected with being creative. Bilinguals may learn and access knowledge in many different ways. The process of con-

stant switching from one language to another and constant operating in two linguistic code systems facilitates a dual linguistic perspective. Bilinguals are more metalinguistically aware, which makes them more cognitively flexible. The structure of bilingual memory can be modified due to the cross-linguistic and cross-cultural experience. In a bilingual mind the same concept is connected to two different linguistic conceptual networks; therefore, bilinguals can see the same thing from different perspectives. This results in a diversity of associations, which is a source of divergent thinking. The enhanced conceptual representation can endorse cognitive flexibility as well as novel and creative ways of thinking. Certain personality traits have been identified in creative people, such as, for example, autonomy, introversion and openness, as well as enhanced tolerance of ambiguity (Houtz, 2009; Kharkhurin, 2009).

According to the *European Commission* report (2009), a greater potential for creativity among multilinguals is suggested; however, currently available research does not provide evidence for an incontrovertible relationship between multilingualism and creativity. Nevertheless, the number of advantages provided by multilingualism is impressive. The most commonly repeated benefit is mental flexibility. People who speak more than one language are more flexible – their capacity to think is extended due to their ability to perceive concepts from more than one perspective. Accordingly, their mind is more adaptable. Multilinguals "have a more extensive range of affordances available" (Singleton & Aronin, 2007, p. 83).

4.1.3. Motivation

Unquestionably, the factor of motivation is one of the most basic aspects of the human mind and an important contributory factor in SLA (Dörnyei, 2001, p. 4). As Ushioda (2008, p. 19) argues: "It almost goes without saying that good language learners are motivated". Exceptional foreign language learners are, by definition, highly motivated, as the process of acquiring of foreign languages to native-like proficiency requires not only high aptitude, but also persistence and sustained effort. Motivation is composed of different and overlapping factors, and thus the discussion of it is inevitably complex (cf. Dörnyei, 2010; Ushioda, 2008; Williams & Burden, 1997, p. 111). Dörnyei highlights three factors concerned with the concept: the choice of a particular action, the persistence with it and the effort expended on it. He defines motivation as:

> [...] dynamically changing cumulative arousal in a person that initiates, directs, coordinates, amplifies, terminates, and evaluates the cognitive and motor processes whereby initial wishes and desires are selected, prioritised, operationalised, and (successfully or unsuccessfully) acted out (Dörnyei & Otto, 1998, p. 65).

Neurological research explains the relationship between physiological arousal and the origins of motivation. Motivation, accompanied by dopamine release triggered by learner's positive appraisal of a learning situation, activates both procedural and declarative memories, thus accelerating the process of learning (Schumann & Wood, 2004, pp. 23-73).

In Dörnyei's process-oriented approach to motivation, it is perceived as a dynamic, continuously changing result of a variety of internal and external forces, in which the importance of learner self-regulation and volitional control over sustaining motivation is highlighted. The learner's ability to remain in control of his/her attitudinal/motivational disposition should be seen as an important determinant of self-regulated learning and achievement. One of the key ideas of the process-oriented approach is promoting self--motivating strategies. By applying self-motivating strategies, learners assume responsibility and control of their own motivational disposition. Dörnyei (2005, pp. 112-114) presents a variety of self-motivating strategies, such as, for example:

- *Commitment control strategies* for helping to preserve or increase the learners' original goal commitment;
- *Metacognitive control strategies* for monitoring and controlling concentration;
- *Emotion control strategies* for managing disruptive emotional states;
- *Environmental control strategies* for eliminating negative environmental influences and exploiting positive environmental influences;
- *Goal-oriented self-talk*, which uses subvocal statements or thoughts designed to increase one's desire to complete a task;
- *Attribution-control*, which is manipulation of causal attributions so that they positively affect motivation by the purposeful selection of causal explanation that put students in a positive light;
- *Efficacy management*, which is monitoring, evaluating and purposefully controlling one's self-efficacy for tasks.

Dörnyei (2005, pp. 103-105) endorses the role of the *ideal language self* associated with the idealised mastery of an L2. It comprises general agreeableness and achievement-related competence of a person striving to achieve near-native level in a foreign language. The ideal language self is a powerful motivator to master an L2 in order to reduce the discrepancy between the learner's actual and ideal selves. Moreover, willingness to communicate is the function of the interplay of linguistic self-confidence and the ideal L2 self (Dörnyei, 2005, p. 210). The concept of motivation has been included in research on 'high achievers' (cf. Ehrman, 1996, 1998; Ehrman & Oxford, 1995; Ushioda, 2008). Using the findings of these studies as a basis, it could be argued that the two individual difference factors, namely FL aptitude and motivation, are the most powerful predictors of second language learning success (cf. Dörnyei & Skehan, 2003; Moyer, 2007).

Since the 1990s, researchers' attention has shifted to cognitive theories of learner motivation along with advances in motivational psychology. This line of reasoning takes

into account the behaviours and characteristics which shape the motivational strategies of a learner, such as, for example, goal setting, self-perceptions of competence, belief in self-efficacy and locus of control (Ushioda, 2008, p. 21). In 2010 Dörnyei investigated the relationship between FL aptitude and motivation looking at how these two factors are related to each other and how they exert their cumulative impact. He suggests that the modular concepts of FL aptitude and motivation are outdated and it would be more fruitful to focus on higher-order trait complexes (cf. Ackerman, 2003; Robinson, 2002b; Snow, 1987). Motivational factors involve cognitive components, which results in 'hybrid' attributes (Dörnyei, 2010, p. 252). In line with this approach, motivation is not independent of cognition, but it is a part of it, in that motivational processes rely on *cognitive* and also *affective appraisal* (cf. Schumann, 2004b). The appraisal systems assign value to current stimuli based on past experience. Through experience of the world, individuals accrue preferences and aversions, which lead them to like or dislike certain things. Environmental stimulus situations are assessed according to criteria such as whether they are novel, pleasant, goal-enhancing, compatible with one's coping potential and supportive of one's social and self-image. The value mechanisms influence the cognition, that is the perception, attention, memory and action, that is devoted to learning. Each person's appraisal system is different due to differences between each individual's personal experiences. Because of these differences, the same stimulus situation may be evaluated differently by different people. Five stimulus evaluation checks have been identified. The *novelty* check assesses whether internal or external stimulation contains novel or unexpected patterns. The *pleasantness* check determines whether an event is pleasant, thus fostering approach, or unpleasant, thus promoting avoidance. The *goal/need significance* check assesses the relevance of the event to the individual's needs and goals. The *coping potential* check determines the individual's ability to cope with the event, to avoid or change the outcome of the stimulus event or to adjust to the outcome. The *norm/self compatibility* check assesses the compatibility of the event with social and cultural norms and with the expectations of significant others (cf. Scherer, 1984). Based on data from motivation studies, Schumann (1999, p. 32) concludes that positive appraisals of the language learning situation such as the target language, its speakers and the teacher facilitate language learning, whereas negative appraisals inhibit SLA.

4.1.4. Locus of control

Locus of control (LOC) (Rotter, 1954), refers to a person's beliefs system about his control over the events in his/her life. According to the LOC theory, people can be divided into two main groups. Those who feel personally responsible for what happens to them are labelled *internals*, whilst those who believe that such external forces as fate, luck or

objective difficulties determine their life are termed *externals* (Findley & Cooper, 1983, p. 419). Numerous researchers have proved a positive correlation between internal LOC and academic achievement. In their review of the literature, Findley and Cooper (1983) conclude that a feeling of being in control of events exerts a positive force on success in learning. Generally, students characterised by internal LOC are more independent, motivated, resourceful, persistent and active. On the other hand, externals are perceived as more dependent, compliant, inattentive and passive (cf. Arlin & Whitley, 1978; Drwal, 1995). LOC is closely connected with other personality dimensions, among them a feeling of power, competence, a need for autonomy, a need for power, ego strength, ego control, self-actualisation and defensive mechanisms. Internal LOC also correlates positively with a high conformability between real-self and ideal-self. Subjects classified as internals more often use such verbs of self-description as 'ingenious', 'efficient', 'independent', 'ambitious', 'potent' and 'assertive' (cf. Drwal, 1995; Lefcourt, 1981). These features correspond with the idea of autonomy and independence in language learning (cf. Benson & Voller, 1997), in which such characteristics as responsibility, taking charge, learner control, freedom from external control, individualisation and maturity are highly esteemed.

The LOC theory and the *attributional theory* are closely intertwined in the field of Weiner's (1986, 2009) *Attributional Theory of Motivation and Emotion*, which deals with the reasons which people attribute to their perceived successes and failures in a situation of academic achievement. Weiner (1986) proposes his theory with achievement strivings as the theoretical focus in which causal ascription plays a key role. Causal perspective deals with the constant pursuit of "why"? As Weiner (1986) claims, the main goal of attaining knowledge is that of effective management of self and one's environment. According to Weiner (1986), *cause*, which is equivalent to causal perception and causal attribution, is the answer to a *why* question regarding an outcome. It therefore follows that causes are constructions imposed by the perceiver in order to account for the relationship between an action and an outcome. Causal ascriptions refer to why an outcome has occurred, not why an action has taken place. Such events as a win by an underdog, a defeat of a favourite team, unusual willingness or unwillingness to help, inconsistent behaviour, and unexpected academic success or failure all elicit attributional search. It is also ascertained that non-attainment rather that attainment of a goal, for example, political loss, negative interpersonal behaviour, or examination failure, promotes attributional search. Non-attainment of a goal as a facilitator of attributional thinking may conform to the idea that organisms are motivated to terminate or prevent a negative state of affairs. Effective coping depends on locating the cause of failure. In this case, attributional search serves as adaptive. In other words, people seek causes for unexpected failure in order to avoid negative states or emotions in the future.

Finally, LOC can be approached from a motivational perspective. Needless to say, motivation is a key disposition when it comes to second language learning (Dörnyei,

2001, 2005). Motivation is also intertwined with the attributional processes and LOC. There is a presumed connection between LOC and achievement motivation; the stronger the internal control, the greater the achievement motivation. However, this connection is probably not linear because a person with high achievement motivation does not need to have a strong belief in his/her internal control. Some characteristics of people with internal LOC such as activity, a preference for performing in situations related to their skill rather than in random situations, high self-esteem and high aspirations, are typical of people with high achievement motivation. Students with internal LOC are more persistent when studying, have more self-responsibility, receive higher marks and declare more positive attitudes towards school (cf. Arlin & Whitley, 1978, p. 989; Drwal, 1995, p. 223). It has been demonstrated (Biedroń, 2008) that successful foreign language learners are internally-oriented, attributing their success to a controllable, high and sustained effort. Research on LOC among exceptionally talented learners might provide interesting insights into the profile of such learners. A construct related to LOC is style of coping with stress.

4.1.5. Style of coping with stress

A model of human coping with stress was developed by Endler and Parker (1990). They assumed that the remedial measures that a subject undertakes in a particular stressful situation result from an interaction between this situation and the coping style of the subject. A coping style is not a trait, but a habit or a method used to resolve problematic situations. Their construct differentiates three types of coping: *emotion-oriented*, *task--oriented* and *avoidant*. The task-oriented coping is a response leading to problem resolution by purposeful confrontation, cognitive restructuring or changing the situation. This style is considered to be the healthiest coping method. The emotion-oriented coping is a response in which the individual remains self-preoccupied and tense, which does not lead to problem solving. The avoidance-oriented coping is a response that reduces stress by drawing back into a different activity. This style is not efficient in the long run because it leads only to a temporary relief (Endler & Parker, 1990).

A situation is evaluated as stressful when, for example, the individual perceives his/her ability to cope with it as low. Stressors perceived as controllable elicit more proactive (task-oriented) coping mechanisms (Karasek & Theorell, 1990), whereas those perceived as uncontrollable elicit more avoidance strategies (Anshel & Kaissidis, 1997; Lazarus & Folkman, 1984). Kariv and Heiman (2005) discovered that the subjective perception of academic stress acted as a restraining factor in students' employment of task-orientated coping behaviour. This means that the more stressful and difficult a situation was, as subjectively assessed by the students, the more likely they were to employ the avoidance-oriented style. Academic performance and achievement goals

might be related to an individual's style of coping. Santiago-Rivera, Bernstein and Gard (1995) scrutinised the significance of achievement and the appraisal of stressful events as predictors of coping. The results of the study confirmed that those who regard achievement as important also tend to evaluate more events as challenging and use more task-oriented coping strategies, which, in turn, reverses the destructive effects of stress.

4.1.6. Emotional intelligence

FL aptitude can be linked to Goleman's (1996) notion of emotional intelligence Many qualities attributed to emotional intelligence tally with the characteristics of a good language learner and autonomous learner. These qualities are listed below (Goleman, 1996, pp. 345-350):

- *Self-awareness*: observing oneself and recognising one's feelings; knowing the relationship between thoughts, feelings and reactions;
- *Personal decision-making*: examining one's actions and knowing the consequences;
- *Managing feelings*: realising what is behind a feeling, for example, the hurt that underlies anger, finding ways to handle fears, anxiety, anger and sadness;
- *Handling stress*;
- *Empathy*: understanding other's feelings and accepting their perspective; appreciating the differences in the way people feel about things;
- *Motivating oneself*: emotional self-control, that is delaying gratification; being able to enter the state of flow;
- *Communication*: talking about feelings effectively; being a good listener and question-asker;
- *Self-acceptance*: feeling pride and seeing oneself in a positive light; recognising strengths and weaknesses;
- *Assertiveness*;
- *Conflict resolution*: knowledge of how to 'fight fair' with peers and teachers; negotiating compromise;
- *Personal responsibility*: taking responsibility; recognising the consequences of one's decisions and actions; accepting one's feelings; following commitments such as to studying through.

Emotional intelligence has been recently examined by personality psychology and SLA researchers (cf. Dewaele, 2009; Dewaele et al., 2008; Petrides & Furnham, 2003; M. Robinson & Clore, 2002; Warwick & Nettelbeck, 2004). In the contemporary literature, it is viewed as a lower-order personality trait (Dewaele et al., 2008, Petrides & Furnham, 2003). Dewaele et al. (2008) conducted research on the relationship between the trait of

emotional intelligence and communicative anxiety in adult multilinguals. They discovered that there is a consistent pattern of negative correlations between emotional intelligence and anxiety in SLA, with higher levels of emotional intelligence corresponding to lower levels of anxiety. Accordingly, Dewaele (2009) hypothesises that learners with higher levels of emotional intelligence are better at controlling stress levels and emotional reactions in communicative situations.

4.1.7. Anxiety

Anxiety is a construct connected to fear characterised by arousal of the autonomic nervous system, which obstructs the learning process (Horwitz, 2000; MacIntyre, 1999; Piechurska-Kuciel, 2008). Anxiety affects cognitive functioning, and, in particular, the memory factor. According to Dewaele (2007), there is a link between anxiety, introversion, high levels of stress and foreign language performance. High levels of anxiety are linked to a high level of norepinephrine, which seems to affect STM and WM. Introverts tend to be anxious, which reduces the processing capacity of their WM. Hence, a mixture of introversion and anxiety could affect fluency in foreign language production. On the other hand, low levels of anxiety have been found to be related to an early exposure to a language, a high frequency of use, a stronger socialisation in a language, an extended range of interlocutors and a higher level of self-perceived proficiency (Dewaele, 2007; Dewaele et al., 2008). A link has been established between anxiety and perfectionism, which means that people who strive for perfection tend to be more anxious (Gregersen & Horwitz, 2002).

4.2. Learning styles and strategies

Personality types affect to some extent learning styles. Classically, learning styles are described as based internally, stable and often used unconsciously to process input (Reid, 1998, p. ix). Reid defines them as "an individual's natural, habitual, and preferred way(s) of absorbing, procession, and retaining new information and skills" (1995, p. viii). In the contemporary literature, there is no consensus as regards the nature of learning styles. For example, their stability is questioned, as they seem to be shaped by early educational experiences (Dörnyei, 2005). Reid (1995, pp. ix-xiii) divides learning styles into three general groups:

- *cognitive styles*, encompassing such styles as *field-dependent*/*independent*, *analytical*/*global*, *reflective*/*impulsive*;
- *sensory styles*, encompassing modalities: *auditory*, *visual*, *tactile*, and *kinaesthetic*;

- *personality-related styles*, encompassing such characteristics as *extraversion/introversion*, *feeling/thinking*, and *tolerance of ambiguity*.

Ely (1995b) defines second language tolerance of ambiguity as one's acceptance of confusion and uncertainty in a foreign language, whereas Ehrman and Oxford (1995) link it to risk taking, which is an essential factor for making progress in the language. In 2003 Ehrman and Leaver introduced a *synoptic-ectenic* distinction, which addresses the degree of conscious control over the process of learning. *Ectasis* refers to conscious control, whereas *synopsis* to unconscious processing.

Dörnyei outlines the contemporary state of knowledge of learning styles placing them "midway between innate abilities and strategies" (2005, p. 123). This category is open-ended and includes cognitive aspects, as well as personality dimensions, sensory preferences and modality. Learning styles are partly based internally and partly result from personality traits, past learning experiences, and acquired abilities and skills. Dörnyei's assumption is that cognitive styles are clearly distinct from learning styles. Cognitive styles are defined as "an individual's preferred and habitual modes of perceiving, remembering, organising, and representing information" (Dörnyei, 2005, p. 124). They are stable, biologically determined and internalised. They are related to language abilities, but constitute a separate group of factors. Ability refers to the content and level of cognition and performance, whereas style accounts for the manner of cognition and performance. Besides, abilities are unipolar, which means that their level can vary, whereas styles are bipolar and form a continuum, neither end of which is considered more advantageous. Finally, the ability level is directly connected with the L2 learning outcomes, whilst, in the case of cognitive styles, such a regularity is not observed, since they are context-dependent. Learning styles operate at the level of learning activity, which is more external, less stable and represents rather the learner's adaptation to the environment, than genetically predetermined behaviour.

Different styles can be equally effective and advantageous; therefore, individual differences are not likely to contribute to the outcomes in SLA provided teaching methods are compatible with the style. However, some styles are described in the literature as more helpful in SLA than others. Field independence, for example, positively correlates with language learning achievement (Chapelle, 1995; Dörnyei & Skehan, 2003, p. 603; Ehrman, 1998, Oxford, 1990b); so do the analytic style (Ehrman & Oxford, 1995; Oxford, 1990b) and second language tolerance of ambiguity (Ehrman, 1998; Ehrman & Oxford, 1995).

Ehrman (1996) suggests that there is a relationship between FL aptitude, as measured by the MLAT (Carroll & Sapon, 2002) subscales, and learning styles and strategies. Therefore, Part One of the MLAT does not reflect any style, Part Two correlates with global, inductive language processing, Part Three reflects field-independence, Part Four reflects field-independence and analytic processing, whereas Part Five is connected with mnemonic and metacognitive strategies. It is also suggested that there exists a link be-

tween personality type, cognitive style and learning style (Dörnyei, 2005; Ehrman, 1996); however, the significance of the link seems ambiguous (Dörnyei, 2005). Good foreign language learners are believed to be able to flexibly adapt their learning style to the needs of a given situation or a task (Nel, 2008). Operating outside the preferred styles is defined as *style stretching*. According to Reid (1995, p. ix), "students can identify their preferred learning styles and stretch those styles by examining and practicing various learning strategies". As Oxford (2001, p. 362) argues, L2 learners must "develop beyond the comfort zone dictated by their natural style preferences". Learners who are aware of their style preferences can become more open to stretching their styles beyond their comfort zone and gradually incorporate new learning styles. To quote Dörnyei: "it is a reasonable assumption that students who can operate in a range of styles in a situation-specific and flexible manner are likely to become more effective learners" (2005, p. 156). Moreover, culture, that is learner's background knowledge, prior educational experiences, cultural tradition and socialisation can significantly affect learning styles as different behaviours and values are differently perceived in different cultures (Reid, 1998, p. xiii).

The definition of language learning strategies has evolved from simple "Steps taken by students to enhance their own learning" (Oxford, 1990a, p. 1) to more complex "Activities consciously chosen by learners for the purpose of regulating their own language learning" (Griffiths, 2008b, p. 87). According to Hsiao and Oxford (2002), strategies are of crucial importance as tools for active and conscious learning promoting proficiency, autonomy and self-regulation. There is a general consensus that learning strategies, when used effectively, facilitate the process of SLA and increase proficiency (cf. Pawlak, 2011).

Since the beginning of the 1990s the concept of language learning strategy has gained the attention of both teachers and researchers (O'Malley & Chamot, 1990; Oxford, 1990a, 1990b; Wenden & Rubin, 1987). Firstly, it intuitively focused on the so-called 'good language learners', described as those that possess characteristics that made them more successful than others in learning a second language (Rubin, 1975). Secondly, the most widely acknowledged definitions and taxonomies of learning strategies were offered by O'Malley and Chamot (1990) and Oxford (1990a). Both taxonomies are highly compatible as they generally comprise four groups of strategies (Dörnyei & Skehan, 2003, p. 609):

- *Cognitive strategies*, which encompass different manipulations with language input, like repetition, translation and deduction;
- *Metacognitive strategies*, which encompass higher-order strategies of managing the process of learning, like monitoring, planning and evaluating. This group is believed to be of special importance in augmenting learner autonomy because their development results from learner maturity and the ability to take responsibility for the learning process;

- *Social strategies*, which encompass interpersonal behaviours, like cooperation or asking for help;
- *Affective strategies*, which encompass emotional self-control of the learner.

There is still no consensus among researchers regarding the definition of language learning strategies, their attributes and taxonomy. In contemporary discussions of the topic, a learning strategy is characterised as thoughts, actions or activities, including physical and mental behaviour (Griffiths, 2008b; Macaro, 2006; O'Malley & Chamot, 1990; Oxford, 1990a), which are used consciously (Oxford, 1990a; Macaro, 2006), with emphasis on the issue of choice. Language learning strategies are *goal-oriented* and *problem-oriented*, which means that they are used purposefully by the learners to achieve goals or to solve problems which occur in the learning process (Ehrman, Leaver, & Oxford, 2003; Macaro, 2006). They are used for self-regulation of the process of learning (Dörnyei & Skehan, 2003). There is also evidence for positive effects of multilingualism on learning strategies development (Cenoz, 2003). As Pawlak (2011) argues in his review of literature, language learning strategies have some specific characteristics which distinguish them from other individual differences. Strategies can be *general*, such as, for example, planning one's learning or *specific*, such as selecting a goal, more or less *concrete*, *observable versus unobservable*, and *linguistic versus non-linguistic*. Strategy choice and use depend on numerous factors, which can be divided into *learner--related*, *contextual* and *situational*. Among learner-related factors Pawlak (2011, pp. 23--24) enumerates such variables as age, motivation, gender and language learning experience, with older, more motivated, female and more experienced learners using a wider range of more sophisticated strategies. Other individual differences affecting strategy use are, for example, personality, learning styles, learner beliefs, proficiency levels and career orientation. Contextual and situational variables embrace such aspects as cultural beliefs and values, instructional setting and the language being learned, among others. Last but not least, the learning task is a powerful modifying variable. The success in learning a foreign language depends to some extent on the right choice of a strategy appropriate to a task and context of learning. A study by Oxford, Cho, Leung and Kim (2004) demonstrates that strategy use is the outcome of a complex relationship between task demands and the subjects' proficiency level. According to Pawlak (2011), the effectiveness of strategy use in language learning depends on combining them into strategy *clusters* and *chains*. Pawlak (2011, p. 26) expresses his opinion on the choice of strategies in the following way:

> All strategies are potentially beneficial on condition that they are matched to the learning task, compatible with students' learning styles, adroitly employed and combined into clusters and chains with other relevant strategies, all of which, however, are requirements that mainly successful learners can be expected to fulfil.

What is more, the relationship between strategy use and the level of proficiency is by no means transparent. Many studies have found a correlation between these two factors. For example, in a longitudinal study, Griffiths (2008b) discovered that higher-level learners use a number of language learning strategies, for example: metacognitive strategies, strategies to expand their vocabulary, strategies to expand their knowledge of grammar, strategies involving the use of resources and strategies involving all language skills (Griffiths, 2008b, p. 92). Although there is abundant evidence in support of the hypothesis that higher proficiency levels correlate with more effective strategy use (cf. Green & Oxford, 1995), there have also been studies that produced less convincing results. Research on the correlation between language proficiency and other cognitive factors among educated adults (Ehrman & Oxford, 1995), revealed a low correlation between cognitive language learning strategies and their proficiency level, and no correlation between metacognitive, affective and memory strategies and their proficiency level. It also indicated no particular strategy preference among the subjects. As the researchers conclude, it appears that in the case of successful learners, their FL aptitude contribution to proficiency surpasses the assumed benefits from efficient strategy use. On the other hand, learners who have previously learned a few languages might use strategies automatically, unconsciously and unreflectively (Ehrman & Oxford, 1995). Moreover, even if there is a correlation between strategy use and the level of proficiency, the causality of this relationship is difficult to determine (Pawlak, 2011). Certain grounds exist for believing that not only strategy use contributes to an increase in foreign language proficiency, but also a reverse direction is possible, namely the level of proficiency has an impact on strategy use (Anderson, 2005), or that strategies are both the cause and effect of the level of proficiency (Pawlak, 2011). In conclusion, it would seem that the relationship between strategy use and the outcomes of learning a foreign language is extremely complex.

Finally, Dörnyei (2005) proposes replacing the concept of language learning strategies with the multidimensional construct of *self-regulation*, which he defines as "some sort of a trait-like strategic potential that enables some to excel in this area" (2005, p. 190). Self-regulation is a dynamic concept emphasising the degree to which individuals are active participants in their own learning. In line with Snow et al.'s (1996) cognitive--affective-conative FL aptitude theory, he emphasises the multidimensionality of the construct: "*Self-regulation of academic learning* is a multidimensional construct, including cognitive, metacognitive, motivational, behavioural, and environmental processes that learners can apply to enhance academic achievement" (Dörnyei, 2005, p. 191). Self--regulation is used interchangeably with such constructs as self-management, self--control, volition, self-directed behaviour, coping behaviour, metacognition and problem solving. It seems that this concept is particularly valid in the theory of learner autonomy in SLA. A challenging hypothesis regards self-regulation as an aptitude (Dörnyei, 2005; Randi & Corno, 2000; Winne & Perry, 2000). According to Randi and Corno (2000),

self-regulation is both an aptitude and an outcome of learning; therefore, its position is midway between an individual difference and a strategy. In a similar vein, Winne and Perry (2000) regard self-regulation as a twofold factor, namely an aptitude and an event. Self-regulation viewed as an aptitude is labelled as a relatively stable characteristic termed as *trait*, whereas self-regulation defined as an event is described as a transient state embedded in a large series of states.

Summing up, research over the last decade has confirmed that successful foreign language learners use more efficient, complex and varied learning strategies. Moreover, they are able to adapt their strategy use to the requirements of a situation, teacher or task (Cohen & Macaro, 2007; Droździał-Szelest, 1997; Michońska-Stadnik, 2008; Moyer, 2007; Pawlak, 2009, 2011). It may, therefore, be argued that the quality and 'appropriateness' of strategy use is what counts, not quantity (Dörnyei, 2005).

4.3. Autonomy

Autonomy is defined as "redistribution of power among participants" (Benson & Voller, 1997, p. 2), which means more learner control over his/her process of learning. Most contemporary researchers and educators agree that the development of autonomy implies more effective language learning. As Benson (2001, p. 1) elucidates, "Autonomy is a precondition for effective learning; when learners succeed in developing autonomy, they not only become better language learners but they also develop into more responsible and critical members of the community in which they live". There are many controversies as regards the definition, types and levels of autonomy. According to Benson (2001, p. 2), this concept is very complex and difficult to define: "Autonomy is in essence multidimensional and takes different forms in different contexts of learning". A few models of autonomy have been proposed. For example, Nunan (1997) presents five levels of autonomy termed as *awareness*, *involvement*, *intervention*, *creation*, and *transcendence*, whereas Littlewood (1997) describes autonomy in terms of *language acquisition* (autonomy as a communicator), *learning approach* (autonomy as a learner), and *personal development* (autonomy as a person). Macaro (1997), in turn, suggests a tripartite model of autonomy including *language competence*, *language learning competence* and *choice and action*. Finally, Scharle and Szabó's (2000) model refers to three stages of the development of autonomy, namely *raising awareness*, *changing attitudes* and *transferring roles*.

The concept of autonomy is related to research on individual differences, in particular motivation and self-regulation (cf. Dörnyei, 2005). The psychological dimension of autonomy regards it as a capacity including abilities, skills, attitudes, as well as other individual differences that allow a learner to take responsibility for his/her process of learning. Freedom of choice and freedom from external control do not mean that a learn-

er will be ready to take this responsibility. Autonomy is not only a question of choice and will, but also, and perhaps first of all, a function of individual learner characteristics: aptitude, personality, awareness, competence, maturity and age (Little, 2004). Moreover, even a high level of proficiency in a foreign language is not a guarantee of a high level of autonomy. Successful foreign language learners are not necessarily autonomous. Autonomy development is limited by various factors, such as institutional requirements, the cultural specificity or a type of task, which means that learners might display different levels of autonomy in different situations and performing different tasks.

On the basis of research findings it emerges that there is a link between giftedness and autonomy. In line with Betts (2009), who conducted research on gifted autonomous learners, an autonomous learner is one of a few possible profiles of gifted/talented learners. As a matter of fact, not all gifted students are able to become autonomous. Betts regards gifted autonomous learners as independent, self-directed, perceptive, knowledgeable, and accepting of self and others. They perceive their abilities as an opportunity to make a positive contribution to the world. One of prominent characteristics of gifted autonomous learners is a positive self-concept and self-esteem. It is striking that they are often creative and successfully manage to combine their creative and cognitive abilities into an independent and self-directed learning style. Like all gifted and successful learners, they display an extremely high level of motivation, termed as *passion learning* (Betts, 2009, p. 84). They view learning as a life-long activity and desire to pursue their passion in depth. It appears that there is a link between giftedness, creativity and autonomy, which can result in success in learning a foreign language learning.

4.4. Dynamic systems theory for individual differences

The term dynamic systems theory (DST), which has its origins in science − mathematics, physics, chemistry, neurology and psychology − has been continually adopted in applied linguistics for the last two decades (cf. N. Ellis, 2007; N. Ellis & Larsen-Freeman, 2006, 2009; Herdina & Jessner, 2002; Jessner, 2008; Larsen-Freeman, 1997; Larsen-Freeman & Cameron, 2008). The main assumption guiding DST is that all factors and processes that come into play in SLA are dynamic, open to change and mutually affect each other. Any change in a complex system is non-linear. What is more, the agents, elements, processes in a complex system may themselves be complex systems. Complex systems, which operate on multiple levels and within multiple timescales, are fuzzy, ambiguous, uncertain and emergent. However, they exhibit self-organisation and ordered patterns of change (N. Ellis, 2007; N. Ellis & Larsen-Freeman, 2009; Herdina & Jessner, 2002). A complex system is in a continuous process of change, a constant interplay of stability and variability. Changes in a system occur over time, are non-linear, complex and can be reversible (e.g. language attrition) (Herdina & Jessner, 2002). Variability is not

‘background noise’ in data, but it is treated as a measure of stability. An increased level of variability is observed at transition points (Dörnyei, 2009; Herdina & Jessner, 2002). According to N. Ellis (2007), De Bot, Lowie and Verspoor (2007), and Dörnyei (2009, 2010), the construct of FL aptitude also fits in with DST.

Dörnyei strongly promotes Robinson’s FL aptitude model because “This is a forward-pointing attempt to describe concrete sets of cognitive demands that can be associated with some basic learning types/tasks” (2009, p. 228). As far as FL aptitude is concerned, he suggests that “It is best viewed in a situated manner, taking into account the dynamic interplay between aptitude and context” (2009, p. 183). Later, he postulates that the most promising research methodology would be one which combines aptitude measures with other individual differences in various trait complexes and takes into account personality and motivational factors, as well as instructional and situational variables (cf. DeKeyser & Juffs, 2005).

In a similar vein, De Bot et al. (2007) describe language as a complex dynamic system where psychological, social and environmental factors interact in a constant state of flux. Cause-effect relationships are non-linear, multivariate and interactive. Each individual path of interlanguage development is different and its stages as presented by SLA researchers are statistical abstractions that fail to describe an individual path of growth. In line with N. Ellis, “Fractally, current SLA theory is no more a static representational system than is L2 interlanguage. Both are states of being in evolving dynamic systems” (2007, p. 23). N. Ellis (2007) considers DST an important trend in SLA research gathering together multiple factors that interact in the system of language, language learning and language use. In his view, DST is a milestone in SLA research. As he explains: “A DST (Dynamic Systems Theory) characterisation of L2 acquisition as an emergent process marks the coming of age of SLA research” (N. Ellis, 2007, p. 23). According to Jessner, a DST relates multilingualism to individual differences: “The complexity and variability, as a measure of stability of the multilingual system are influenced by individual cognitive factors such as motivation, anxiety, language aptitude, and self-esteem” (2008, p. 274). She holds that individual differences not only affect multilingual development, but they are also subject to change along with the acquisition of subsequent languages.

In keeping with these hypotheses, Dörnyei (2009) proposes “a radically new approach in order to understand the complexity of learner-based performance variation” (2009, p. 180), that is, the DST paradigm. His review of research on individual differences in the fields of SLA and psychology raised several doubts related to defining and measuring these factors. First and foremost, traditional individual differences research involves a quantitative approach, which focuses mainly not on differences, but on statistical averages that group together people sharing common characteristics. His criticism of a quantitative approach is based on the claim that it focuses on a central tendency, neglecting individual deviation from the norm, which is treated as irrelevant ‘background’ noise. This is a major inadequacy because a generalised description resulting

from this method might, as a matter of fact, not match any of the studied subjects. In contrast, an individual-level analysis, which takes into account apparently irrelevant pieces of information, is capable of producing a more complete description of a subject's profile. His argumentation is in line with contemporary researchers who advocate the need for individual-level paradigm in individual differences research (cf. Dewaele, 2009; Jessner, 2008; N. Ellis & Larsen-Freeman, 2006). Dewaele, for example, holds that "learners are more than bunches of variables" (2009, p. 637), whereas N. Ellis and Larsen-Freeman argue that "What generalisations exist at the group level often fail at the individual level" (2006, p. 564).

Should, therefore, all research on regularities be abandoned? As N. Ellis has it, "the truth usually lies somewhere in between, in the dynamics of the dialectic" (2007, p. 23). There are certainly regularities in language development and general tendencies, which can be predicted from cognitive and affective factors. N. Ellis emphasises their importance in SLA research: "Cognitive factors such as attention, working memory […], consciousness and explicit learning are the heart of SLA, as social, affective, and cultural factors are its soul" (2007, p. 24). In consequence, all the factors can be reliable predictors of learning a foreign language.

Dörnyei's DST challenges the traditional understanding of the nature of individual differences in psychology and SLA terming it as 'individual differences myths'. The first myth undermined by Dörnyei is that individual differences are relatively stable and free from any contextual influence. In line with N. Ellis and Larsen-Freeman (2006), he regards individual differences as temporal and context-dependent, and prone to dynamic changes over time. Even genetically inherited characteristics interact with the environment, which constantly exerts an impact on them. From the perspective of SLA, this claim does not seem to evoke much controversy, as it accords with the findings of research on personality factors (cf. Dewaele, 2007; Dörnyei, 2005; Ehrman, 2008). However, in the field of psychology both cognitive (e.g. intelligence or aptitude) and affective (e.g. agreeableness) factors are treated as relatively stable over time (cf. Jensen, 1998; McCrae & Costa, 2003). On the other hand, Dörnyei assumes some sort of temporary, intra-individual stability of individual differences. In order to solve the conflict between the stability of individual differences and the variability of dynamic systems they operate in, Dörnyei proposes a reconciliation offered by the concept of *attractors*. As he explains: "Attractor states are preferred states towards which the system gravitates" (2009, p. 198). More stable states occur when attractors are powerful and less stable states are observed in the case of weak attractors. In this view, higher-order individual variables, such as aptitude or general intelligence, act as a stabilising force – a strong, stable attractor, whereas, for example, an emotion is a less stable attractor. A slight change in the system, 'the butterfly effect', might affect this stability. Even relatively stable attractors can be moved from their position by some external forces, thus changing the whole equilibrium.

The second postulate is the multicomponential nature of individual differences. According to Dörnyei, all human characteristics are multifaceted and made of several layers of constituents. This is probably the least controversial of Dörnyei's claims because the idea of multidimensionality of individual differences has always been present in SLA and psychology research alike. Most intelligence theories assume a hierarchical structure of two or three levels of cognitive abilities subsumed under a general factor (cf. Cattell, 1971; Jensen, 1998; Vernon, 1950). FL aptitude theories also present this concept as hierarchical (cf. Carroll, 1993) and multidimensional (cf. Corno et al., 2002; Robinson, 2009; Skehan, 2002). Personality factors are not all hierarchically structured; however, they usually consist of several components. For example, neuroticism is a higher-order factor connected with negativism and anxiety, whereas different types of language learning anxiety are lower-order factors linked to other lower-order personality traits such as emotional intelligence (cf. Dewaele, 2007; McCrae & Costa, 2003).

Thirdly, Dörnyei proposes that individual differences are not only susceptible to dynamics and situational constraints, but also interact with each other and the environment synchronically and diachronically (cf. N. Ellis, 2007). Each factor is entangled in a complex web of other elements, which mutually influence each other in various manners. The balance between elements is complex and unpredictable – a change in one element does not produce a proportional change in the remaining elements. Changes in the system may be disproportional to the factors that evoke them. Dörnyei emphasises the interaction between cognition, motivation and affect: "the three systems have continuous, dynamic interaction with each other and cannot exist in isolation from one another" (2009, p. 225). Individual differences should be analysed as "amalgams or constellations of cognition, affect, and motivation that are relatively stable and which act as 'wholes'" (Dörnyei, 2009, p. 225).

Consequently, any attempt to describe this three- (or more) dimensional, highly complex, and fluctuating system by a two-dimensional cause-effect relationship cannot produce any fruitful findings. This argumentation inevitably leads to methodological inferences. Because the interaction between factors is dynamic and non-linear, it cannot be analysed by a simple correlation analysis. Instead, Dörnyei (2009) postulates that researchers focus on individual level analysis integrating cognition, affect and motivation in multidimensional longitudinal studies. These qualitative, in-depth studies will take into account all neglected, apparently irrelevant modifying variables, thus complementing traditional, quantitative analysis.

The idea of multidimensionality is often considered in modern studies on individual differences, also those primarily and deliberately focusing on statistical analysis (cf. Abrahamsson & Hyltenstam, 2008, 2009; Dewaele, 2009). Dewaele (2009), for example, puts forward an emic perspective, that is one taking into consideration an individual's personal perception of his/her process of learning, as well as individual characteristics interpreted in a dynamic interaction with the social environment. Abrahamsson and

Hyltenstam (2008, pp. 502-503), in turn, in their ongoing study of the phenomenon of native-like proficiency, present biographical data and even parents' opinions on the first language development of their subjects. In this case, the qualitative aspect supplements the quantitative analysis of the linguistic data and FL aptitude test results.

Conclusion

The present chapter has focused on these individual differences which exceed the cognitive domain, being situated midway between personality characteristics and cognitive variables. If we take into account the complexity and multidimensionality of the human psyche, it seems necessary to shed some light on these factors in order to obtain a more complete profile of a linguistically gifted foreign language learner. The present author is fully aware that the above-mentioned factors are multifaceted and the brief presentation by no means explores their complexity. Nonetheless, as has already been stated, the significance of personality factors and learning styles and strategies in the concept of FL aptitude is not as high as that of cognitive factors and their relationship to FL aptitude development can be non-linear. Accordingly, the discussion of these factors was only cursory because they are not the main concern of the present work.

The opening section of this chapter presented the role of personality factors in foreign language learning and Snow's (1987) model of FL aptitude, which includes affective as well as cognitive characteristics. As has been emphasised earlier, there is very little research on FL aptitude termed as a conglomerate of cognitive and affective variables; therefore, great caution must be exercised when evaluating the predictive value of non-cognitive variables. Many personality factors affect the learning outcomes, but are rather unlikely to correlate with FL aptitude as measured using traditional instruments, like the MLAT (Carroll & Sapon, 2002). Foreign language anxiety, learning styles and personality characteristics within the FFM belong to this group. However, the factor of openness, which implies high intellect, intellectual curiosity and creativity, is a potential predictor of FL aptitude. Other factors presented in the following sections of this chapter, namely motivation, locus of control, style of coping with stress, learning strategies and self-regulation, as well as emotional intelligence are closer to the cognitive domain, as they all include the appraisal of one's intellectual potential and resulting from it personal choice. All those factors are connected with taking responsibility for one's own intellectual development and the learning process. Consequently, the subsequent section focused on learner autonomy, which is associated with studies of good foreign language learner. In keeping with the line of research that advocates the need for multidimensional studies of individual differences, the present author decided to focus on dynamic systems theory, which seems to be an adequate paradigm to describe non-cognitive factors in gifted foreign language learners, as complementary to quantitative analysis. A section

presenting Dörnyei's (2009) DST for individual differences closed this chapter. The following chapter is designed as a thorough investigation of empirical research on linguistically gifted foreign language learners.

CHAPTER FIVE

GIFTED FOREIGN LANGUAGE LEARNERS

Introduction

This last theoretical chapter focuses on the core issue of this book, that is gifted foreign language learners. In the first section the definitions of *talent* and *giftedness* will be presented. From a review of literature, it appears that high aptitude is only one of many necessary conditions for the development of talent; personality factors and environment are also significant modifying variables. The second section will present the methods of identifying gifted individuals and the criteria for selection. The following three sections will concentrate on empirical research on gifted and talented foreign language learners. Firstly, case studies on exceptional linguistic abilities that are the most often referred to in the literature will be described; secondly, group studies on highly advanced adult foreign language learners will be outlined; and, finally, multidimensional, in-depth studies on accomplished high achievers will be presented. The present author's intention was to focus on both case studies and multidimensional studies because of their direct relevance to the topic under discussion. Particular emphasis will be placed on Abrahamsson and Hyltenstam's (2008) study which casts new light on the problem of FL aptitude. Subsequently, the focus of attention will be shifted to the neurological advances referring to FL aptitude differences.

5.1. Giftedness and talent

Traditionally, giftedness was equated with high IQ (Terman, 1926). Nowadays, most researchers argue that intelligence is not a unitary concept, and they propose more multifaceted approaches to intelligence and cognitive abilities (cf. Carroll, 1993; Cattell, 1971; Sternberg, 1985). There are many definitions of giftedness; however, most of them are correlated with one another. Most researchers define giftedness in broad terms of multiple intellectual and non-intellectual qualities. The IQ score is considered to be

a necessary, but insufficient measure of giftedness. Besides IQ, such factors as motivation, high self-concept and creativity are regarded as key qualities in the development of talent (Kerr, 2009; Sternberg & Davidson, 2005).

Francoys Gagné's (2000, 2005) *Differentiated Model of Giftedness and Talent* explains how outstanding natural abilities, also termed as gifts or aptitudes, develop into specific expert skills (talents). Giftedness, also referred to as aptitude, is an untrained natural ability evident in at least one ability domain, to a degree that places a child at least among the upper 15% of his/her peers. Talent indicates the superior mastery of systematically developed abilities, skills and knowledge in at least one domain of human activity, which ranks the individual's achievements within at least the top 15% of his/her peers. There are five domains of aptitude: *intellectual*, *creative*, *socio-affective*, *sensorimotor* and *other factors*. Natural abilities/gifts/aptitudes are inborn and can be detected in intellectual tasks, for example, foreign language learning. These abilities can be observed in children, adolescents and adults through the facility and speed of acquiring new skills. The greater the ability, the easier and faster the process of learning. Aptitudes/gifts progressively transform into talents through a systematic training and development. Hence, aptitudes[33] are considered 'raw material', which systematically evolves into a talent. There are two necessary conditions for a gift to become a talent: the first is the presence of well above-average natural ability and the other is a systematic effort devoted to training, learning and practising.

According to Gagné, there are six components whose peculiar interaction fosters the transition from inborn giftedness to talent: *gift*, *chance*, *environmental catalyst*, *intrapersonal catalyst*, *learning/practice* and *the outcome of talent*. Environmental catalysts may have a great impact on personal development. They include such factors as family size, parenting style of rearing, socio-economic status, or significant events, such as the death of a parent or winning an award, and they significantly influence talent development. The most important intrapersonal catalyst is motivation, which sustains the process of talent development. Other important intrapersonal catalysts are temperament, personality characteristics, attitudes, as well as acquired styles of behaviour. Chance, environmental catalysts and intrapersonal catalysts either facilitate or hinder talent development. Learning/practice is a moderator. Through environmental and intrapersonal interactions, which influence the process of learning, natural abilities (gifts) are transformed into talents.

One of the best empirically scrutinised conceptions of giftedness is Renzulli's (1986) *Three Ring Model*. Renzulli recognises three basic clusters of human traits that make

[33] According to Gagné's model (2000) *aptitude* is a concept tantamount to *giftedness*. However, in line with SLA researchers, FL aptitude is defined as a complex set of cognitive abilities (cf. Robinson 2007; Skehan, 1998), whereas giftedness/talent for languages is regarded as an extremely high level of FL aptitude (cf. Abrahamsson & Hyltenstam, 2008; Skehan, 1998). It is clearly the latter stance that is adopted in this book.

a gift, namely *above-average ability*, *high levels of task commitment* and *high levels of creativity*. Above-average ability can be classified as either general cognitive ability or specific abilities which refer to specific domains. In order to successfully implement all the three elements, a wide variety of educational opportunities is needed. Renzulli claims that it is not the 'strength' of particular clusters of traits, but rather the interaction occurring between them that determines the development of talent. In a similar vein, Callahan (2000) regards an exceptional ability as a specific complex of individual factors, emerging in early childhood in some individuals. The most often used criterion is a very high intelligence quotient (IQ): over one hundred and thirty points. Other criteria embrace the speed of learning, extended knowledge, early intellectual maturity and extraordinary achievements in some area, for example, science, arts, or languages (cf. Nęcka, 2003).

The Polish researcher into giftedness, Professor Andrzej Sękowski (2004), points out that exceptional achievements are considered to be the most significant index of exceptional ability. Achievement manifests itself in success in different domains of life. Success, in turn, is the outcome of life goals, values, motivations and preferences for ability development. In other words, people actively modify and develop their inborn capacity interacting with the environment. A very important role is attributed to personality. Such features as conscientiousness, persistence, stubbornness, goal-orientation and ambition facilitate achievement. Achieving success requires a deep, persistent effort, as well as high self-esteem and indifference to criticism. Research results indicate that high--achievers are more hard-working and more persistent than their less successful peers. Another significant attribute of a high-achiever is fascination; fascination with the new is one of the factors in the personality dimension of openness to experience. Moreover, people who gain success are often creative. They are fascinated with new ideas, display intellectual curiosity, are tolerant of ambiguous information, and willing to test new ideas and to take risks. Finally, successful people are highly motivated (cf. Dörnyei, 2005). There is a cumulative body of evidence that there is a direct strong correlation between personality factors and academic achievement (Sękowski, 2004).

5.2. Identification of giftedness

In most theories giftedness and talent are treated not in a dichotomous way, but as a continuum. Definitions of giftedness are differentiated and include terms such as 'bright', 'able', 'more able', 'highly able', 'gifted' and 'talented', denoting degrees of exceptionality. Notions of 'gifted', 'able' and 'highly able' are used interchangeably. Procedures for identifying giftedness are varied because there is no conceptual clarity as to what comprises giftedness (cf. Hartas, Lindsay, & Muijs, 2008; Kerr, 2009). Qualitative and quantitative criteria for the choice of a talented learner are proposed in the liter-

ature (Arancibia, Lissi, & Narca, 2008; Hartas et al., 2008; Hewston et al., 2005; Kerr, 2009; Threlfall & Hargreaves, 2008). Qualitative criteria encompass teacher, parent, peer, or self-nomination on the basis of academic results. Quantitative criteria embrace data relative to the student's school history and standardised tests, such as the Wechsler Intelligence Scale and aptitude tests. The process of identification of gifted individuals is defined from a broad perspective including a variety of factors, such as specific and general cognitive ability, as well as cultural, gender and language differences (Kerr, 2009, p. xxviii).

Normative definitions, such as giftedness or talent, must specify how talented people differ from the norm. The norms proposed in the literature are varied. Some researchers recommend that individuals placed within the top 15-20% (Renzulli, 1986), 10% (Arancibia et al., 2008; Bates & Munday, 2005), or 3-5% (Nęcka 2003; Selinker, 1972) of the normal curve are considered to be talented. Gagné proposes the threshold for both giftedness and talent at the 85th percentile, that is one standard deviation above the mean. Therefore, those placed within the top 15% of a population are defined as talented. Gagné (2000) argues that there are degrees of talent comprising four groups:

- 'basically' gifted – the top 15%;
- 'moderately' gifted – the top 2-3%;
- 'highly' gifted – the top 1 or 2 in a thousand;
- 'extremely' gifted – the top 20-30 in a million.

Usually, the identification of giftedness concerns children, but special abilities can also be traced in adolescents and adults. There are different criteria for the identification of giftedness for different age groups. Accordingly, the following three sections will present the characteristics of gifted children, adolescents and adults.

5.2.1. Children

Generally, gifted individuals learn more quickly, deeply and broadly than their peers. Gifted children may learn to speak in sentences and to sustain a conversation with an adult very early. They can read at a very early age and operate at the same level as older children. Typically, they display high reasoning ability, creativity, inveterate curiosity, a sense of humour, a large vocabulary, excellent memory, as well as the ability for sustained concentration. Owing to superior memory and concentration, gifted children are able to remember new concepts after a few repetitions. What is more, they demonstrate a preference for complex, abstract thought often using higher-level thinking skills. They possess wide general knowledge and a vivid imagination. They can be physically and emotionally sensitive, perfectionist and often tend to question authority. Giftedness is usually unevenly distributed throughout all spheres; an individual can be profoundly gifted in one sphere and quite average in another (Bates & Munday, 2005; Johnsen, 2004).

5.2.2. Adolescents

The identification of gifted and talented students raises important issues regarding what counts as evidence for giftedness and talent and the validity of assessment procedures. It is recommended that multiple sources of evidence be sought, such as, for example, academic performance, intelligence scores, ability tests and certain personality characteristics, for example, persistence, perseverance, resilience, motivation and interest (Hartas et al., 2008). Gifted students are often identified as the highest performing students in an area of work. Threlfall and Hargreaves (2008, pp. 83-98) propose that gifted students differ from their peers in the following respects:

- they have broader and more interconnected knowledge base;
- are quicker at solving problems, while spending more time planning;
- are more efficient at representing and categorising problems;
- have more elaborated procedural knowledge;
- are more flexible in their use of strategies;
- prefer complex, challenging problems;
- are more sophisticated in their metacognition;
- make more reference to what they already know.

Steiner (2006) suggests that gifted students know more and better learning strategies, are more flexible in their use and more likely to choose effective strategies. Similarly, Sękowski (2004) emphasises the role of memory strategies in talented individuals; gifted students are believed to use more differentiated and effective memory strategies. Finally, Nęcka (2003), on the basis of his research and literature review, argues that the most significant characteristics distinguishing highly gifted individuals are excellent memory and the speed of learning.

5.2.3. Adults

There is a remarkable lack of research on talented adults. According to Siekańska (2004), among numerous studies on giftedness only 13% was devoted to this group. The main reason for this situation are organisational and methodological problems. Highly able adults and older students are recognised on the basis of their remarkable achievements in a domain of activity. This criterion can be regarded as a sufficient indicator of high abilities (Housand, 2009). High achievement is not only a result of high abilities, but also effort, hard work and commitment. On the other hand, it can be treated as a predictor of subsequent achievements. It is remarkable that only some individuals gain success, whereas some others, equally gifted, do not excel in any sphere of life. The reasons for this uneven fulfilment of a natural gift should be attributed to motivational and personality factors (Siekańska, 2004).

Siekańska (2004), on the basis of her research conducted on 32 subjects whose average age was 30 years, reported that highly able adults with high achievements in an academic domain pursued their career in accordance with their ability and achievements. Most of them chose an academic career and were generally very satisfied with their professional life. The most significant personality characteristics in the sample were internality of control, which indicates high controllability, high professional competence and an efficient style of coping with stress.

In her review of literature on gifted adults, Housand (2009) presents a number of characteristics identified in this group. Two main factors contributing to the development of talent are adequate educational opportunities and high cognitive ability. Apart from these two factors, the following personality traits are consistently identified in gifted individuals:

- resilience and perseverance;
- superior capacity for communication;
- a sense of destiny about work;
- strong will and determination;
- ability to focus for a long time;
- strong need to excel;
- motivation;
- broad interests;
- creativity, imagination, innovativeness;
- ability to take risks.

Biographies of eminent individuals uncover joint environmental influences. The most often mentioned impact is the support of friends and family members, in particular at times of profound breakthroughs. Moreover, talented individuals report:

- having to overcome obstacles;
- 10 years of experience;
- emotional, logistical and financial parental support and involvement;
- time and opportunity;
- good health.

Gifted adults are described as extremely productive and goal-oriented. Their mood of acting is referred to as 'rage to master'. This level of proliferation is not driven by external forces, but by intrinsic motivation and working for personal pleasure (Housand, 2009, pp. 28-31).

To conclude, it is evident that the definitions of giftedness are not very restrictive and there is much scope left for a subjective interpretation of what a gift or a talent is. However, all the researchers agree that there are two most significant indications of giftedness in students, namely superior academic attainment and high cognitive abilities.

5.3. Research on gifted foreign language learners

So far, little research addressing exceptionally talented foreign language learners has been conducted, and cognitive and affective factors have been probed only in general terms. Researching exceptional talents is difficult because such talents are quite rare and it is difficult to assemble a sizeable group to conduct a statistical analysis. Moreover, the criteria for the choice of gifted individuals presented in the literature as well as research methodology are to some extent inconsistent (cf. Bongaerts et al., 2000; Ioup et al., 1994; Marinova-Todd, 2003; Morgan et al., 2007; Moyer, 1999; Novoa, Fein, & Obler, 1988; Obler, 1989; Sawyer & Ranta, 2001; Schneiderman & Desmarais, 1988a, 1988b; Skehan, 1998; Smith et al., 2011).

All the studies on exceptional L2 learners can be roughly divided into two groups. The first group comprises early research on gifted individuals (Ioup et al., 1994; Obler, 1989; Schneiderman & Desmarais, 1988b), and two ongoing studies of savants: Christopher − by Smith and his team (Morgan et al., 2007; Smith & Tsimpli, 1991; Smith et al., 2011) and Daniel Tammet (Treffert, 2011). The second group includes research on accomplished L2 post-pubescent learners (Abrahamsson & Hyltenstam, 2008, 2009; Birdsong, 2004, 2007; Bongaerts, 2005; Bongaerts et al., 2000; Marinova-Todd, 2003; Moyer, 1999, 2007; van Boxtel et al., 2003). Within this group, the most in-depth multiple-domain study is the one conducted by Swedish researchers, Niclas Abrahamsson and Kenneth Hyltenstam. The following three sections will present respectively case studies, group studies and multiple-domain studies conducted on exceptional L2 learners.

5.3.1. Case studies

The definition of talent in early research on gifted L2 learners was adopted from psychology. Fein and Obler (1988) defined the performance of a talented individual as outstanding in one of two ways: either it is outstanding by comparison to the performance of others in society, or it is outstanding for the individual in question. It is similar to a more contemporary definition proposed by Arancibia et al. (2008), who define talented individuals as those who display significantly superior ability in comparison with peers of similar demographic characteristics. Most researchers in the 1980s and 1990s upheld Selinker's (1972) position that 5% of the adult population is capable of attaining native--like competence in languages after puberty. More recently, this statement has been challenged. As Abrahamsson and Hyltenstam argue, "There are researchers who have doubted Selinker's (1972) and others' quite optimistic estimations and have instead suggested that the actual incidence of nativelikeness should approach zero" (2008, p. 484).

Despite the marked scarcity of research on exceptional foreign language learners, Skehan emphasises its significance in applied linguistics. As he writes: "Analyses of

aptitude are relevant to some fundamental issues in applied linguistics, since aptitude can be seen as a rare window on the nature of the talent for language learning" (1998, p. 207). Skehan's (1998, p. 233) view on specific language learning ability can be subsumed under three fundamental points:

1. Modularity in language organisation of FL aptitude. In the case of the first language, the modular division is between syntax and semantics, whereas in the second language the modules refer to the stages of information processing: input, central processing and memory/output. The changed pattern of modularity is established after the critical period. A talent for learning languages should be analysed within these three components;
2. There is a relationship between specific language learning ability and general cognitive ability (intelligence) (cf. Carroll, 1993). The link is especially strong for analytic abilities and far less evident for memory and phonetic coding ability;
3. Very talented learners are not qualitatively different from simply high aptitude learners. The most significant characteristic of exceptionally successful learners is the possession of unusual verbal memory.

In the 1980s and 1990s the specificity of linguistic talent was by no means transparent. In the view of Schneiderman and Desmarais (1988b), linguistic talent was defined as an exceptional ability to achieve native-like competence in a foreign language after puberty. This definition was consistent with Skehan's (1998) position that exceptional foreign language learners master a foreign language relatively quickly, postpubertly and to a native-like level.

Nevertheless, research in the field of linguistic talents somehow contrasted with these claims as far as the criteria for choice of talented individuals were established. Different criteria regarding age of the participants, the age of onset, the number of languages previously learned, the length of learning and proficiency levels were chosen and operationalisations of talent varied. For example, a talented polyglot savant, Christopher, age 49, examined by Smith and Tsimpli (1991), Morgan et al. (2007) and Smith et al. (2011), was presented as a person able to read, write, understand and translate twenty languages. However, his ability ranged from fluency to mastery only in the bare elements of the languages. What is more, the analysis of excerpts of his translations as well as his very low intelligence quotient, questioned his abilities, in particular, in the field of pragmatics. The researchers (Morgan et al., 2007) admitted that it is rather the range of languages he learned, not the depth of mastery of them that impresses. Totally different criteria were chosen by Ioup et al. (1994), who examined a woman who learned Arabic as an adult in a natural environment. Her knowledge of Arabic was scrupulously examined by linguists and native speakers and evaluated as native-like in all aspects, that is pronunciation, grammar, vocabulary and accent recognition. At the moment of the research she had lived in Egypt for 25 years, was married to an Egyptian and her children were native speakers of Arabic. Although her mastery of Arabic was unquestiona-

ble, the criterion of the speed of learning is doubtful in this case. As has already been stated, the choice of subjects in the field of exceptional linguistic abilities was inconsistent. The age of the subjects varied from 23 years (Obler, 1989) to 49 years (Smith et al., 2011), the number of languages they had learned varied from 1 (Ioup et al., 1994) to over 20 (Smith et al., 2011), so did the level of proficiency: from basically indistinguishable from native (Ioup et al., 1994) to rudimentary (Smith et al., 2011). The age of onset of learning a language was also variable: from 11 (Schneiderman & Desmarais, 1988b), to over 40 years (Smith et al., 2011). The length of learning of an L2 was also varied: 12 and 20 years (Schneiderman & Desmarais, 1988b), 26 years (Ioup et al., 1994) and 14 years (Novoa et al., 1988).

Early research on exceptional linguistic abilities concentrated on the neurological basis underlying linguistic talent (Fein & Obler, 1988; Novoa et al., 1988; Obler, 1989; Schneiderman & Desmarais, 1988a, 1988b). Schneiderman and Desmarais (1988a, 1988b) proposed a neuropsychological substrate for talent described in terms of greater neurocognitive flexibility. Owing to this special brain feature, gifted individuals were supposed not to process L2 input in terms of the rigid parameters they have set for their L1, but to set new parameters or neural connections for an L2. The researchers defined talented foreign language learners as those basically indistinguishable from native speakers. In line with Selinker (1972), they argued that only 5% in a population are able to achieve such a level of proficiency in all aspects of a language. They separated phonological talent, which they considered a talent to mimic dialects, from other talents for grammar and lexis. It is evident that the researchers focused mainly on phonetic aspects of a language. It is interesting that they associated phonological ability with a personality feature, namely the willingness to adopt the identity or be taken for a native speaker. This willingness or readiness was believed to influence the rate and efficiency of taking up a foreign accent. Other personality features associated with perfect pronunciation were high motivation, non-conformist self-concept and willingness to take risks. We will now turn to the discussion of six case studies of gifted foreign language learners, namely two subjects examined by Schneiderman and Desmarais (1988b), CJ (Novoa et al., 1988), Julie (Ioup et al., 1994), Christopher (Smith & Tsimply, 1991) and Daniel Tammet (Treffert, 2011).

Schneiderman and Desmarais' (1988b) study

Early studies on linguistic giftedness focused on the specificity of the gifted brain. One study that pursued this line of enquiry was conducted by Schneiderman and Desmarais (1988b) on two gifted foreign language learners selected on the basis of their native-like proficiency in at least one foreign language gained after puberty. The age of onset of foreign language learning was 11 years. At the moment of the research the subjects' ages

were 23 and 31 years. Their proficiency level in phonetics and grammar was assessed by native speakers. The native-like proficiency L2 was French; they were also fluent in some other languages. The researchers concentrated on memory and IQ measures of ability. The instruments they applied included: the Wechsler Memory index, the Wechsler Digit-Symbol Coding, the MLAT (Parts One, Two and Five), as well as verbal and performance scales of the Wechsler Intelligence Scale. Besides, they compared the subjects against Geschwind and Galaburda's (1985) cluster in order to determine the lateralisation of the subjects.

Geschwind and Galaburda (1985, as cited in Skehan, 1998, pp. 214-215) proposed that there are clear individual differences in the degree of lateralisation and also its nature, resulting from testosterone affecting the cortex at a particular point during the prenatal phase of development. Consequently, a cluster of features may co-occur including an abnormal talent for languages. The cluster involves (Geschwind & Galaburda, 1985, as cited in Skehan, 1998, p. 214):

- twins (in the family);
- left-handedness (in the family);
- possible homosexuality (in the family);
- possible schizophrenia (in the family);
- problems with the immune system, leading to, for example, allergies;
- correspondingly weak mathematical and spatial abilities;
- talent for languages.

Schneiderman and Desmarais's (1988b) study confirmed the extraordinary memory ability in the subjects. The researchers attributed this phenomenon to the ability to employ unusual strategies in performing standardised verbal memory tasks, such as memorising lists of words. Their argumentation was that flexible individuals do not need to rely on categorisation of items into classes, but bypass them. Exceptional foreign language learners are independent of established networks – their superior memory means an exceptional ability to acquire new codes. What is more, the subjects performed better on verbal than non-verbal tasks; the difference was 15 points. Some of Geschwind and Galaburda's (1985) features were also present in the subjects. As a result, the researchers draw the conclusion that linguistic talent implies bilateral processing of the brain.

CJ

A review of research on linguistic talent was presented in a collection of articles *The exceptional brain* (Obler & Fein, 1988). The authors, in line with Schneiderman and Desmarais (1988b), accounted for linguistic talent in terms of a specific neurological substrate for this talent. The authors adopted as a point of departure a claim that what makes second language acquirers exceptional is that they have escaped the apparent

critical period[34] for SLA, which means that their innate acquisition system remains intact (cf. Carroll, 1973). Novoa et al. (1988) presented a study conducted on CJ – a 29-year--old male talented foreign language learner. In contrast to Schneiderman and Desmarais (1988b), they introduced more details referring to both the criteria for choice and characteristics of the subject. CJ was a native speaker of English who had learned six languages: German, French, Latin, Moroccan Arabic, Spanish and Italian. It is not reported if he knew all of them equally well. CJ was nominated for the research as a result of an advertisement for students in language departments of local universities and consulting with colleagues. The criteria for choice required that he had learned several languages postpubertly, quickly and to a native-like proficiency level. His abilities with respect to accent and fluency were evaluated by native speakers. They confirmed his ease and speed of learning and that CJ did not have a foreign accent.

The study started with an interview about his language-learning history and family background. The questions involved such issues as developmental milestones, growth, family history, school and academic performance, parental interactions and Geschwind and Galaburda's (1985) cluster. The study revealed that CJ was born one month prematurely and as a child was slow in reading, but he was generally a good student. His age of onset of a foreign language was 15 years. CJ studied French and German in high school and French literature in college. He spent one year in France and only a few weeks in Germany. The exposure to other languages was rather short: a few weeks in Spain and Italy, where he 'picked up' both languages in 'a matter of weeks' through a contact with media and informal gatherings with native speakers. CJ also studied Spanish and Latin for one semester each. CJ reported many factors in relation to Geschwind and Galaburda's (1985) cluster: left-handedness, twinning, allergies and hives, schizophrenia in the family, homosexuality and poor spatial orientation. As the researchers concluded, two factors, specifically linguistic talent and homosexuality, were both the result of foetal hormonal levels that affected his endocrinological system and the cortical language areas.

Novoa et al. (1988), just like in the previously reported study, concentrated on memory and language abilities as prerequisites for talent. Other tested areas involved abstract reasoning, visual-spatial functioning, musical ability and personality. Among the applied instruments were the following: the Wechsler Adult Intelligence Scale-Revised, the Raven Progressive Matrices, the MLAT, the Rorschach test and others. With respect to general intellectual functioning CJ was average. His WAIS-R IQ score was 107. There was no significant difference between the verbal and performance IQ scores. The scores which the researchers considered significant were obtained for these tests of the WAIS-R which are directly linked to FL aptitude – Vocabulary and Digit-Symbol Coding. A high score on Vocabulary reflects the ability to define words, whereas Digit--Symbol Coding is a test of STM. Especially impressive was his performance on the

[34] The CPH is described in Chapter Two, section 2.6.

latter test, in which the subject was able to recall nine digit-symbol pairs with no error immediately after the presentation and after a twenty-minute delay. CJ also performed very well on the Raven Progressive Matrices – at 95th percentile, whereas his visual--spatial reasoning was poor. It was concluded that CJ's areas of outstanding ability include vocabulary, the acquisition of a new code and the ability to perceive and complete formal patterns.

Unfortunately, the researchers did not provide information about CJ's score on the MLAT. The reader was only informed that he performed perfectly on the three subtests requiring learning a new code system, that is MLAT 1, 2 and 5. These tests measure memory and phonetic abilities. His score on Part 3 (vocabulary) was also high, whereas he was only at the 50th percentile on Part 4 (grammar sensitivity). CJ's verbal intelligence was not impressive. When asked to provide a description of a story, CJ did not astound the researchers, as it was rather simple and schematic. Therefore, they concluded that CJ was highly talented in the acquisition of new codes, but not in conceptual manipulation of verbal material.

The most impressive were CJ's scores on memory tests. Generally, his performance on verbal memory tasks was superior in comparison to visual memory, which was average. His ability to retain long sequences of words after twenty minutes provided evidence for his superior STM abilities. Also, his LTM, as measured by retention of prose passages was outstanding – above the 99th percentile. CJ's musical ability was assessed as average, but his ability to pick up a foreign accent was regarded as outstanding. This, according to the researchers, can be linked to risk-taking ability involved in taking up a new identity. CJ possessed personality features associated with perfect pronunciation, namely high motivation, non-conformist self-concept and willingness to take risks (cf. Schneiderman & Desmarais, 1988b).

The final conclusion was that CJ's exceptional linguistic abilities were generally caused by two factors, namely exceptional verbal memory and perception of formal patterns. In accordance with the theoretical basis, the authors ascribed his linguistic talent to neurological factors, that is a more bilateral organisation of the brain for language. From the contemporary perspective, it seems that CJ was profoundly talented in short-term phonological memory and noticing.

Julie

Ioup and her colleagues (Ioup et al., 1994) described a case study of an adult woman (age 47) who achieved native-like competence in a natural environment with no formal instruction. Julie emigrated to Cairo at the age of 21 when she married an Egyptian. She acquired Egyptian Arabic in an untutored setting living for 26 years in Egypt. She was literally immersed in the language, as all her family spoke Arabic. Julie, as she reported,

acquired Arabic very quickly. After 6 months she was able to communicate well, and after 2.5 years she was able to pass as a native speaker. Phonology was never a problem for her. However, Julie did not learn to read or write in Arabic because of the lack of formal instruction.

The measures employed by the researchers to evaluate her linguistic competence included: a speech production task, a grammaticality judgement task, a translation task, an anaphoric interpretation task and an accent recognition task. The results were compared to those of native speakers and to those of a proficient foreign language learner with extensive formal instruction. It has to be borne in mind that the ultimate purpose of the study was not to measure Julie's cognitive or personality characteristics, but to provide evidence supporting her proficiency in order to re-examine the CPH. Native speakers evaluated her Arabic as native with respect to perceptual abilities, which allowed her to reach accent-free speech, production skills and underlying linguistic competence. Although in the domains of syntax and semantics she failed to reach native-like norms, her grammatical competence was the same as that of a formally instructed learner.

The researchers interpreted Julie's outstanding success in accordance with the previous research tradition, that is ascribing her talent to the unusual brain organisation and greater neurocognitive flexibility. She also possessed some of the characteristics from Geschwind and Galaburda's (1985) cluster, namely left-handedness, allergies, twins in the family and weak mathematical abilities. Another of Julie's interesting attributes that might be considered a symptom of her giftedness was the fact that she started to speak in full sentences in the L1 at the age of 18 months. She always had a talent for mimicking accents and was good at grammar (both English and Latin which she learned at school). Finally, the researchers emphasised Julie's noticing ability (cf. Schmidt, 1990). She made an effort to consciously manipulate the language structure and attend to form. Moreover, she paid attention to morphology and tried to self-correct all her errors. The conclusion of the study was that talented adult foreign language learners pay conscious attention to form.

Christopher

An ongoing study by Smith and Tsimply (1991), Morgan et al. (2007) and Smith et al. (2011) fits in with the line of research on talented foreign language learners, but the subject of the study substantially differs from other talented foreign language learners described in the literature. Their subject, Christopher, age 49[35], is a peculiar example of a polyglot savant able to speak, read, write and translate more than twenty languages.

[35] Christopher was 49 at the time of the recent study by Smith et al. (2011).

What makes the case so exceptional is the fact that Christopher is so severely mentally retarded that he has to be institutionalised as he is unable to look after himself.

Christopher was the youngest of five children and diagnosed as brain-damaged at the age of 6 weeks. He was late in walking and talking. As an adult, Christopher was diagnosed as having hydrocephalic brain damage and severe neurological impairment in his motor coordination resulting in apraxia (Smith et al., 2011, p. 5). Moreover, he has a number of the characteristics of autism. His interactions with other people are laconic, his emotions are opaque, he is socially unforthcoming and avoids eye contact. According to the researchers, Christopher belongs to high-functioning autists. As they comment: "Christopher is a savant, someone with an island of startling talent in a sea of inability" (Smith et al., 2011, p. 1). The most striking characteristic of his psycholinguistic profile is the asymmetry between his verbal and non-verbal abilities. His verbal IQ level, as measured by the Wechsler Intelligence Scale, is 98, which is an average score, whereas his performance IQ is 52, which is very low and ranks him in a moderate retardation category. His English language ability is superior in excess of 120 – a level more than sufficient to enter university (Smith et al., 2011, p. 1). At the same time, Christopher is unable to play noughts and crosses, and he does not understand the usual for three- or four-year-old children make-believe play in which they pretend, for example, that a banana is a telephone. This abnormality accompanied by a linguistic talent became the subject of research aimed at establishing what constitutes his exceptionality.

Christopher's mastery of various languages is not uniform. He is reasonably competent in French, German, Greek and Spanish, fairly good at Norwegian, Polish and Portuguese; however, "his other languages are impressive more because of their number, variety and speaker than because of his fluency in them" (Smith & Tsimply, 1991, pp. 322-323). What is more, Christopher "appears sometimes not to care if what he says makes sense" (Smith & Tsimply, 1991, p. 323). It was observed that despite his relatively rich vocabulary he makes many mistakes, both lexical and grammatical, which often change the whole sense of a sentence. This fact seems to be obvious taking into consideration his retardation. Christopher has learned all the languages relatively quickly and his ability to translate from different languages into English is impressive; however, he translates basically word for word and his text lacks cohesion. The researchers argue that Christopher's lexical development predominates over other language areas, specifically pragmatics and syntax. His vocabulary development is normal or even above average, whereas his syntactic development is limited. This is interpreted that his abilities are only partly linguistic and constrained by his cognitive retardation (Smith et al., 2011, p. 24).

Christopher's remarkable vocabulary in a number of languages results from his excellent LTM as well as good phonological WM. In Skehan's (1998) interpretation, Christopher's talent seems to rest entirely on a capacity of STM to absorb very large

quantities of verbal material that is available for actual language use. He also performs extremely well on tests of auditory and visual recognition, in which the subject is first presented with words and then asked to indicate whether or not he has recently seen or heard these words. Interestingly, his memory abilities are uneven and memory tests results contradictory. On standard tests of digit span and reading span Christopher performs poorly. These distortions are tentatively attributed to a selective impairment of his memory, especially, to a damage to his central executive as a result of which his attentional resources cannot be focused sufficiently fast to encode information (Smith et al., 2011, p. 16). Unfortunately, the researchers are not able to explain Christopher's remarkable talent in terms of neurology. As they explain: "there has been huge progress in teasing apart the neurological (and genetic) determinants of various pathologies but […] there has been minimal progress in getting to grips with talents" (Smith et al., 2011, p. 182).

Daniel Tammet

Another remarkable example of a linguistic savant is Daniel Tammet. Daniel was born in London, in 1979, with congenital child epilepsy. He also suffers from Asperger's syndrome. His remarkable abilities of memory, arithmetic computation and languages appeared after a series of seizures in his early childhood. Therefore, he belongs to the so-called *acquired savants* − people whose outstanding abilities emerged as a result of an injury or disease (Treffert, 2011). In contrast to Christopher, Daniel is completely self-reliant. He earns his living by producing web-based language tutorials and he has also published his autobiography. Daniel is able to describe the ways in which he memorises, learns and computes, which clearly distinguishes him from other savants and makes him a valuable source of information about savantism. He knows 7 languages, including French, German, Spanish, Lithuanian, Esperanto, Icelandic, and a language invented by himself. Moreover, he was able to learn Icelandic in a week (Smith et al., 2011). Another peculiar characteristic of Daniel is his synaesthetic ability – he sees numbers as colours in his head as if they were images (Treffert, 2011). Daniel, as he reports, assigns a shape and colour to a number. When he recalls the numbers, he can see them as images emerging in front of him. When he makes calculations, the images merge to create the right result.

Daniel, termed as a high functioning autistic savant, was examined by psychiatrists and neurologists. As they found, similarly to Christopher, he possesses an extraordinary memory capacity which is highly selective. In particular, his STM measured by digit-span is excellent; he is able to recall long strings of numbers or symbols and manipulate them with incredible speed, but his memory for faces is impaired. His brain organisation is normal. Bor, Billington and Baron-Cohen (2007) conclude that his abilities might be

explained by hyperactivity in the left prefrontal cortex, which results from his Asperger's syndrome and synaesthesia.

From these six cases of talented foreign language learners described above it is evident that linguistic talent is not precisely defined; however, certain features are present in all the cases. The most striking factor is excellent memory, especially verbal memory. Besides, there are significant differences between the classic cases described in the literature, that is the two learners tested by Schneiderman and Desmarais (1988b), CJ (Novoa et al., 1988) and Julie (Ioup et al., 1994), and the cases of savants described by Smith et al. (2011) and Treffert (2011). These differences regard the goals of the studies, the choice criteria and the methods of investigation which have evolved over the last thirty years. As far as the first four cases are concerned, the characteristics shared by the subjects include the following: a very good command of at least one foreign language, high phonological abilities, high analytic abilities on dealing with simple codes and rich vocabulary. Their IQ is within the average range; however, they perform higher on verbal than performance scales. These characteristics are univocally attributed to a specific brain organisation. Nevertheless, most of the criteria applied in judging the speed of learning and the proficiency level, are, with the exception of Julie, highly subjective and imprecise. Little information is given about the cognitive and personality factors, as well as the learning strategies of the subjects. According to Skehan (1998), among the described individuals, CJ and Christopher can be categorised as genuinely talented foreign language learners owing to the number of the languages they have learned and their outstanding memory. Christopher and Daniel are savants – people who possess extraordinary abilities accompanied by a variety of physical and mental impairments. It appears that such phenomena as Christopher and Daniel Tammet are a linguistic peculiarity of one in a thousand. In view of the small number of studies examining linguistic savants and correspondingly limited knowledge of this issue, the only reasonable conclusion is that further research on this fascinating phenomenon is needed.

All the cases seem to confirm the hypothesis that FL aptitude is disconnected from general cognitive ability. Skehan (1998), in his review of literature on exceptional language users, opts for a separation between syntax and other cognitive abilities. In many disabilities, patients with serious mental retardation reveal normal language development. Medical cases of severe cognitive deficits of individuals manifesting intact grammatical acquisition imply that syntax develops autonomously from semantics and general cognitive ability. In some other cases, for example in autism, an impairment of language accompanied by normal cognition is observed. Based on data from medical studies, Skehan concludes that syntax and semantics modules in the first language acquisition function independently. Moreover, the same rule applies to FL aptitude, which is relatively independent of intelligence and other cognitive abilities. From the three processing stages proposed by Skehan: input/phonetic coding, central processing/analytic

ability and output/memory, the central stage associated with analytic abilities is the most related to general cognitive ability. Neither analytic abilities nor intelligence of the subjects are as impressive as their memory. Hence, the exceptionality of foreign language learners lies not in their analytical abilities, which overlap with their general cognitive factor, but in their exceptional verbal memory – that is a more language-specific ability independent of general intelligence. The importance of the memory factor radically rises once an advanced level is reached. As Skehan (1998, p. 218) explains: "it clearly surpasses analytic ability in importance and becomes the determining factor for those unusual people who may achieve native-like command of a second language". Skehan (1998) also leans towards the position ascribing exceptional FL aptitude to neurological conditions. At two stages of SLA unusual neurological conditions have influence on the level of attainment. The first moment is the beginning stage of learning when phonetic coding ability is the most important. The second one is the advanced level at which point memory becomes the most decisive. Between these points aptitude is normally distributed, but at the very beginning, as well as at the very advanced stage, qualitatively different neurological structures are chief qualities of exceptional learners. It has to be borne in mind that Skehan, in general, refers to healthy subjects. Such complex cases as Christopher or Daniel seem to fall outside any generalisations and definitions.

In conclusion, it may be said that these case studies illustrate a variety of factors in exceptional L2 learners that suggest directions for further research on this phenomenon. First and foremost, they explain the exceptionality of the subjects in terms of specific brain functioning, thus contributing to the discussion on neurolinguistic aspects of FL aptitude. Unfortunately, the exceptional case of Christopher, contrary to the linguists' assumptions as to the neurological peculiarity of the brains of linguistically talented foreign language learners, provided no relevant evidence (Smith et al., 2011). Another important contribution is the discovery of the role of memory and attention as defining characteristics of gifted L2 learners. Finally, the studies of linguistic giftedness suggest that not only cognitive, but also personality characteristics such as motivation, attitude and self-concept may add to talent development. The following section will focus on group studies of exceptional language learners.

5.3.2. Group studies

First of all, it has to be emphasised that group studies in the literature are generally of special concern to the problem of ultimate attainment after the critical period. The literature presents group studies that refer to very advanced, late foreign language learners. They commonly examine native-like attainment in L2 syntax (cf. Birdsong, 1992, 2004, 2007; Coppieters, 1987; McDonald, 2000; Montrul & Slabakova, 2003; van Boxtel et al., 2003, 2005; White & Genesee, 1996), or in pronunciation (cf. Birdsong, 2007; Bon-

gaerts, 2005; Bongaerts et al., 1995; Bongaerts et al., 1997; Bongaerts et al., 2000; Moyer, 1999). It has been shown that native-like attainment in pronunciation is possible for some late learners. It remains controversial, however, if the reported cases of success referred to those learners whose L1 was typologically closely related to the L2. In the case of syntax, the conclusions are even more ambiguous. Generally, it appears that reaching a native level with respect to all aspects of structure is rare. The methodology of examining the level of attainment seems to be inconsistent. For example, the level of difficulty of the structures tested is varied, whereas the most difficult structures should definitely be included in such tests. Moreover, it is doubtful whether the chosen learners are really the best learners in the target language. Finally, there is a controversy concerning the selection of native speaker controls. The problem is whether there should be a representation of the total target language population, or if other criteria should be applied (cf. Abrahamsson & Hyltenstam, 2008; van Boxtel et al., 2003).

In the research conducted by van Boxtel et al. (2003, 2005) on 43 participants, 3 German, 4 French and 1 Turkish participant − learners of Dutch, fell within the native speaker range on the grammaticality judgement test and on an imitation task. It was found that the French-speaking participants performed worse than the German-speaking participants. This is interpreted as a result of an overload of the participants' WM capacity, which occurs in the case of a greater difference between an L1 and an L2. The greater the differences between an L1 and an L2, the larger problems occur in decoding the surface structure of the target language. The problems in decoding are also larger in auditory than in written input. A neurological study confirmed this relationship. In an ERP study on the processing of second language grammar by English, Romance and German learners of Dutch, it was found that on a grammaticality judgement test performed by all the participants, Germans had much more native-like ERP patterns than the other groups (Sabourin, 2003). Another plausible interpretation offered by van Boxtel et al. (2005) is that biologically determined factors connected with WM maturation constrain the acquisition of L2 syntax. As a result, non-salient elements, such as dummy subjects, are not attended to by late learners. It is possible that linguistic experience, education, or high FL aptitude enable late learners to pay special attention to these non--salient elements of syntax.

On the basis of the presented data, van Boxtel et al. (2003) conclude that most of the participants who fell within the native speaker range had a native language related to the target language. What is more, all the native-like achievers had stayed in the L2 country for a long time (mean – 15 years). They all spoke the target language regularly with the native speakers. The age of arrival in the target language country was between 19 and 30 years. It is significant that all the participants were highly educated and had a linguistic background – a degree in their native language. It is hypothesised that education and metalinguistic awareness play a role in native-like attainment in foreign language grammar. It seems that metalinguistic awareness facilitates focusing on form,

which enables them to notice grammar forms in the input. On the other hand, in 2005, the same authors drew a contradictory conclusion, namely that it is possible to attain a native level of proficiency for late L2 learners even if their L1 is typologically different from the L2 (van Boxtel et al., 2005).

A study conducted by Montrul and Slabakova (2003) fits in with the line of research which supports the high incidence of native-like proficiency with respect to morphosyntax after the critical period. They conducted a study on highly proficient English foreign learners of Spanish. There were 64 participants in the study, 17 of whom were classified as near-natives, 23 as superior learners and 24 as advanced learners of Spanish. The focus of the study was on morphological and semantic properties of Spanish aspectual tenses, which are very difficult for learners. The research results revealed that 19 participants fell within the range of native speaker controls, most of whom (12) belonged to the near-native group. This result was interpreted as evidence that certain syntactic properties of a foreign language can be acquired by late L2 learners.

Phonological abilities are believed to be the most susceptible to the critical period. A study that aimed to challenge the CPH (Lenneberg, 1967) with respect to the ultimate attainment in L2 phonology was conducted by Moyer (1999, 2007). She examined the phonological performance of 24 highly motivated and advanced foreign language learners of German, whose L1 was English, taking into consideration such factors as age, instruction, motivation, suprasegmental training and self-perception of productive accuracy. The objective of Moyer's study was to specify what factors predict near-native achievement in L2 pronunciation. The research partly supported the theoretical basis. It was concluded that non-native speakers' performance differed from native speakers' performance. A strong, negative correlation between the age of immersion and the ultimate achievement of the participants was observed. However, contrary to the previous research results, the age of immersion and the onset of instruction were not significant predictors of success. As regression analysis revealed, motivation and suprasegmental type of feedback accounted for most variance in the outcomes. Moyer (1999, 2007), using her studies on phonological attainment as a basis, concludes that although we are not able to understand why some late learners are better at acquiring a native-like accent than others, we can observe that some personality characteristics and behaviours contribute to ultimate attainment. These characteristics involve active seeking opportunities to practise, asking for feedback, developing cognitive and affective learning strategies, and setting learning goals. Affective and cognitive factors, such as motivation, learner orientation to the target language, attitudes and satisfaction with attainment influence the learning outcomes (Moyer, 2007, p. 113).

In Moyer's study, one learner of German was described as exceptional. The evaluation of his performance was consistently native across all tasks, despite the fact that he was first exposed to German very late − at the age of 22 − and had been immersed for only two years and received only five years of instruction. Surprisingly, his performance

was evaluated as more native-like than that of native speakers. He never learned any languages before. He declared a fascination with the language and its speakers and a very strong motivation to acculturate and to sound German. His evaluation of his linguistic and cultural acculturation was very high. He was mainly self-taught and his preferred method of learning was simply listening.

In similar studies by Bongaerts et al. (1995), Bongaerts et al. (1997) and Bongaerts et al. (2000) a group of highly motivated and advanced foreign language learners were chosen specifically for their exceptional abilities by teachers who identified them as excellent speakers and writers of an L2 – English. The research provided evidence for their high proficiency; the selected subjects overlapped with native speaker controls with respect to their pronunciation skills. Bongaerts (2005, p. 262) evaluates these findings in the following way: "native-levels can be attained in a variety of linguistic domains, by individuals who begin to learn an L2 at ages beyond (sometimes well beyond) a purported critical period". Even a more optimistic view on native-like attainment was presented by Birdsong (2007), who examined the pronunciation of 22 Anglophone late learners of French as a second language. He found that about 10% of long-resident, educated late learners overlapped with native speaker controls. The author does not exclude the possibility of contribution of such factors as L2 practice, motivation and phonetic training to native-like attainment. Birdsong suggests that "nativelike pronunciation is not out of the grasp of late L2 learners" (2007, p. 99). Summing up, both Bongaerts (2005) and Birdsong (2007) argue that native-like attainment is not only possible, but quite common for post-pubescent learners and that the results of their studies are unsupportive of the CPH.

Colantoni and Steele (2006), in a phonetic study of 5 intermediate and 5 advanced English-speaking late L2 learners of Spanish, scrutinised one specific area of phonological acquisition, namely stop-liquid sequences. Contrary to the previous studies, they did not use native-speaker judges, but analysed acoustically the readings of 44 words from each participant with regard to three different phonetic properties of stop-liquid clusters. The researchers reported that only one of the advanced learners and none of the intermediate learners exhibited truly native-like behaviour on all three properties. Although the incidence of native-likeness in their study was similar to that in Birdsong's study (10%), the conclusions they draw are contradictory. Colantoni and Steele evaluate the cases of native-likeness as "clearly exceptional" (2006, p. 71), whereas Birdsong regards the rate of native-likeness in his studies as impressive (2007, p. 112).

Evidently, the results presented by the researchers are highly inconsistent and leave much space for subjective interpretations and speculations as regards the possibility of native-like achievement by late L2 learners. As has already been stated, the methodology of examining the level of attainment seems to be inconsistent. Especially, scanty information about the level of difficulty of the tasks is available. This shortcoming has come in for criticism from Abrahamsson and Hyltenstam (2009) who emphasise that the

accounts of the incidence of native-likeness in late L2 learners are highly divergent; from quite high (cf. Montrul & Slabakova, 2003; White & Genesee, 1996), through moderate (cf. Birdsong, 2007; Bongaerts, 1999; Colantoni & Steele, 2006; Marinova--Todd, 2003; Moyer, 1999; van Boxtel et al., 2005), to zero occurrences (cf. Coppieters, 1987; Ioup et al., 1994; Johnson & Newport, 1989). Abrahamsson and Hyltenstam's (2008, 2009) study, which will be described in the next section, can be positioned among the last group, that is those studies that exclude the possibility of native-like attainment among late L2 learners.

5.3.3. Multiple-domain studies

Interesting conclusions as well as controversies result from rare studies comparing L2-learners' and native speakers' linguistic knowledge across multiple domains of performance (Abrahamsson & Hyltenstam, 2008, 2009; Marinova-Todd, 2003). Marinova--Todd (2003) examined 30 late learners of English on nine tasks, including measures of pronunciation, vocabulary, morphosyntax and language use. She found that 3 learners performed within the native range on all the tasks. What is significant, all three of them were immersed in the target language at the age of 21, besides, 2 of them represented Slavonic languages typologically distant from English. Interestingly, Marinova-Todd concludes that FL aptitude does not explain the phenomenon of native-like accomplishment of L2 learners. In a similar vein, the role of FL aptitude as the best predictor of success is totally dismissed by Bialystok (2002). Marinova-Todd's study accords well with Bongaerts's (2005) and Birdsong's (2005) strong conviction that it is possible to attain native-like proficiency postpubertly, and that it is not restricted to learners whose languages are typologically related to the target language.

This opinion remains in sharp contrast with Abrahamsson and Hyltenstam's (2008, 2009) conclusion drawn as a result of their ongoing study on near-native post-pubescent learners, as well as their critical analysis of relevant studies on this topic. The researchers' main aim was to test DeKeyser's hypothesis (2000) that only late learners with a high level of FL aptitude will reach native-like levels of L2 proficiency. Besides, they tested a hypothesis that early and late L2 learners who pass for native speakers in everyday conversation will consistently overlap with natives in 10 criteria of thorough linguistic analysis. The researchers examined 42 subjects – advanced L2 speakers of Swedish with Spanish as their L1. The selection of the subjects was two-staged. At first, 10 native speakers of Swedish judged whether or not a subject is a native speaker of Swedish. At stage two, the selected apparently native-like subjects were linguistically scrutinised with a number of instruments. The target group of subjects were selected from 104 candidates who passed for native speakers of Swedish with at least 6 of 10 native listeners. It is interesting that only 5 candidates with the age of onset beyond 11 years and none

with the age of onset beyond 17 years passed for native speakers with 9 of 10 native listeners. Eventually, the sample consisted of 31 speakers with the age of onset of Swedish between 1 and 11 years, and only 11 late learners (age of onset 12-23 years). Another significant fact is that the mean length of residence of the subjects in Sweden was 25 years. Twenty different instruments for language testing and speech elicitation were used. They included measures of pronunciation, speech perception, grammatical intuition, grammatical and semantic inferencing, formulaic language and FL aptitude. To evaluate grammatical intuition the researchers used a grammaticality judgement test, but their test differed substantially as to the level of complexity from the previously used tests. The test comprised quite long and difficult, even for native speakers, sentences with the intention of testing what the subjects cannot do, instead of what they can do.

The research hypotheses were confirmed. As the researchers assumed, most of the learners who passed for native speakers in everyday communication, turned out to be less than native-like when scrutinised in linguistic detail. None of the late learners performed within the native-speaker range. This observation was also related to early L2 learners. As Abrahamsson and Hyltenstam explain: "when faced with a rather demanding linguistic task, nearly half of those who began to acquire the L2 between ages 1-11 exhibited less than native-like grammatical intuition" (2008, p. 496). Moreover, all the near-native subjects with a late age of onset (over 12 years) had above-average FL aptitude.

The researchers formulated two claims based on their research results: (1) Adult native-like L2 learners should be termed as near-native because scrupulous linguistic analyses for broad-based proficiency reveals that they fail to achieve a level that overlaps with that of native speakers (cf. Bley-Vroman, 1989; Gregg, 1996; Long & Robinson, 1998); (2) These few individuals who manage to reach a level of proficiency indistinguishable from that of native speakers have a high degree of FL aptitude (cf. DeKeyser, 2000). Hyltenstam and Abrahamsson (2003) introduced a term *non-perceivable nonnativeness* to characterise apparent native-likeness, that is a level of proficiency that cannot be distinguished from native in everyday conversation, but can only be found through methodical linguistic scrutiny. As they conclude: "native-like ultimate attainment in adult learners is, in principle, nonexistent" (2008, p. 499).

Hyltenstam and Abrahamsson's study has provoked much discussion and controversy over the criteria for selection and evaluation of near-native participants as well as the interpretation of results. For example, Birdsong (2005), criticises the methods of evaluation of native-likeness in the following way: "individuals who have demonstrated native-likeness in several areas of experimental performance could be subjected to even further poking and prodding, until a betraying shibboleth is found" (p. 322). As he argues, there are numerous examples of native-like attainment (cf. Birdsong, 2007; Bongaerts et al., 2000; Ioup et al., 1994; Marinova-Todd, 2003; van Boxtel et al., 2005). Moreover, not all exceptions from native-likeness indicate defective language learning

mechanisms. As he points out, it is possible that there are certain tasks on which native--like performance is impossible for all late learners. Some imperfections might be connected with the effect of bilingualism. On the other hand, there are individuals whose L2 is dominant; thus it is possible that they overlap with native controls with respect to proficiency across a variety of tasks.

Contemporary researchers report an interesting tendency in subjects attaining near--native levels of proficiency in an L2, namely "strong and often highly academic interest in issues related to language and language learning" (Abrahamsson & Hyltenstam, 2008, p. 500). Many of the accomplished multilinguals chose academic careers connected with languages; they were, for example, senior university students, teachers or professors (cf. Bongaerts, 1999), as well as professional translators, language teachers, linguists, or language students (cf. Abrahamsson & Hyltenstam, 2008; van Boxtel et al., 2005). All the near-native participants in Moyer's (1999) study and most of them in Montrul and Slabakova's (2003) study were doctoral students employed as university teachers.

Abrahamsson and Hyltenstam (2008) decided to present two case studies of the highest achieving post-pubescent learners with the highest age of acquisition onsets. The first case, a woman described as Participant 067, was the one with the highest age of onset, and the highest grammaticality judgement test and FL aptitude test scores. She arrived in Sweden at the age of 23 years and had lived in this country for 26 years at the moment of the study. This exceptionally talented person reported using 6 languages on a daily basis. Her L1 was Basque; she started to learn Spanish at the age of 5. Her experience in learning foreign languages was extremely rich. Her first two years of primary education were spent in a German school in the Basque Country with German as an exclusive means of instruction. During school education she learned English and Latin. She also studied French for 3 years, learned Italian and Flemish at courses, and worked as an au pair in France and Ireland. After she arrived in Sweden, she started formal instruction in Swedish and after 4 months she was able to start an advanced course for interpreters at a Swedish university. She worked as an interpreter in Spanish/Swedish for 10 years. Moreover, she obtained a BA degree in Romance languages and worked as an interpreter in Swedish/French. She also worked in the political administration of the European Union. The researchers present some biographical data referring to the subject. The most significant biographical fact is that she never had any problems with handling her two L2s at school and she was always an excellent learner. Her three siblings did not reveal any linguistic talents. She and her parents declared that she was very talkative as a child. She described herself as a person attending to linguistic form. The second case, also a woman, described as Participant 070, was the second highest performing learner; however, her FL aptitude was not so outstanding. This participant arrived in Sweden at the age of 19, learned the language at a 240-hour course and started to study Swedish at the university level. At the time of the study she had worked for 25 years as a teacher of Swedish. Unfortunately, no information about her personality is given. As Abrahams-

son and Hyltenstam (2008, p. 502) argue, the near-nativeness of these two learners can be accounted for by their FL aptitude, interest in language structure, devotion to language learning and their professional career which provided them with opportunities to focus on the structure of the target language.

Summing up, although a near-native level of proficiency is attainable for highly able and motivated foreign language learners, genuine native-like performance, which seems to overcome the biological timetable, is extremely rare. Especially, some phonological and morphosyntactic aspects of a foreign language seem to be unattainable after the critical period. The learners who appeared to have overcome these limitations were classified as exceptional. It is worth mentioning, however, that their proficiency was often assessed only with respect to selected linguistic areas and that often their L1 was similar to an L2. Little is known about their personality. The researchers suggest that some specific personality factors might, in connection with exceptional aptitude, affect these outstanding abilities (cf. Bongaerts et al., 1995; Moyer, 1999, 2007). In the opinion of the present author multiple-domain studies focusing on cognitive and personality characteristics, learning styles and strategies, as well as biographies of gifted foreign language learners appear to be perfectly suited to inform the discussion of the issue of linguistic giftedness. Most of the studies in the field of linguistic giftedness connect this factor to specific brain functioning. It is the neurology of linguistic giftedness that is the focus of the next section.

5.4. Neurology of linguistic giftedness

Special abilities, such as linguistic, are referred to as special, as they are probably determined by a specific brain anatomy or greater brain plasticity in talented foreign language learners (de Bot, 2006). Neuroscience is a relatively new field of science, which includes such disciplines as neurology, psychology and biology. Neurological techniques of brain examination have ushered in a new era in SLA. Methods such as PET, fMRI and ERP, explained in Chapter One, section 1.4., which measure changes in brain activity help to discover how a foreign language is organised in the brain, how the age of onset and proficiency level affect this organisation, and what structural changes differentiate monolinguals from multilinguals at different levels of linguistic proficiency. Neurolinguistic studies using modern methods are relatively novel and evidence obtained from them is often speculative or contradictory (cf. Indefrey & Gullberg, 2006; Paradis, 2004; Reiterer, 2009; Schumann, 2004b). Some mechanisms which serve language learning behaviour are better investigated than others, for example, neural mechanisms for motivation, procedural and declarative memory, memory consolidation, and attention (Schumann, 2004a, p. 1). Research on individual differences, in particular FL aptitude, is in the commencing stage; however, some mechanisms in this field can be inferred

from the observed patterns of brain activation and anatomy (de Bot, 2006; Reiterer, 2009).

The major problem that complicates the foundation of a unified neurological picture of FL aptitude is a high level of individualisation of the brain. As Schumann (2004b, p. 7) argues: "all brains are different – as different as faces […] and these differences have consequences for learning". Some differences result from genetic inheritance, for example greater brain plasticity (de Bot, 2006), some others are considered adaptive changes in the brain happening in response to experience (Green, Crinion, & Price, 2006), whereas the origin of some others remains unknown. Based on data from neuroimaging studies, de Bot hypothesises:

> There are individuals who will have both exceptional language skills and deviant brain structures. […] it is likely that learning might have an impact on brain structures, although it is unclear how plastic the brain is and to what extent specific teaching and learning methods might enhance plasticity or make optimal use of it (2006, p. 130).

To conclude, high FL aptitude might result from both inborn functional and structural characteristics and an individual brain response to an individual experience of learning a language.

According to Schumann (2004b), there are five sources of variation among brains which result in differences in FL aptitude, namely *genetic*, *developmental*, *experiential*, *degeneracy* and *individual appraisal system*. Genetic variance in a child attributable to parental genes accounts for about 50% of correlation between siblings and is higher for monozygotic twins (about .86) and lower for fraternal twins (.60) and for regular siblings (.48). However, the additive influence of genes does not explain the emergence of a specific talent, which is the result of emergenesis (Jensen, 1997)[36]. During the embryonic stage of development genes control the adhesion molecules that initiate cells to bind together and move along certain trajectories. This process is affected by a specific chemical environment in the embryo. As a result of this development, termed as developmental selection, a cell's location and connectivity are established. Thanks to this process, human brains are similarly constructed, but differ significantly at the microstructural level. The third source of variation results from interactions with the environment. These interactions guide the brain's anatomy, that is the growth of neurons and connections among them. Each individual has different environmental experience; therefore, these influences contribute to additional microstructural variation of the neural structure. The fourth process which contributes to variation between brains is called degeneracy. Degeneracy is a term used to describe a phenomenon when two or more

[36] Emergenesis is described in Chapter One, section 1.4.

different neural systems subserve the same purpose. This means that the same behaviour can be achieved by different underlying processes. These alternate systems differentiate individual brains (Indefrey & Gullberg, 2006; Schumann, 2004b). The fifth source of variance comes from individual preferences and aversions, that is an appraisal system (Scherer, 1984)[37]. An individual appraises an experience in terms of its emotional and motivational relevance. The experience and the individual's affective reaction to it are stored in memory and used to evaluate future experiences. Therefore, neural preference systems in individuals are idiosyncratic.

From the evolutionary perspective, FL aptitude might be a result of evolutionary selection processes. Because environments change quickly, some individuals are better neurologically prepared to respond to the change, and, consequently, to survive and to spread their genes (Schumann, 2004b). Differences in brains, for example *hypertrophies*[38] resulting in a specific ability, are selected by the environment. If a talented individual with a particular hypertrophy starts learning in a facilitating environment, the brain responds to the environment strengthening particular neural connections. This, in turn, facilitates learning, that is, makes it easier and faster. As a consequence, the talented individual might achieve high expertise in the field of study.

Human beings are not only victims of incidental genetic/environmental influences that determine their destiny, but also active creators of their neural systems. They choose and create environments that resonate with their genotypes and intentionally develop abilities through learning. In the words of Schumann: "Individuals select [= choose] and evoke [= are selected by] experiences [= environments] that are directly influenced by [= resonate with] their genotypes […]" (2004b, p. 17). The environments they choose and abilities they develop actively affect their brain structure.

Generally, neurological differences between foreign language learners, which might be attributed to different levels of FL aptitude, are divided into *functional* and *structural*. Because it is not exactly known whether the changes occur as consequences of proficiency in a foreign language or are pre-existing anatomical and functional differences that cause higher FL aptitude, researchers, trying to obtain a more complete picture of FL aptitude, look for commonalities across studies (Indefrey & Gullberg, 2006).

5.4.1. Functional differences

One of the best investigated, although controversial, processes described in the literature is *convergence*. Convergence is a process where the representations of two languages become more similar as a function of increasing proficiency or time (Indefrey & Gullberg,

[37] Appraisal system is described in Chapter Four, section 4.1.3.

[38] Hypertrophy is a structural (anatomical) change in the brain (van den Noort et al., 2005).

2006). Convergence predicts that L2 acquisition will have both functional and structural consequences (Green et al., 2006). Opinion is divided on the question whether there are the same or different neural correlates for an L1 and an L2. For example, Dehaene et al. (1997) found that, unlike an L1, which always activates the same areas in the left hemisphere, an L2 activates a highly variable network of both the right and left hemispheres. This tendency was observed in late L2 learners. It has been found that in multilinguals different languages may be disrupted selectively, which means that they are served by different areas in the brain (van den Noort, Nordby, Bosch, & Hugdahl, 2005). These studies are also regarded as neurological evidence in support of the CPH. Variability in the cortical representation of an L2 can be ascribed to the age of onset and level of proficiency. Greater right hemisphere activation was observed in late, low proficiency L2 learners, whereas in early, more proficient learners areas of L1 and L2 activation overlapped (Kim, Relkin, Lee, & Hirsch, 1997). Kim et al. (1997) assume that languages in multilingual learners are localised partly in common, partly in different areas. In their interpretation, differences across studies arose as a result of different methodologies (cases of aphasia vs. fMRI), languages (typologically close vs. distant), subjects (high vs. low proficiency, early vs. late), and the level of linguistic analysis (phonology vs. syntax vs. semantics).

According to Indefrey and Gullberg (2006), L2 proficiency level, not the age of onset, emerges as the strongest predictor of the degree of similarity between late learners and native speakers. As L2 proficiency increases, the processing profile in the L2 becomes similar to the L1. In contrast, Paradis (2004) strongly advocates the existence of one anatomical structure of the brain, but different microanatomical subsystems to represent different languages. Recently, a moderate view termed as *partial overlap* (Reiterer, 2009, p. 160), has been gaining popularity. In line with this view, there is a basic core overlap for L1 and L2 processing; however, additional brain areas are activated for an L2, possibly as a function of fluency or proficiency (cf. Abutalebi et al., 2008; Gandour et al., 2007).

Another functional difference is connected with activation of the brain during the processing of more fluent *versus* less fluent languages. Evidence has accumulated to confirm a claim that there are differences between activation patterns during L1 and L2 processing. L2 processing evokes stronger activation of the brain connected with more effort required to process a less fluent language. Stronger activation is the result of higher attentional demand in L2 processing, detection of errors or differences in performance. Regions that are more active during L2 processing concentrate in the left posterior inferior frontal gyrus (IFG). More advanced and more able learners show much weaker activation in the left posterior IFG (Indefrey, 2006; Stowe, 2006; van den Noort et al., 2005).

Chee, Soon, Lee and Pallier (2004) investigated phonological WM in bilinguals at different levels of proficiency. Differences in activation were interpreted as evidence for

more optimal engagement of phonological WM in the high proficiency group. In Indefrey's (2006, p. 300) interpretation, the IFG is optimised for an L1 and less efficient for an L2. Effort increases activation and automatisation lowers it. Speakers might compensate for lower efficiency in an L2 by driving this region more strongly or, alternatively, a bigger number of neurons might be activated to perform a task. Therefore, the efficiency of the neural organisation might establish a neurological basis for FL aptitude.

A few neurological studies have addressed FL aptitude directly. For example, Díaz, Baus, Escera, Costa and Sebastián-Gallés (2008), using the ERP method, found individual differences between more and less talented learners with respect to phonetic discrimination ability. The differences were observed in both the native and foreign languages of the subjects. The conclusion was that foreign language phonetic abilities can be predicted from native phonetic abilities; moreover, the abilities result from language--specific rather than general acoustic abilities. Differences in brain activation between faster and slower vocabulary learners were discovered by Breitenstein et al. (2005).

An ongoing study on phonetically talented L2 learners conducted by Reiterer (2009) and her colleagues has provided interesting insights into the correlation between phonetic abilities, cognitive and personality factors, and brain activation patterns in talented L2 learners. Their preliminary results basically confirmed the findings of previous studies, that is greater activation of language-related areas in less talented L2 learners. Brain activation patterns correlated with pronunciation aptitude scores. On the basis of their study, the researchers suggest that the primary factor of FL aptitude correlates with reduced effort in speech production as well as increased cortical efficiency (Reiterer, 2009, p. 176). As the reduced effort results from higher proficiency, it is likely that FL aptitude is a result of an interplay between inborn capacities, early experience and training.

5.4.2. Anatomical differences

A number of anatomical differences have been found in more *versus* less proficient foreign language learners. These adaptive changes of the brain are detected by examining differences in the brain structure by the means of voxel-based morphometry (VBM)[39]. Mechelli et al. (2004) found that acquisition of multiple languages leads to an expansion of grey matter in the left parietal cortex. Green et al. (2006) studied structural changes connected with processing a language among simultaneous interpreters as compared to monolingual, bilingual and multilingual speakers. They found higher grey matter density in interpreters, which suggests that the acquisition of a very advanced linguistic skill has long-term effects, which means that the structural changes it causes make the acquisition of subsequent

[39] VBM is a technique which compares the density or volume of grey or white matter in structural MRI brain images (Green et al., 2006, pp. 108-109).

languages easier. This conclusion confirms Bialystok, Craik, Klein and Viswanathan's (2004) suggestion that the acquisition of another language increases selective attention skills necessary in SLA. Some studies offer an alternative interpretation of this phenomenon tracing the roots of anatomical specificity in inborn differences. The example of a polyglot Emil Krebs (1867-1930), who spoke fluently more than 60 languages, is presented as evidence for an inborn peculiar brain architecture that facilitates FL aptitude. The cell structure in his Broca's area was significantly different from a normal brain cell structure (Amunts, Schleicher, & Zilles, 2004).

Golestani and her team (Golestani, Molko, Dehaene, LeBihan, & Pallier, 2007; Golestani, Paus, & Zatorre, 2002; Golestani, Price, & Scott, 2011) discovered that more phonologically talented learners have more grey matter and white matter[40] in parietal regions, especially in the left hemisphere. Left parietal cortex has a role in phonetic tasks and is the location of phonological verbal WM. In their interpretation, the anatomy underlying WM in left auditory cortex predicts phonological aptitude. Greater asymmetry in the amount of white matter in faster learners can be attributed to greater myelineation[41], which results in faster and more efficient neural processing vital in successful learning of phonological aspects of a language. Probably, this asymmetry is not specific to the ability to learn speech sounds, but to a more general ability to learn rapidly changing acoustic information. The researchers conclude that this morphological feature is independent of training; therefore, morphological differences in parietal white matter can predict the ease of learning of new sounds.

There is a number of other hypertrophies that differentiate more from less able L2 learners. For example, higher white matter density in the left Heschl's gyrus[42] (HG) in more able learners, as well as a split or a duplicate of the HG. There can be two or three HG per hemisphere. The right insula and HG are more superiorly located in slower learners. Generally, a global displacement of components of the language area in the left hemisphere can predict the learning of speech sounds. There is also evidence that variation in perisylvian[43] anatomy is related to oral language ability. Abnormalities were found in dyslexia and in children with language disorders. Abnormal asymmetry of the planum temporale[44] was detected in people with poor verbal ability (Golestani et al.,

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[40] White matter – brain tissue beneath the cortex (grey matter). Contains mainly myelinated axons (Gullberg & Indefrey, 2006, p. 327).

[41] Myelineation – increase in myelin volume (white matter) which indicates a better isolation of the transport of electric signals (Uylings, 2006, p. 67).

[42] Heschl's Gyrus − the area where sound first reaches the brain. The primary auditory area (Warrier et al., 2009, p. 61).

[43] Perisylvian areas – a summary term for the language-related area in the left hemisphere (Gullberg & Indefrey, 2006, p. 325).

[44] Planum temporale − a highly lateralised brain structure involved with language (Barta et al., 1997, p. 661).

2007). An increase in grey matter was observed in the mid-body of the corpus collosum[45] in highly proficient L2 speakers (Coggins, Kennedy, & Armstrong, 2004; Van den Noort, Bosch, & Hugdahl, 2006). What is more, a larger volume of grey matter in the HG was found in musicians and it positively correlated with musical aptitude (Schneider et al., 2002). Interestingly, there are not only differences in auditory cortex, but in the more general language network and even in the right hemisphere. For example, greater white matter density was observed in certain visual brain regions, which means that those are also engaged in phonological processing (Golestani et al., 2007). In 2011 Golestani and her team published the results of an examination of brain structure in expert phoneticians. Their results suggest that gross morphological difference might have existed before the onset of phonetic training and that its presence affected career choices. As they explain, complementary influences of inborn predispositions and experience-dependent brain pliability interact in determining not only how experience shapes the human brain, but also why some individuals become engaged by certain fields of expertise (Golestani et al., 2011, p. 4213).

The interpretation of all these phenomena is complex. Based on data from neurolinguistic studies, Indefrey and Gullberg conclude: "We lack a real understanding of the functional significance of differences at the neural level" (2006, p. 4). Their relevance to individual differences is plausible. As Indefrey and Gullberg (2006, p. 4) argue: "Observed differences tend to be interpreted in a circular manner starting from the (plausible) assumption that whatever is found in the more proficient speakers must be more effective". Nevertheless, neuroscience still seems to be the most promising source of information about FL aptitude.

Conclusion

The aim of this chapter has been to provide the reader with information about the identification and definition of linguistic giftedness and about empirical research on talented foreign language learners. In order to accomplish this goal, first, an attempt was made to define giftedness and talent as well as describe methods of their identification in children, adolescents and adults. In psychological literature, apart from general and specific cognitive abilities, a number of factors are associated with giftedness. The most important group includes personality factors such as high motivation, perseverance and creativity. Other factors, connected with choices, preferences and attitudes, as well as the environment, decide about professional career and life success. Subsequently, empirical research on gifted foreign language learners was presented. Early research focused on

[45] Corpus collosum − connects the two cerebral hemispheres with more than 300 million fibers (Hofer & Frahm, 2006, p. 989).

a neurological substrate underlying linguistic giftedness; six case studies of gifted individuals were described, two of which referred to autistic linguistic savants, together with the researchers' interpretations of this phenomenon. The most important conclusion based on those studies was that exceptional learners have excellent verbal memory, which results from their peculiar brain organisation. Group studies generally did not address the problem of FL aptitude directly, as they mainly focused on the verification of the possibility of native-like achievement after puberty. The study that is the most interesting and relevant to the theory of FL aptitude is that of Abrahamsson and Hyltenstam (2008) on accomplished multilinguals. As the researchers conclude, native-like proficiency is non-existent and those rare cases of near-native achievement should be ascribed to exceptional FL aptitude. This effect was also observed in the cases of early onset of a foreign language. The last three sections focused on the neurological sources of linguistic talent, in particular, functional and anatomical differences between brains.

Gifted foreign language learners comprise a very specific group of talented individuals, so far weakly scrutinised and described. First of all, there is no transparent definition of what a linguistic talent is. The traditional definition (cf. Schneiderman & Desmarais, 1988b; Skehan, 1998), describing linguistically talented individuals as those who learn a foreign language quickly, postpubertly and to a native-like level is imprecise, vague and inadequate. Especially, in the light of the most contemporary empirical studies and the discussion about FL aptitude resulting from them (cf. Abrahamsson & Hyltenstam, 2008), it is evident that further research is necessary to reconceptualise the definition of a linguistically talented person. Among many controversial aspects are the possibility of native-like achievement after the critical period, selection and measurement criteria, linguistic talent development, the role of personality factors and, perhaps the most intriguing one: the chance of native-like achievement in general. These and many other questions are still to be answered. Chapter Six will present the findings of a study conducted on gifted foreign language learners.

CHAPTER SIX

EMPIRICAL RESEARCH ON GIFTED FOREIGN LANGUAGE LEARNERS

Introduction

The study addresses a problem which is poorly investigated in SLA research, namely cognitive and personality correlates and predictors of linguistic giftedness. The array of factors that can affect the development of linguistic talent is infinite; therefore, the present study will only focus on selected cognitive and personality characteristics. The choice of the investigated factors was made on the basis of the literature on linguistic giftedness and success in learning a foreign language (cf. Abrahamsson & Hyltenstam, 2008; Ehrman & Oxford, 1995; Skehan, 1998), and the relevant psychological literature on cognitive ability (cf. Carroll, 1993; Sękowski, 2004). The main focus of the study are the cognitive characteristics of a gifted foreign language learner, namely FL aptitude, intelligence and WM. The secondary focus are personality factors, which, due to their relationship to intellectual functioning, can affect the development of linguistic talent. These factors include openness to experience, conscientiousness, extraversion, agreeableness, neuroticism, locus of control, style of coping with stress and emotional intelligence. In order to obtain a more complete picture of a gifted foreign language learner, other factors such as learning styles, strategies and preferences, psychological needs, creativity, motivation, learner autonomy, as well as different biographical details were taken into consideration. Because most of these data are quite subjective, it was decided to present them within a dynamic systems theory paradigm in order to complement statistical analyses. Therefore, the study comprises two main parts, namely a statistical analysis and a qualitative-quantitative description of the gifted sample. The description, which includes biographical information and data obtained by means of questionnaires and tests, is applied to present the cognitive-affective profile of gifted L2 learners and three case studies of the most talented subjects in the sample.

Personality, biographical and other non-intellectual characteristics are usually weakly correlated with cognitive abilities and they are not likely to explain much variance in FL

aptitude (cf. Robinson & N. Ellis, 2008). On the other hand, these factors constitute an integral part of the development of cognitive giftedness (cf. Dörnyei, 2009; Gagné, 2000; Sękowski, 2004); therefore, neglecting them in research on linguistic giftedness would be unjustified. In view of the lack of empirical studies into the personality of gifted L2 learners, the following study can be treated as a pioneering attempt to analyse an array of personality factors in linguistically gifted learners, and, consequently, all the results and their interpretation should be treated with caution.

The chapter will first present the objectives and hypotheses of the research formulated with respect to the cognitive and personality factors in gifted foreign language learners. Next, the subjects of the study will be described. As the emphasis of the study is placed on gifted L2 learners, this sample will be more thoroughly portrayed than the other, used for comparison, mainstream philology group, termed as 'non-gifted L2 learners'. In the subsequent section, the methods of data collection and analysis will be presented, followed by the description of the research instruments. In this section, emphasis will be on a WM test, the *Polish Reading Span (PRSPAN)* (Biedroń & Szczepaniak, 2012), devised by the present author. Memory is a significant variable in FL aptitude responsible for a large part of variance in the outcomes of learning a foreign language (cf. Robinson, 2003) and the main characteristic of gifted foreign language learners (cf. Skehan, 1998); therefore, its influence on FL aptitude will be thoroughly examined (cf. Biedroń & Szczepaniak, in press). The subsequent sections will include the description of the research results. To begin with, cognitive factors will be described in the following order: descriptive statistics, a comparison of the subjects' intelligence with the normal Polish population, the Pearson correlation between FL aptitude factors and other cognitive factors, and a comparison of the subjects' WM with the non-gifted L2 learners' WM. Personality factors and learning styles will be described according the same scheme, excluding the comparison with the norm. In section 6.6.9., the available data will be submitted to regression analyses in order to answer the question as to which cognitive abilities and personality factors have a predictive effect on FL aptitude scores, and to what extent those abilities and characteristics have a predictive effect on the aptitude factor. The summary of the quantitative analysis will be presented in a scheme of factors predicting FL aptitude tests scores. The qualitative-quantitative analysis will comprise two parts. In the first, personality, biographical and other non-intellectual characteristics, which were not taken into account in the statistical analysis, will be presented. In the second, three case studies of the most talented foreign language learners will be portrayed. Following this, the results and their implications will be discussed.

6.1. Objectives

The purpose of the study reported here was to examine the relationship between FL aptitude and the cognitive and personality factors in 44 accomplished multilinguals, termed as gifted L2 learners. The selection criteria for the study were both qualitative and quantitative. The qualitative criteria included language learning history and recommendation of their teachers. The quantitative criteria included the following: proficiency scores confirmed by certificates or other documents, the number of languages they had learned including at least 1 language at level C1/C2 in the case of younger (< 23 years) and at least 2 languages at level C1/C2 in the case of older (23-35 years) L2 learners. All the participants represented an advanced level of English (C1/C2). Moreover, the quantitative criteria comprised the Modern Language Aptitude Test (Carroll & Sapon, 2002) score (at least 95th percentile) and the Language Ability Test (Test Zdolności Językowych) (Wojtowicz, 2006) score (at least 80% of correct answers)[46]. The sample of the gifted L2 learners was compared to a group of mainstream English philology students, termed as non-gifted L2 learners. The primary assumption guiding the study was that an analysis of correlations between cognitive abilities and personality factors and FL aptitude components can provide remarkable insights into the domain of FL aptitude and explain variance in FL aptitude among learners.

6.2. Hypotheses

The research hypotheses are grouped into four clusters referring to (1) cognitive factors; (2) personality factors; (3) learning styles; and (4) the relationship between FL aptitude and cognitive factors, personality factors and learning styles.

1. *Cognitive factors*

With respect to cognitive factors it is hypothesised that:

H1. *Gifted L2 learners will score high on all FL aptitude tests* (cf. Abrahamsson & Hyltenstam, 2008; Ehrman, 1998; Skehan, 1998).

H2. *Gifted L2 learners will score high on intelligence tests (comparing to the norm)* (cf. Sasaki, 1996); *They will score higher on the Verbal Comprehension index and the Memory and Resistance to Distraction index than on the Perceptual Organisation index* (cf. Carroll, 1993; DeKeyser, 2000; Hornowska, 2004).

H3. *Gifted L2 learners will obtain very high or high scores on the following Wechsler Intelligence subscales: Vocabulary, Similarities, Information and Comprehension (verbal IQ)* (cf. Carroll, 1993; Carroll & Sapon, 1959; Hornowska, 2004; Pimsleur, 1966; Sparks & Ganschow, 2001; Wojtowicz, 2006).

[46] In fact, 31 participants (70%) gained over 91% of correct answers.

H4. *Gifted L2 learners will obtain high scores on the following Wechsler Intelligence subscales: Arithmetic, Digit-Span and Digit-Symbol Coding (the Memory and Resistance to Distraction index)* (cf. Biedroń & Szczepaniak, in press; Grigorenko et al., 2000; Novoa et al., 1988; Robinson, 2002b; Skehan, 2002; Treffert, 2011).
H5. *Gifted L2 learners will obtain very high scores on all STM and WM tests. Their scores on memory tests will be significantly higher than the scores of non-gifted L2 learners* (cf. Biedroń & Szczepaniak, in press; Dörnyei, 2005; N. Ellis, 1996; Sawyer & Ranta, 2001).
H6. *The number of languages which gifted L2 learners have learned will correlate with FL aptitude factors* (cf. Ehrman, 1998; Grigorenko et al., 2000).

2. *Personality factors*

With respect to personality it is hypothesised that gifted L2 learners will score high on the following factors:
H7. *Openness to experience and conscientiousness (the Five Factor Model)* (cf. Biedroń, 2010b; Dörnyei, 2005; Young, 2007, as cited in Dewaele, 2009).
H8. *The task-oriented style of coping with stress* (cf. Endler & Parker, 1990).
H9. *Internality of control* (cf. Biedroń, 2008; Drwal, 1995).
H10. *Emotional intelligence* (cf. Dewaele et al., 2008).
H11. *Gifted L2 learners' scores on openness to experience, the task-oriented style of coping with stress, internality of control and emotional intelligence will be higher than the scores of non-gifted L2 learners.*

3. *Learning styles*

As far as learning styles are concerned, it is hypothesised that gifted L2 learners will score high on the following:
H12. *The analytic style* (cf. Ehrman & Oxford, 1995; Oxford, 1990b) *and second language tolerance of ambiguity* (cf. Ehrman, 1998; Ehrman & Oxford, 1995).

4. *The relationship between FL aptitude and cognitive factors, personality factors and learning styles*

As far as the relationship between FL aptitude, cognitive and personality factors is concerned, it is hypothesised that:
H13. *FL aptitude factors will correlate with cognitive factors (WM and intelligence)* (cf. Sasaki, 1996; Skehan, 1998).
H14. *There will be few correlations between personality factors and FL aptitude factors* (cf. Dörnyei, 2005, Robinson & N. Ellis, 2008).
H15. *Memory and intelligence will explain some variance in FL aptitude, whereas among personality factors only openness to experience is likely to explain some variance in FL aptitude. Learning styles will probably not explain variance in FL aptitude.*

6.3. Subjects

There were two groups of learners: accomplished multilinguals, termed as 'gifted L2 learners' and mainstream English philology students, termed as 'non-gifted L2 learners'. The accomplished multilinguals group consisted of 44 students who were identified as gifted based on proficiency scores, the number of languages they had learned, language learning history, recommendation of their teachers, the MLAT (Carroll & Sapon, 2002) score and the Language Ability Test (Wojtowicz, 2006) score. They were either appointed by their teachers or encouraged by co-workers or classmates to participate; some responded to an invitation to participate in the study sent via e-mail. The non--gifted participants were first-year English philology students at Polish university – the Pomeranian Academy in Słupsk. They were intermediate learners of English as a foreign language.

6.3.1. Gifted L2 learners

The sample consisted of 44 gifted multilingual foreign language learners. Thirty-one were female and 13 were male. All of them were native speakers of Polish, but two participants had two L1s: one Polish and German and one Polish and French. They were mainly philology students from Polish universities (n = 32), but there were also teachers in foreign language departments at a university (n = 6), school teachers of English (n = 4), doctoral students of philology (n = 5), one doctor of philology, one student of economics, one doctoral student of psychology and one editor[47]. Three participants were members of the Polish MENSA. The participants were mainly undergraduates and postgraduates who had been nominated by their teachers. In line with the previous research results (cf. Abrahamsson & Hyltenstam, 2008; Bongaerts, 1999; DeKeyser, 2000; Johnson & Newport, 1989; Montrul & Slabakova, 2003; Moyer, 1999; Patkowski, 1980; van Boxtel et al., 2005), most of the participants of the study were students of languages or professional linguists, which, according to DeKeyser (2000, p. 507), implies high verbal aptitude.

Their age varied from 20 to 35 years; the mean was 24.5. All the participants were experienced language learners. The age of onset varied for different learners and for different languages. In the case of English, the average age of onset was 11 years. For Chinese and Japanese, it was generally 19 years. For other languages, it varied from 19 to 27 years. The period of learning also varied, from 15 years to a few months. Many of the participants had had a break in their learning. Some had learned for some time and

[47] The numbers do not sum up because some participants belonged to a few categories, e.g. an academic teacher was a student at the same time.

then stopped. Some declared that they had learned a language well, but had forgotten most of it because of lack of practice. Some learned and used languages regularly, some others practised them only once a week or occasionally. The participants learned in formal settings, such as school and university, and most of them had had a chance to study abroad. The length of their stay abroad varied from a few weeks to 7 years. One participant was born in Austria (German dominant, but fluent in Polish because her mother was Polish), one had attended primary school in Switzerland (balanced in French and Polish) and one had lived in the United States for 7 years where she had worked as a teacher. Each learner's language learning history was different, so it would be difficult to categorise them into subgroups. The level of proficiency of the sample in at least one foreign language was advanced (C1/C2). All the participants were highly advanced in English. Fourteen (32%) were highly advanced in one foreign language, 19 (43%) in two languages, 8 (18%) in three, 2 (4%) in four, and 1 (2%) in five languages. If they spoke more than two foreign languages, their level of proficiency in the additional languages was usually communicative (A2/B1+). The number of languages they were learning varied from 1 to 11 (4.5 average) and included European and non-European languages. European languages were the following: English (n = 44), German (n = 27), French (n = 21), Spanish (n = 12), Italian, Swedish, Danish, Norwegian, Portuguese, Irish, Welsh, Russian, Hungarian, Romanian, Croatian and Latin. Non-European languages included: Chinese (n = 14), Japanese (n = 8), Tibetan, Hindi, Turkish, Arabic, Mongolian, Korean and Hebrew, among others. Altogether, the group consisted of 3 (7%) bilinguals, 13 (29%) trilinguals, 9 (20%) quadrilinguals and 10 (23%) pentalinguals; 9 (20%) participants spoke more than 5 languages, the highest number being 11 languages. The terms 'bilingual', 'trilingual' and 'quadrilingal' were adopted from Dewaele (2007) and do not refer to proficiency levels. All the achievements were formally confirmed by official documents: certificates acknowledged in Poland and diplomas from universities in the case of an advanced level of a language. If an elementary/communicative level was declared, end-of-course marks were accepted as a proof of the level of advancement. In the case of Chinese philology students, both their native and non-native teachers evaluated their rate of progress in comparison to their classmates. One of the Chinese language teachers (a professor working at Warsaw University), evaluated the level of Chinese of her students according to the Council of Europe norms. The best students were invited to participate in the research. These measures were undertaken to ensure the advanced level of the participants. Only participants whose general MLAT score placed them within at least the 95th percentile were accepted for the research.

6.3.2. Non-gifted L2 learners

The sample consisted of 82 first year English philology students[48]. Sixty-seven were female and 15 were male. Their age varied from 20 to 23 years; the mean was 22. They were monolingual Polish learners of English as a foreign language. At the time the study was conducted, they had been learning English for 7-10 years. Most of them had private lessons in addition to their regular course at school. 90% did not practise English in a natural setting. Their proficiency level was generally assessed as intermediate (B1/B2). However, individual learners varied with respect to the levels of proficiency at particular skills from intermediate to advanced. Their speaking and listening abilities were higher than their reading and writing skills, while grammar was the weakest point of the majority of the learners. Their mastery of English was sufficient to complete only Parts 1, 2 and 5 of the MLAT, which do not require advanced English. The information about their level was based on end-of-semester marks.

6.4. Procedure

In the first part of the study, the gifted L2 learners were tested. At first, they were asked to fill out a survey, which aimed at collecting biographical information about the subjects (Appendix A). In the main part of the study, two kinds of information were obtained: referring to cognitive factors and referring to personality and other factors. The cognitive factors included: FL aptitude, intelligence and WM. The personality characteristics encompassed: personality, style of coping with stress, locus of control and emotional intelligence. The additional group of factors were learning styles, including second language tolerance of ambiguity. These data were subjected to statistical analysis. One factor obtained from the survey (Appendix A), namely the number of languages learned by the participants, was also included in the statistical analysis. As has already been stated, the relationship between FL aptitude and personality factors and learning styles is poorly investigated; therefore, their impact on the development of giftedness is unconfirmed. For this reason, the present author decided to include only the psychological constructs of personality (the Five Factor Model), locus of control, style of coping with stress and emotional intelligence in the quantitative part of the research. This is because these factors, due to the well-established reliability and validity of the instruments for measuring them, as well as their relevance to SLA outcomes, allow the researcher to conduct a consistent analysis. In a similar vein, two reliable and valid tools

[48] The study started in the first and ended in the second year of their studies. The number of the non--gifted L2 learners varied from 83 to 44 depending on a test, which was the consequence of the students' dropout and the economic constraints connected with the work of the psychologist.

for measuring learning styles, namely the *Style Analysis Survey* (Oxford, 1995) and the *Second Language Tolerance of Ambiguity Scale* (Ely, 1995a) were used in the study and the results were subjected to statistical analysis. Other factors including learner biography, preferred methods and strategies of teaching and learning, motivation, anxiety, self--efficacy, creativity and the need for autonomy were treated as supplementary and subjected to a combined qualitative-quantitative analysis, mainly with the aim of describing the case studies.

The data about cognitive factors were collected by means of the *Wechsler Adult Intelligence Scale − WAIS-R (PL)* (Brzeziński et al., 1996), the *Modern Language Aptitude Test MLAT* (Carroll & Sapon, 2002), the *Language Ability Test TZJ* (Wojtowicz, 2006), and a WM test, the *Polish Reading Span PRSPAN*, (Biedroń & Szczepaniak, 2012), which was devised by the author of the study. The subjects' personality was tested using the *Revised NEO-Five Factor Inventory* (Zawadzki, Strelau, Szczepaniak, & Śliwińska, 1998), the *Coping Inventory for Stressful Situations CISS* (Szczepaniak, Strelau, & Wrześniewski, 1996), the *Delta Questionnaire* (Drwal, 1995), the *Emotional Intelligence Questionnaire INTE* (Ciechanowicz, Jaworowska, & Matczak, 2000), and the *Adjective Check List ACL* (Juros, Oleś, & Wujec, 1987). Besides, three classic tools used in SLA research were applied: the *Motivation and Strategies Questionnaire MSQ* (Ehrman, 1996), the *Style Analysis Survey SAS* (Oxford, 1995), and the *Second Language Tolerance of Ambiguity Scale* (Ely, 1995a). The instruments are described below under the heading 'Instruments'.

The study lasted 16 months, from February 2008 till May 2009 and was conducted at Polish universities. The tasks were administered over three days. On day one, the participants completed the MLAT and the TZJ, on day two, the Wechsler Scale and the PRSPAN and on day three, the personality tests. Beforehand, they filled out the survey and the SLA questionnaires, which were delivered via e-mail. The psychological tests, that is the intelligence test and the personality tests, were conducted by a professional psychologist, in order to ensure validity, as well as to comply with formal requirements (APA, 1985). All the tests were coded to ensure the participants' anonymity. The data were analysed using descriptive statistics and the Pearson product-moment coefficient of correlation. The descriptive statistics included calculation of means, maximal and minimal results and standard deviations (SD), which show how participants vary from the mean.

In the second part of the study, the non-gifted L2 learners were tested and compared to the gifted L2 learners. The students (non-gifted L2 learners) completed the tests on different days, depending on their availability, from March 2009 till March 2010. They completed MLAT 1, MLAT 2 and MLAT 5, the TZJ, the PRSPAN, and all the personality tests, apart from the ACL (Juros et al., 1987). The scores of the gifted L2 learners were compared to the scores obtained by the non-gifted L2 learners. The results were submitted to a series of *t*-tests. A *t*-test for independent groups shows differences be-

tween two groups on the measurement of a variable, for example, differences in WM between gifted and non-gifted L2 learners.

In the third part of the study, in order to answer the question as to which cognitive abilities and personality characteristics have a predictive effect on the aptitude tests scores, and to what extent those characteristics have a predictive effect on the aptitude tests scores, the results obtained in the correlation matrix were subjected to a series of step-wise hierarchical multiple regression analyses. As a result of those analyses, a model of FL aptitude was designed. The level of significance for all the analyses was $p < .05$.

The data obtained by means of the survey (Appendix A), and two questionnaires, that is the *Adjective Check List ACL* (Juros et al., 1987) and the *Motivation and Strategies Questionnaire MSQ* (Ehrman, 1996), were both qualitative and quantitative. The biographical data obtained from the survey concerned such problems as the ages at which a participant started to speak and read in his/her mother tongue, information about a purposeful stimulation of his/her development ("Did your parents particularly care about your intellectual development, for example, by giving you educational toys and books, spending much time talking to you or devising didactic games?"), the knowledge of languages in the family, marks in Polish (or another L1 learned at school), motivation to learn languages, occupation, conditions and contexts of learning languages, stays abroad, learning preferences, self-efficacy, and hobbies and interests. The survey was quite subjective and based on the participants' or their parents' memories from the past; therefore, it did not aim at obtaining detailed information about the participants' past and present life, but at sketching a general picture. In this way, valuable information that falls outside any statistical analysis but affects the final conclusions was obtained. In order to provide a more detailed picture of a gifted L2 learner, three case studies of the most talented participants are presented. The information about the case studies comes from questionnaires, tests, a psychological observation and an interview, which accompanied the completion of the Wechsler Intelligence Scale. Accordingly, both the quantitative and qualitative data are included in the descriptions.

6.5. Instruments

The following instruments were used in this study:

Modern Language Aptitude Test MLAT (Carroll & Sapon, 2002). This is a language aptitude test that is useful for predicting success in learning a foreign language (Skehan, 1998). The MLAT is entirely in English and is suitable for native and near-native speakers of English. It measures aptitude traits by five scores:

1. *Number learning*: measures verbal STM, in particular, 'auditory alertness', which might play a role in auditory comprehension of a foreign language. The maximal score is 43.

2. *Phonetic script*: measures the ability to associate sounds with symbols, that is, the ability to learn the correspondence between speech sounds and orthographic symbols. It also measures memory for speech sounds and the ability to mimic speech sounds. The maximal score is 30.
3. *Spelling clues*: this partly measures the examinee's native vocabulary knowledge and partly the ability to associate sounds with symbols, but to a lesser extent than Parts 1 and 2. The maximal score is 50.
4. *Words in sentences*: measures sensitivity to grammar structure and the student's ability to learn the grammar of a foreign language. The maximal score is 45.
5. *Paired associates*: measures the rote memory aspect of foreign language learning. The maximal score is 24.

The maximal general score of the MLAT is 192. Split-half reliabilities for the MLAT are .90-.94, depending on the grade or age. For college students, the validity coefficients (correlations with course marks) provided in the MLAT Manual (Carroll & Sapon, 2002) are .18-.69.

The Modern Language Aptitude Test (MLAT) was used for two reasons. Firstly, all the participants were highly advanced in English. Secondly, the MLAT is considered the best available predictor of language learning success and of extremely good and bad language learners (Ehrman, 1998). The American version was used because at the moment of the study there was no Polish version of the MLAT, or its equivalent.

Language Ability Test (*Test Zdolności Językowych – TZJ*) by Wojtowicz (2006). The test was constructed to diagnose foreign language learning abilities. It includes three scales: *Discourse*, *Vocabulary* and *Grammar*. The *Discourse* scale includes gap filling with a phrase or word and a choice of the best summary of a text − all in the Polish language. The maximal score is 10. The *Vocabulary* scale comprises recognising prefixes and suffixes, finding synonyms and antonyms and guessing the meaning of phrases in a foreign language. The maximal score is 18. The *Grammar* scale includes translation of an artificial language, analysis and modifying reproduction of a conjugation in a foreign language and constructing an analogical grammatical form in the Polish language. The maximal score is 15. The maximal general score of the TZJ is 43. The test reliability is .90; the validity coefficient (correlation with foreign language school marks) is .49.

Wechsler Adult Intelligence Scale − WAIS-R (PL). This is an adaptation of the Wechsler Intelligence Scale for use with the Polish population by Brzezinski et al. (1996). The Wechsler Intelligence Scale is a series of standardised tests used to evaluate intellectual abilities in adults. The test is used to determine vocational ability, to assess adult intellectual ability in the classroom and to determine neurological deficiencies. Intelligence testing requires a clinically trained examiner. The scales should be administered, scored and interpreted by a trained professional, preferably a psychologist. Observation of the subject's behaviour during the test completion is also taken into considera-

tion in the interpretation of results. The complete test takes 60-90 minutes to administer. The test is standardised. The scales have a mean score of 100 and a standard deviation of 15. The standard deviation indicates how far above or below the norm the subject's score is. A person taking the test receives a full-scale (general) IQ score, a verbal IQ score, a non-verbal (performance) IQ score, as well as scaled scores on each of the subtests. The full-scale score beyond 130 places an individual in the 'gifted' or 'very high' range. Scores between 120-129 are classified as 'high', whereas scores between 110-119 as 'bright normal' (Hornowska, 2004). The Polish version of the Wechsler scales is composed of eleven subtests (six verbal and five performance) comprising the full test. The maximal score is 19 points for each subtest.

The verbal scale involves six subtests:

Similarities: abstract verbal reasoning (e.g. "In what way are a dog and a lion alike?")

Vocabulary: the degree to which one has learned to comprehend and verbally express vocabulary (e.g. "What is a tomato?")

Information: the degree of general information acquired from culture (e.g. "What city is the capital of Italy?")

Comprehension: the ability to deal with abstract social conventions (e.g. "Why shouldn't we beat children?")

Arithmetic: the ability to solve mental mathematical problems. It tests WM, attention and numerical reasoning (e.g. "How many months are in three quarters of a year?")

Digit-Span: attention, concentration and mental control. In this subtest, subjects are given sets of digits to repeat initially forwards then backwards (e.g. "Repeat the numbers 2, 4, 9 in reverse order").

The performance scale involves five subtests:

Digit-Symbol Coding: visual-motor speed and short-term visual memory. The subtest involves copying a coding pattern. Symbols are matched with numbers according to a key.

Block Design: spatial perception, abstract visual processing and problem solving.

Picture Completion: the ability to perceive visual details quickly.

Object Assembly: the ability to create a whole by discovering relations between elements. Involves jig-saw type puzzles.

Picture Arrangement: pattern recognition. Involves arranging pictures into a logical sequence.

At the second stage of the analysis, the scores for the three indices of *Verbal Comprehension*, *Perceptual Organisation* and *Memory and Resistance to Distraction* are determined.

Split-half reliabilities for the WAIS-R (Pl) are .88-.93 for the full scale, .86-.91 for the verbal scale, and .79-.88 for the performance scale, depending on age. The validity coefficients (correlations with other intelligence tests, e.g. Raven's Matrices (Raven, 1981)) are .39-.60, depending on a test for the full scale (Brzeziński et al., 1996)[49].

[49] The Wechsler Intelligence Scale was introduced in Chapter One, section 1.3.

A close inspection of the Wechsler subscales indicates that many of the abilities measured by these scales can be predictors of success in learning a foreign language. In the *Verbal Comprehension index, Vocabulary* appears to be the most promising one. It tests verbal comprehension, the native language proficiency, a range of vocabulary and intellectual readiness to define words. It enables the researcher to trace the most common ways of defining words chosen by a person, such as, for example, using synonyms, explaining how something operates, describing, demonstrating or illustrating. The frequency of choice of a particular manner of defining provides information about the subject's ability to create and classify concepts, whereas the variety of ways in which concepts are defined illustrates his/her processing abilities. Verbal comprehension is an ability belonging to the language domain in Carroll's (1993) view, whilst native language proficiency is a prerequisite for foreign language proficiency in Sparks and Ganschow's (2001) Coding Deficit Hypothesis. Vocabulary is considered a significant aspect of both first and second language aptitudes tested in FL aptitude tests, namely Carroll and Sapon's (1959), Pimsleur's (1966), and in the Language Ability Test (Wojtowicz, 2006). The *Vocabulary* test indicates inborn abilities on the one hand, and educational chances provided by the environment, on the other. People who gain high scores on *Vocabulary* are described as having broad interests, good memory and intellectual ambitions. They are well-read and highly motivated to learn. *Vocabulary* and *Information* are the most saturated with the *g* factor of all the cognitive ability tests; therefore, they are considered to be the best measures of general intelligence (Hornowska, 2004). The *Comprehension* scale tests the knowledge of everyday customs and typical social situations, sources of behaviour and social norms. These aspects, although not related directly to any aptitude theory, reflect pragmatic competence essential in gaining language proficiency. It also tests cause-effect relationship and logical thinking. The *Similarities* scale tests inductive reasoning (the identification of common features and classifying), the ability to perceive relations between concepts, abstract logical thinking, analogical reasoning, associative thinking, and differentiation between important and unimportant details. Finally, the *Information* scale measures LTM, the exactness and permanence of retrieval, and the readiness to reproduce memorised verbal material (Hornowska, 2004).

The Memory and Resistance to Distraction index includes three subtests, namely *Arithmetic, Digit-Span* and *Digit-Symbol Coding*. These subtests measure STM and WM, focusing of attention and resistance to distraction. These factors are essential in learning a foreign language (cf. Robinson, 2002b; Skehan, 2002, Skehan & Wen, 2009). *Digit--Symbol Coding* tests memory and also reflects the ability to learn new things, which is a key factor in Grigorenko et al.'s (2000) CANAL-FT aptitude test. Some of the gifted foreign language learners described in Chapter Five, section 5.3.1., for example CJ (Novoa et al., 1988) and Daniel Tammet (Treffert, 2011), excelled in digit-span tests. However, it is expected that the participants' results on these tests will not be as high as those on verbal intelligence tests because they are based on numerical material. It has

been demonstrated by Biedroń and Szczepaniak (in press) that gifted L2 learners score higher on memory tests based on linguistic material than on numerical material.

Polish Reading Span (PRSPAN) (Biedroń & Szczepaniak, 2012) is a Polish adaptation of the American Reading Span (RSPAN) (Engle et al., 1999), designed by the author of the study in cooperation with a psychologist[50]. The RSPAN is referred to as a prototypical WM test, which is a modified version of the reading span task (Daneman & Carpenter, 1980). The reading span test is considered to be a valid and reliable instrument for measuring WM capacity (Conway et al., 2008). In accordance with Daneman and Carpenter's (1980) classic reading span test, the PRSPAN is a dual task that requires the participant to read a series of sentences and, simultaneously, to keep track of the last word displayed, so that the words can be recollected later.

The test comprises eight sets of sentences, which contain 3, 4, 5, 6, 7, 8, 9, and 10 sentences in Polish, respectively. Some of the sentences make sense in the context of everyday life and others do not, but all are grammatically correct. The length of each sentence is approximately 10 words. There is an unrelated word at the end of each sentence, which is a two-syllable noun. Participants read aloud sentences that are shown on the monitor while trying to remember the unrelated words at the end of the sentence. The sentences are displayed one sentence at a time. A participant reads the sentence aloud and marks whether the sentence is acceptable (A) or unacceptable (U) in an answer sheet. Beforehand, the participants are told that the criterion that they should use for determining whether or not a sentence is acceptable, is whether they think it fits easily into everyday communication. For example, the sentence "It is a nice day today" is acceptable, whereas the sentence "a frog said that it is a nice day today" is not. The participants are asked to judge the acceptability or otherwise of the sentences to ensure that they attend to the sentences. After each sentence, the experimenter presses a key that causes the next sentence to be presented. The sentences are presented at 3-second intervals. After the last sentence in each set, a blank slide is displayed as a cue for the participant to write down the words he remembered in the answer sheet. The sentences are presented from the shortest set (3) to the longest (10) one. The PRSPAN score is the cumulative number of words recalled perfectly in all the trials. The maximal score is 52.

For example:

1. Naukowcy twierdzą, że mleko jest szkodliwe dla zielonego człowieka. LAMPA
   (Scientists claim that milk is harmful to a green man. LAMP)
2. Myślałem, że to chrabąszcz o historii sportu, ale myliłem się. WATA
   (I thought it was a cockchafer about the history of sport, but I was wrong. COTTON)
3. Niemożliwe, że pracowałeś nad projektem, kiedy przyszliśmy do biura. DRZEWO
   (You can't have been working on the project when we came to the office. TREE)

[50] The procedure of the test construction is described in Biedroń and Szczepaniak (2012).

The validity of the test was assessed by seven competent judges. Highly convergent results were interpreted as evidence that the judges agreed on whether or not the participants' answers met the criteria for evaluation. The competent judges came from two groups. In one group were four psychologists who are familiar with the methodology of psychological testing. In the other group were three academic teachers of English. All of them were native speakers of the Polish language. The data were analysed using Friedman's ANOVA and Kendall's coefficient of concordance. The Kendall's coefficient of concordance for the whole test was .898, $p < .05$. All four of the psychologists decided that the test is a valid measure of WM (the mean result on a scale of 1 to 7 was 6.75). The concordance of the judges was very high; The high concordance among the judges indicates strongly that the test is valid. The concurrent validity of the PRSPAN was tested with four standard STM tests. The PRSPAN correlated significantly with all the memory tests. The correlations with MLAT 1, MLAT 5 (Carroll & Sapon, 2002), Digit--Symbol Coding, and Digit-Span (Brzeziński et al., 1996) were .45, .47, .30, and .49, respectively, $p < .05$. A factor analysis was conducted to verify the hypothesis that more than one factor is needed to explain the variance among the test results. The factor analysis (Varimax) indicated that one factor, memory, was present in all the tests: WM (PRSPAN), MLAT 1 and MLAT 5, Digit-Symbol Coding, and Digit-Span. This factor accounted for 52% of the variance altogether, which means that all the tests measure a similar factor – memory. In order to establish whether the PRSPAN is reliable, the test-retest method was applied. The correlation between the test and the retest, which took place 2 weeks apart, was .89 ($n = 36$), $p < .05$. The Cronbach alpha for the reliability of internal consistency for the PRSPAN is .69 and the standardised item alpha is .76.

The Revised NEO-Five Factor Inventory (Costa & McCrae, 1992), a Polish adaptation by Zawadzki et al. (1998) is a psychological personality inventory; a 60-question measure of the Five Factor Model: openness, conscientiousness, extraversion, agreeableness and neuroticism. There are 12 statements per factor answered on a 5-point scale. The subject can score from 0 to 4 points for each answer and for some questions the scoring order is reversed. The raw results range from 0 to 48 points per scale and they are converted into a ten-point standardised scale. Results from 1 to 3 are considered low, from 4 to 7 average and from 8 to 10 high. The Cronbach alpha for the reliability of internal consistency for conscientiousness is .82, for neuroticism .80, for extraversion .77, for openness to experience .68 and for agreeableness .68. The validity coefficients (correlation with a description by two persons and a self-description) are between .40 and .60.

Coping Inventory for Stressful Situations CISS (Endler & Parker, 1990), adapted by Szczepaniak et al. (1996), is based on an assumption that the remedial measures taken in a stressful situation result from the interaction between the characteristics of a situation

and an individual coping style. Coping style is defined as a typical of an individual array of behaviours in stressful situations (Szczepaniak et al., 1996, pp. 187-210). The inventory consists of three scales referring to coping styles: *task-oriented*, *emotional-oriented* and *avoiding-oriented*. There are 48 statements, 16 per scale answered on a 5-point Likert scale. The Cronbach alpha for the reliability of internal consistency for the CISS is from .78 to .90. The validity coefficients (correlation with a Polish adaptation of the *Ways of Coping Questionnaire* (Folkman & Lazarus, 1988)) are varied but satisfactory for all the three scales.

Delta Questionnaire by Drwal (1995), a tool designed to examine the locus of control (LOC). The LOC scale comprises 14 statements accounting for controllability dimension in everyday situations. The subject can score 1 point for an answer from the key (true/false) in the scale. A high result in the controllability dimension (LOC) indicates externality of control. Split-half and test-retest reliabilities for the Delta Questionnaire are very high; The validity coefficients (correlation with I-E Rotter's scale (Rotter, 1966)) are from .57 to .83 depending on a group.

Emotional Intelligence Questionnaire INTE by Schutte et al. (1998), a Polish adaptation by Ciechanowicz et al. (2000). This tool was constructed to investigate emotional intelligence, defined as the ability to recognise, understand and control one's own, as well as other people's emotions. Emotional intelligence helps in the effective management of emotions, in controlling behaviour and in solving problems. It comprises 33 statements answered on a 5-point scale. The Cronbach alpha for the reliability of internal consistency for INTE is from .83 to .87 depending on gender and age. The validity coefficients (correlation with other tests, e.g., NEO-FFI (Zawadzki et al., 1998)) are from .28 with agreeableness to .58 with extraversion.

Adjective Check List ACL (Gough & Heilbrun, 1980), a Polish adaptation by Juros et al. (1987) is an instrument that operationalises the concept of psychological need. The ACL consists of 300 adjectives. A respondent marks all adjectives that describe him/her and leaves blank those, which are not self-descriptive. The ACL can be scored for 37 scales in five categories, including *modus operandi scales*, *need scales*, *topical scales*, *transactional analysis scales* and *origence-intellectence scales*. Test-retest reliability of the ACL is high – from .60 to .77, even if the test is repeated after a few years. Test validity is difficult to establish, but its diagnostic value has been established in many studies[51].

[51] As the application of psychological tests is restricted to the use only by psychologists, the tests or their parts cannot be published (http://www.practest.com.pl/files/itc-stosowanie_testow.pdf).

Motivation and Strategies Questionnaire MSQ (Ehrman, 1996). This tool consists of three parts: *Aptitude and Motivation*, *Learning and Teaching Techniques* and *Personal Learning Techniques*. The responses indicate the student's perception of his aptitude, motivation and learning/teaching preferences. For the purpose of the study only Part 1 (*Aptitude and Motivation*) was used (Appendix B).

Style Analysis Survey SAS (Oxford, 1995). This test is designed to indicate overall style preferences of a learner, measured by five parts. Part 1 indicates modalities, specifically *visual*, *auditory* and *tactile*, Part 2 indicates a personality style, that is *extraversion versus introversion*, Parts 3, 4 and 5 indicate cognitive styles, namely *intuitive versus concrete-sequential*, *open versus closure-oriented* and *global versus analytic*. The SAS has the Cronbach alpha reliability of .76 (Appendix C). Part 2 was eliminated from the study because the dimension of extraversion-introversion was measured by the Revised NEO-FFI Personality Inventory (Zawadzki et al., 1998)

Second Language Tolerance of Ambiguity Scale (Ely, 1995a). The responses in Likert-scale format indicate the degree of ambiguity tolerance in foreign language learning, which denotes the ability to accept inconsistencies in a foreign language (Ely, 1995b). The Cronbach alpha internal consistency reliability for Second Language Tolerance of Ambiguity Scale is .84 and the standardised item alpha is .84 (Appendix D).

6.6. Results and interpretation

The findings of the study are described in accordance with the subsequent hypotheses. At first, table 6.1. presents basic information about the gifted L2 learners, specifically age, the number of languages they had learned and the number of languages they knew at an advanced level (C1/C2)[52].

Table 6.1. Descriptive statistics (age and number of languages) for the gifted L2 learners $n = 44$

Variable	Mean	Minimum	Maximum	SD
Age	24.818	20.000	35.000	3.486
No. of lang.	4.477	2.000	11.000	1.823
C1/ C2	2.022	1.000	5.000	0.952

Note: Age = age of the gifted L2 learners; No. of lang. = the number of languages the gifted L2 learners had learned; C1/C2 = the number of languages they knew at an advanced level

[52] In the case of Oriental languages, the norms can be less transparent, due to the specificity of the process of learning. In addition, students usually start learning at the first year of studies, from level 0. In the case of Chinese, (to use an example), the HSK (http://www.hsk.org.cn) exam result was taken into account, as well as the rate of progress, as evaluated by teachers.

The following sections will present the description of the research results regarding cognitive factors. At first, descriptive statistics for FL aptitude, intelligence and WM will be presented, followed by the comparison of the subjects' intelligence with the normal Polish population. Next, the Pearson correlation between the MLAT scores and the number of languages the participants had learned and WM, and between the MLAT scores and the Wechsler Scale scores will be analysed. Analogically, the correlation between the TZJ scores and the number of languages the participants had learned, WM, as well as the Wechsler Scale scores will be presented. Finally, the results of the gifted L2 learners will be compared to the results of the non-gifted L2 learners by means of a series of *t*-tests. The following factors will be compared: the number of languages they had learned, the number of languages they knew at an advanced level (C1/C2), MLAT 1, MLAT 2, MLAT 5, the TZJ and the WM scores.

6.6.1. Foreign language aptitude

In order to investigate the relationship between FL aptitude and the cognitive and personality factors in the gifted L2 learners, first the main results of FL aptitude measurements, that is the MLAT and the TZJ, are analysed. Descriptive statistics for FL aptitude for the gifted L2 learners are presented in table 6.2.

Table 6.2. Descriptive statistics (FL aptitude) for the gifted L2 learners $n = 44$

Variable	Mean	Minimum	Maximum	SD
MLAT 1	41.090	28.000	43.000	2.900
MLAT 2	28.272	25.000	30.000	1.590
MLAT 3	38.022	29.000	47.000	4.943
MLAT 4	30.909	19.000	38.000	4.553
MLAT 5	22.227	13.000	24.000	2.429
MLAT G	160.522	149.000	178.000	8.753
Discourse	9.750	8.000	10.000	0.488
Vocabulary	17.340	15.000	18.000	1.010
Grammar	13.431	11.000	15.000	1.318
TZJ G	40.522	34.000	43.000	2.317

Note: MLAT 1, MLAT 2, MLAT 3, MLAT 4, MLAT 5 = subscales of the MLAT; MLAT G = MLAT general result; Discourse, Vocabulary, Grammar = subscales of TZJ; TZJ G = TZJ general result

The descriptive statistics that characterised the sample were mean, minimal and maximal scores and standard deviations (SDs). The results presented in table 6.2. distinctly show that the gifted L2 learners had strong ability. Their mean MLAT score was 160.5 (99th percentile). The minimal result was 149 (95th percentile), the maximum was 178 (99th percentile, 92% of correct answers). In comparison to the results obtained by Ehrman (1998) in research on the language aptitude of participants in intensive language courses, these results are very high. In Ehrman's research, the mean general score for the participants who were the best at speaking (14 persons selected out of 295) was 151.2. The results in all the FL aptitude tests indicate high FL aptitude. Very high results were obtained in MLAT 1 (95.5%), MLAT 2 (94.2%) and MLAT 5 (92.6%). In the case of the TZJ, all the results were also very high – the mean score for the full scale was 94% of correct answers and the 'ceiling effect' occurred − the test was definitely too simple for the participants. Besides, very small SDs indicated a high homogeneity of the sample with respect to particular abilities.

6.6.2. Intelligence and working memory

The cognitive factors analysed in the study included intelligence and WM. Intelligence was measured by means of the Wechsler Intelligence Scale (Brzeziński et al., 1996), which includes eleven subtests, six verbal and five performance. The results consist of the full-scale, verbal and performance IQ scores, as well as the scores for the three indices of: Verbal Comprehension, Perceptual Organisation and Memory and Resistance to Distraction. Descriptive statistics for intelligence and WM for the gifted L2 learners are presented in table 6.3.

Table 6.3. Descriptive statistics (intelligence and WM) for the gifted L2 learners

Variable	*n*	Mean	Minimum	Maximum	SD
Information	44	14.477	11.000	17.000	1.649
Digit-Span	44	15.068	10.000	19.000	2.527
Vocabulary	44	15.727	12.000	19.000	2.038
Arithmetic	44	14.045	8.000	18.000	2.605
Comprehension	44	16.113	10.000	19.000	1.931
Similarities	44	14.613	11.000	19.000	1.943
Pict. Completion	44	12.409	8.000	17.000	2.545
Pict. Arrangement	44	11.704	8.000	17.000	2.108
Blocks Design	44	13.500	6.000	19.000	2.984

Object Assembly	44	12.272	7.000	17.000	2.731
Digit-Symbol Cod.	44	14.409	11.000	19.000	2.049
Verbal Comp. Index	44	130.340	116.000	142.000	7.133
Percept. Org. Index	44	115.931	94.000	136.000	10.475
Memory Index	44	128.454	102.000	150.000	10.285
Verbal IQ	44	129.818	112.000	145.000	8.218
Performance IQ	44	118.636	96.000	137.000	9.714
Full-scale IQ	44	125.431	108.000	139.000	7.692
WM	40	39.000	23.000	52.000	7.246

Note: Information, Digit-Span, Vocabulary, Arithmetic, Comprehension, Similarities, Picture Completion, Picture Arrangement, Block Design, Object Assembly, Digit-Symbol Coding = intelligence subscales; Verbal Comprehension index, Perceptual Organisation index, Memory and Resistance to Distraction index = intelligence indices; Verbal IQ, Performance IQ = intelligence scales; Full-scale IQ = the Wechsler Intelligence Scale total score; WM = working memory (the PRSPAN)

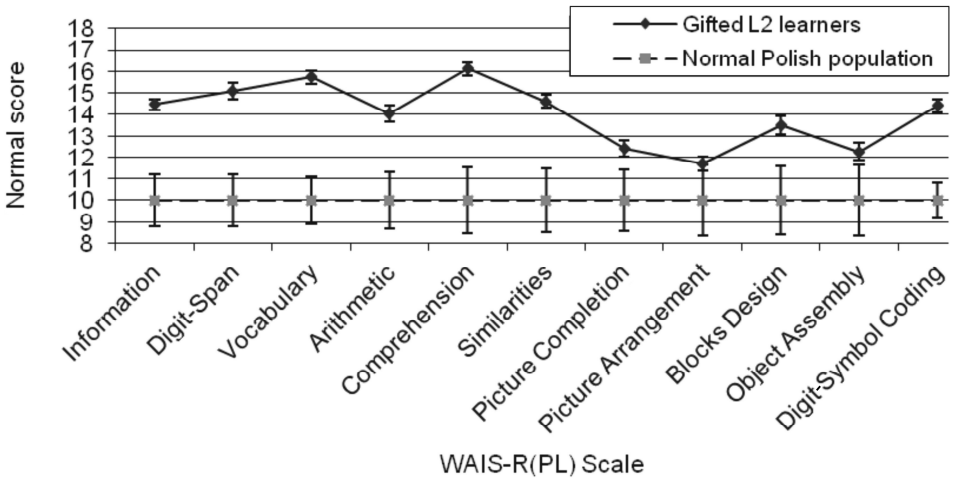
The general IQ of the subjects was high (125); the verbal IQ was very high (130), whereas the performance IQ was much lower (119). The particular subtests scores were very uneven. The highest results on the verbal scale were obtained in Comprehension (the third SD above the norm) and Vocabulary (very high – the second SD above the norm), and in Information, Similarities, Digit-Span, Digit-Symbol Coding and Arithmetic (high − the second SD above the norm). The lowest results were obtained in Picture Completion, Picture Arrangement, Block Design and Object Assembly (average – the first SD above the norm), on the performance scale. The Memory and Resistance to Distraction index was high (128); the Perceptual Organisation index was above average (116); whereas the highest score was obtained in the Verbal Comprehension index (over 130 – very high). From these data it is evident that the subjects performed much better on verbal than performance (non-verbal) tasks. They also gained high scores on all the memory scales.

The results for the PRSPAN which measured WM capacity were varied (mean = 39; SD = 7.2); however, some of the participants managed to recollect about 90% of the words, the highest result being 100%. This score was recorded by two participants. One of these was a 28-year-old university lecturer, a polyglot working in a Chinese philology department. This person knew one language at level C2 (near-native) (Chinese), three languages at level C1 (advanced) (English, Arabic, and German), and was able to communicate in seven other languages: Swedish, Italian, Japanese, Croatian, Russian, Hebrew and Turkish. It is worth mentioning that she started to learn Chinese at the age of 19. The other participant was a 21-year-old Japanese philology student, learning five languages. Her MLAT score was 175 (91% of correct answers) and her TZJ score was

maximal (100%). Both participants completed the Wechsler Intelligence Scale well ahead of time.

6.6.3. Gifted L2 learners' intelligence and the norm

The Wechsler scales have norms; therefore, it was decided to compare the gifted L2 learners' scores on intelligence tests to the norm – the results of the normal Polish population[53] (Brzeziński et al., 1996). Figure 6.1. shows the mean scores for the gifted L2 learners and the normal Polish population.



Note: Error bars in the graph represent standard errors of the mean

Figure 6.1. Wechsler mean scores of the gifted L2 learners and the normal Polish population

The comparison of the gifted L2 sample to the normal Polish population (norm) showed that on all the scales, apart from Picture Arrangement and Object Assembly, the results obtained by the gifted L2 learners were significantly higher than the results of the norm. A one-sample *t*-test was conducted to demonstrate whether there were any significant differences between the gifted L2 learners and the norm. The one-sample *t*-test confirmed that there existed statistically significant differences in intelligence scores between the gifted L2 learners and the norm in the population (see table 6.4.).

[53] A normal population is a population of values having normal distribution usually represented by a bell-shaped curve. The normal Polish population represents the general population of adult Polish persons, that is the mean result in the society (norm), to which the results of an individual are compared (Nęcka, 2003).

Table 6.4. One sample *t*-test of differences between the gifted L2 learners and the norm

Variable	Mean	SD	*t* (43)	*p*	*d*
Knowledge	14.48	1.65	18.01	<.001	5.49
Digit-Span	15.07	2.53	13.29	<.001	4.05
Vocabulary	15.73	2.04	18.63	<.001	5.68
Arithmetic	14.05	2.6	10.33	<.001	3.15
Comprehension	16.11	1.93	21.00	<.001	6.40
Similarities	14.61	1.95	15.68	<.001	4.78
Picture Completion	12.41	2.55	6.26	<.001	1.91
Picture Arrangement	11.71	2.11	5.34	<.001	1.63
Blocks Design	13.51	2.98	7.79	<.001	2.38
Object Assembly	12.27	2.73	5.51	<.001	1.68
Digit-Symbol Coding	14.41	2.04	14.34	<.001	4.37
Verbal Comp. Index	130.34	7.13	28.22	<.001	8.61
Percept. Org. Index	115.93	10.48	10.08	<.001	3.08
Memory Index	128.45	10.26	18.39	<.001	5.61
Verbal IQ	129.82	8.22	24.06	<.001	7.34
Performance IQ	118.64	9.71	12.73	<.001	3.88
Full-scale IQ	125.43	7.69	21.93	<.001	6.69

The results for all the memory tests indicated high, although not homogenous, abilities in this field. Very high results were obtained in MLAT 1 (95.5%), MLAT 5 (92.6%), and PRSPAN (75%). The results for the Wechsler memory subscales (Digit-Span, Arithmetic, Digit-Symbol Coding) were high; hence, the Memory and Resistance to Distraction index was also high, but not as high as in the MLAT results. Evidently, the gifted L2 learners performed better on memory tests based on verbal than on numerical material (cf. Biedroń & Szczepaniak, in press).

The parametric correlation (the Pearson product-moment correlation coefficient) was applied to measure the correlation (linear dependence) between FL aptitude as measured by the MLAT and the number of languages the participants had learned, the number of languages they knew at an advanced level and WM (see table 6.5.).

Table 6.5. Pearson correlation of the MLAT with the number of languages the participants had learned and WM

Variable	WM	No. of lang.	C1/C2
MLAT 1	0.29	-0.06	-0.12
MLAT 2	0.19	0.19	0.09
MLAT 3	0.12	-0.07	-0.02
MLAT 4	0.10	0,01	-0.01
MLAT 5	0.28	0.22	0.02
MLAT G	**0.32***	0.04	-0.03

*$p < .05$

It can be seen that FL aptitude factors were not correlated with the number of languages the participants had learned irrespective of the proficiency level. The MLAT general score correlated with WM capacity and the correlations between MLAT 1 and 5 measuring memory and WM were close to significant.

As has been assumed in section 6.5., the Wechsler subtests scores can yield correlations with FL aptitude tests scores. In order to test this hypothesis, the MLAT scores were correlated with the Wechsler Intelligence Scales (see table 6.6.). The first general

Table 6.6. Pearson correlation of the MLAT with the Wechsler scales

Variable	Knowledge	Digit-span	Vocabulary	Arithmetic	Comprehension	Similarities	Pict. Compl.	Pict. Arrang.	Block Design	Object Assem.	Digit Symbol	Verbal Index	Percep. Index	Memory Index	Verbal IQ	Perform. IQ	Full Scale IQ
MLAT 1	-0.04	0.29	0.19	**0.45***	0.00	-0.06	0.29	-0.21	**0.47***	**0.33***	0.20	0.05	0.20	**0.48***	0.27	**0.41***	**0.41***
MLAT 2	-0.21	0.05	0.04	0.17	-0.04	-0.24	-0.01	-0.02	-0.03	0.05	0.17	-0.15	-0.09	0.19	-0.03	0.04	0.02
MLAT 3	0.07	-0.03	0.04	0.02	0.29	0.04	0.14	0.21	-0.02	-0.08	-0.23	0.18	0.13	-0.11	0.10	0.01	0.07
MLAT 4	-0.04	0.10	0.24	**0.36***	0.19	0.00	0.06	-0.11	0.25	0.01	**0.36***	0.16	0.10	**0.40***	0.25	0.20	0.28
MLAT 5	0.23	0.21	0.08	0.26	-0.00	0.09	0.02	0.16	0.20	0.09	0.27	0.15	0.17	**0.37***	0.24	0.24	0.29
MLAT G	0.02	0.20	0.24	**0.45***	0.26	-0.02	0.21	0.02	**0.33***	0.11	0.23	0.21	0.22	**0.44***	**0.33***	**0.32***	**0.40***

*$p < .05$

impression is that the MLAT general (full-scale) score correlated moderately positively (r = .40) with the full-scale IQ, as well as the verbal IQ, the performance IQ and the

Memory and Resistance to Distraction index. This is to be interpreted that as IQ increases, the MLAT score increases. The inspection of the results showed that the strongest correlations existed between the MLAT and the Memory and Resistance to Distraction index. This accords with the results of the previous analysis, that is a positive correlation between the general MLAT and WM. MLAT 1, 4 and 5 correlated with the Memory and Resistance to Distraction index, which is attributed to the memory factor measured by these subtests (MLAT 1 and 5). The correlation with MLAT 4, which measures grammar sensitivity could be related to the WM factor, which shares some variance with full-scale IQ, but, in view of the lack of correlation between MLAT 4 and WM this interpretation would be unjustified. Probably, MLAT 4 requires more reasoning ability (as in, for example, Arithmetic) than verbal WM. MLAT 2 and 3 showed close to zero correlations with general intelligence. The lack of correlation between MLAT 2 measuring phonetic ability and IQ confirms the separateness of these factors (cf. Sasaki, 1996). The lack of correlation between MLAT 3 (vocabulary) and IQ can be attributed to the fact that, unlike the vocabulary component in the Wechsler Scale and the TZJ, MLAT 3 is rather a measure of the ability to relate a sound to a symbol, than the range of vocabulary. Concluding, there were stronger correlations between the general MLAT, MLAT 1, MLAT 4 and MLAT 5 and the memory scales than the other IQ scales.

Analogically, the same analyses were applied in the case of the TZJ. Firstly, the TZJ was correlated with the number of languages the participants had learned, the number of languages they knew at an advanced level and WM (table 6.7.). Secondly, the TZJ scores were correlated with the Wechsler Intelligence Scales (table 6.8.).

Table 6.7. Pearson correlation of the TZJ with the number of languages the participants had learned and WM

Variable	WM	No. of lang.	C1/C2
Discourse	**0.38***	**0.33***	**0.43***
Vocabulary	0.28	**0.43***	**0.48***
Grammar	**0.42***	**0.53***	**0.50***
TZJ G	**0.39***	**0.49***	**0.52***

*$p < .05$

Table 6.8. Pearson correlation of the TZJ with the Wechsler scales (the gifted L2 learners)

	Knowledge	Digit-span	Vocabulary	Arithmetic	Comprehension	Similarities	Pict. Compl.	Pict. Arrang.	Block Design	Object Assem.	Digit Symbol	Verbal Index	Percep. Index	Memory Index	Verbal IQ	Perform. IQ	Full Scale IQ
Discourse	**0.48***	0.20	0.26	0.05	0.20	**0.31***	0.04	0.28	-0.12	0.01	0.01	0.43	0.09	0.13	**0.36***	0.05	0.26
Vocabulary	**0.49***	0.05	**0.40***	0.26	0.08	0.22	**0.51***	0.20	0.26	**0.37***	0.05	**0.41***	**0.49***	0.19	**0.37***	**0.51***	**0.53***
Grammar	**0.34***	0.22	**0.31***	**0.34***	0.12	0.23	**0.34***	-0.13	0.15	0.30	0.30	**0.36***	0.27	**0.42***	**0.41***	**0.34***	**0.46***
TZJ G	**0.51***	0.19	**0.40***	**0.32***	0.14	0.29	**0.42***	0.07	0.17	0.33	0.20	**0.47***	**0.39***	**0.35***	**0.48***	**0.42***	**0.55***

*$p < .05$

In this case we can observe significant correlations between the TZJ and the number of languages the participants had learned, the number of languages they knew very well and WM. As most tasks in the TZJ are in Polish, this analysis confirms the relationship between the native language learning ability and FL aptitude. On the other hand, the TZJ was a test definitely too easy for the participants (31 of them gained over 90% of correct answers), which could have affected the results. Nevertheless, it is suggested that FL aptitude as measured by the TZJ (especially the subtest Grammar), can be related to the ultimate attainment in learning a foreign language. The positive correlation between WM and FL aptitude as measured by the TZJ (especially Grammar, including an inductive ability task) is interpreted as evidence that WM is a part of FL aptitude.

Interestingly, similar conclusions can be reached on the basis of the analysis of correlations for the non-gifted L2 learners. In this case, the correlations between the MLAT and WM were statistically significant: MLAT 1 ($r = .34$); MLAT 2 ($r = .35$); MLAT 5 ($r = .37$). The same patterns occurred for the correlation between the TZJ and WM: Discourse ($r = .24$); Vocabulary ($r = .31$); Grammar ($r = .40$); and the TZJ full score ($r = .43$). The MLAT did not correlate with the number of languages, whereas the TZJ correlated significantly with the number of languages the non-gifted L2 learners had learned ($r = .37$). These results confirm the hypothesis that WM affects FL aptitude.

The analysis of the correlations between the TZJ and the Wechsler scales indicated that the patterns of correlations yielded by FL aptitude as measured by the TZJ and by the MLAT, and the IQ scales were similar. The biggest difference between the MLAT and the TZJ was in the correlations with the verbal scales. The TZJ scales (table 6.8.) correlated significantly with the verbal scales (Knowledge, Vocabulary, the Verbal index); in particular, Vocabulary seems to rely heavily on verbal IQ. In contrast, Grammar, which measures inductive learning ability, correlated more strongly with the memory subtests (Arithmetic, the Memory index) than other subscales. Generally, it seems that the tasks in the TZJ rely more on general IQ than the tasks in the MLAT.

6.6.4. Gifted *versus* non-gifted L2 learners' cognitive factors

The results of the gifted L2 learners were compared to the results of the non-gifted L2 learners. It was decided to compare the number of languages they had learned and the number of languages they knew at an advanced level (C1/C2), as well as MLAT 1, MLAT 2, MLAT 5, the TZJ and WM. The factors of age and gender were not taken into consideration as variables because most of the tests used in the study have age and gender norms. The purpose of this comparison was to demonstrate whether there are any differences in the cognitive abilities between the two groups of learners. The results for the comparison are presented in table 6.9.

Table 6.9. *T*-test of differences between the gifted and non-gifted L2 learners (cognitive factors)

Variable	Mean gifted	Mean non-gifted	*t*	*df*	*p*	*n* gifted	*n* non-gifted	SD gifted	SD non-gifted
MLAT 1	41.090	29.768	7.25	124.000	0.001	44.000	82.000	2.900	10.120
MLAT 2	28.273	24.915	5.99	124.000	0.001	44.000	82.000	1.590	3.521
MLAT 5	22.227	16.720	6.21	124.000	0.001	44.000	82.000	2.429	5.598
Discourse	9.750	7.890	5.93	124.000	0.001	44.000	82.000	0.488	2.042
Vocabulary	17.341	11.768	9.67	124.000	0.001	44.000	82.000	1.010	3.742
Grammar	13.432	8.915	8.70	124.000	0.001	44.000	82.000	1.318	3.296
TZJ G	40.523	28.573	11.04	124.000	0.001	44.000	82.000	2.317	6.963
WM	39.000	27.543	6.68	119.000	0.001	40.000	81.000	7.246	9.568
No. of lang.	4.477	2.182	10.21	124.000	0,001	44.000	82.000	1.823	0.669
C1/C2	2.022	0.121	15.74	124.000	0.001	44.000	82.000	0.952	0.397

The results of the analysis showed that there were very significant differences in all the cognitive factors between the gifted and non-gifted L2 learners. Moreover, despite the high level of differentiation of the group of the gifted learners (ages, languages and professions), the SDs of this group were lower than those of the non-gifted learners for all the cognitive factors, which indicated a balanced high level among the members of the gifted group. As expected, there were large differences in the memory abilities of the two groups (MLAT 1, MLAT 5, WM), with those of the gifted L2 learners being higher. The difference in the PRSPAN (WM) was significant: 22.11%. Figure 6.2. shows the results of the *t*-test of differences in WM between the gifted and non-gifted L2 learners.

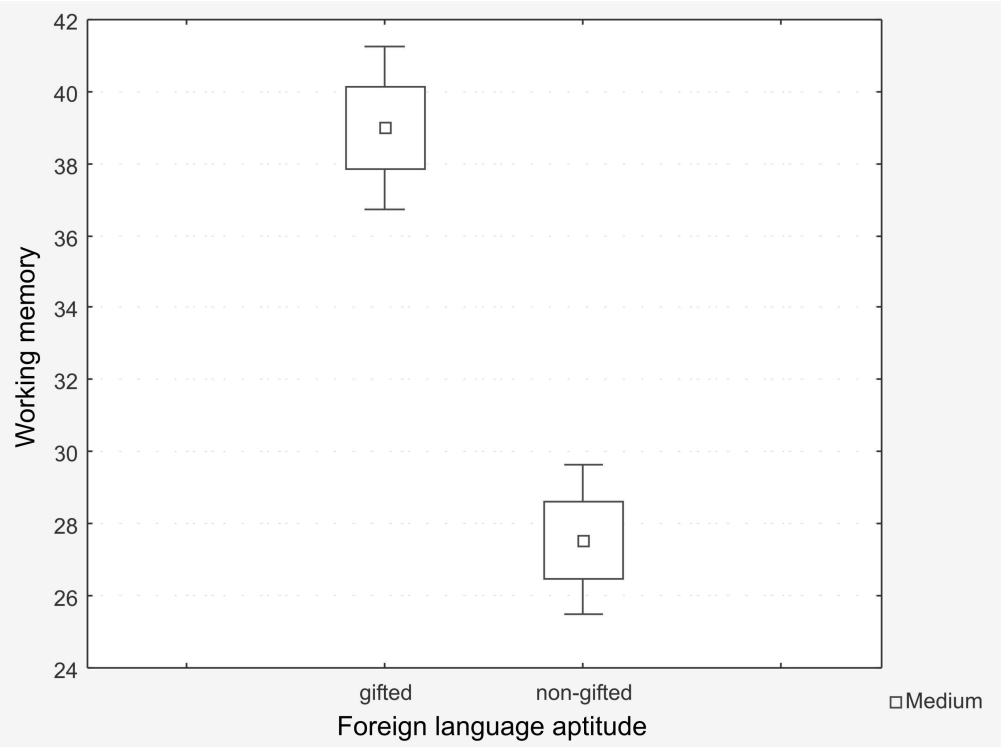


Figure 6.2. Differences in WM between the gifted and non-gifted L2 learners

6.6.5. Personality factors

In order to find out if personality factors have an effect on FL aptitude the following factors were investigated: openness to experience, conscientiousness, extraversion, agreeableness and neuroticism (the Five Factor Model), styles of coping with stress, locus of control and emotional intelligence. These factors were tested in both groups, that is the gifted L2 learners (n = 44) and the non-gifted L2 learners (n = 46). Other personality factors, namely the need for autonomy (psychological needs), creativity (Creative Personality), motivation and anxiety were subjected to analysis only for the gifted group. Table 6.10. shows descriptive data for the personality factors in the gifted L2 sample.

Table 6.10. Descriptive statistics for the gifted L2 learners − personality factors

Variable	Mean	Minimum	Maximum	SD
neuroticism	4.568	1.000	10.000	2.245
extraversion	5.227	1.000	10.000	2.165

openness	6.159	2.000	9.000	1.627
agreeableness	4.954	1.000	10.000	2.271
conscientiousness	5.818	1.000	10.000	2.489
task-oriented style	61.386	50.000	76.000	6.672
emotional style	45.295	18.000	66.000	10.917
avoiding style	42.886	27.000	63.000	9.286
locus of control	2.909	0.000	9.000	2.290
emotional intelligence	4.659	1.000	9.000	1.975

Note: neuroticism, extraversion, openness, agreeableness, conscientiousness = NEO-FFI (the Five Factor Model) scales; task-oriented, emotional, avoiding = CISS (style of coping with stress) scales; locus of control = Delta scale; emotional int. = INTE scale

In the NEO-FFI questionnaire the raw results are converted into stens. Results from 1 to 3 are considered low, 4 to 7 average, and 8 to 10 high. It is evident that the participants fell within the average range of scores. However, the highest scores were recorded for openness (6.1) and for conscientiousness (5.8). This indicates that the subjects can be intellectually open, curious and flexible, on the one hand, and dutiful, planning and thorough, on the other. As regards the CISS questionnaire measuring styles of coping with stress, scores from 40 to 70 are regarded as average. Hence, all of the participants' styles of coping fell within the average range; however, the task-oriented coping style significantly dominated. This indicates that they do not avoid confrontation; In a stressful situation they establish a plan and follow it. Moreover, five subjects recorded over 70 points (high) on the task-oriented style, whereas none gained such a score on the avoiding and emotional-oriented styles. By the same token, in the INTE questionnaire measuring emotional intelligence, scores from 4 to 7 are average. Therefore, the subjects' emotional intelligence (4.7) was average, according to the norm. The only extreme result was obtained in the Delta questionnaire measuring locus of control; Their mean score was 2.9 on a scale of 0 to 14. In this test, low scores (1-3) indicate internality of control and high scores (8-10) externality of control. The participants are internals, that is they tend to ascribe results of their actions to themselves rather than to external, uncontrollable factors.

The parametric correlation (the Pearson product-moment correlation coefficient) was applied to measure the correlation between two FL aptitude tests (the MLAT and the TZJ) and the personality factors (tables 6.11. and 6.12.). It can be seen that the FL aptitude factors were not correlated with the personality factors. It is interpreted as evidence that there is no direct relationship between personality factors and cognitive abilities connected with learning a foreign language in gifted L2 learners.

Table 6.11. Correlation of the MLAT scores with personality factors

Variable	N	E	O	A	C	TS	EM	AV	LOC	INTE
MLAT 1	0.02	0.11	-0.05	0.22	-0.14	-0.04	0.17	0.11	0.15	0.05
MLAT 2	-0.19	-0.11	-0.12	-0.02	-0.06	-0.03	0.02	-0.13	0.22	-0.25
MLAT 3	0.04	0.11	0.04	0.01	-0.17	-0.23	0.06	0.29	-0.03	-0.01
MLAT 4	-0.18	-0.09	-0.15	0.19	0.07	-0.10	-0.21	-0.02	0.01	-0.15
MLAT 5	-0.14	-0.15	0.08	0.25	0.04	-0.16	-0.12	0.15	0.02	0.25
MLAT G	-0.14	-0.01	-0.07	0.24	-0.10	-0.25	-0.04	0.21	0.08	-0.04

Table 6.12. Correlation of the TZJ scores with personality factors

Variable	N	E	O	A	C	TS	EM	AV	LOC	INTE
Discourse	0.18	-0.14	0.29	-0.01	-0.08	-0.11	-0.01	0.01	-0.15	0.05
Vocabulary	0.27	-0.14	-0.02	0.03	**-0.30***	-0.16	0.21	0.14	0.01	-0.08
Grammar	-0.01	-0.08	-0.02	0.25	-0.02	0.04	0.02	0.02	-0.06	-0.02
TZJ G	0.15	-0.14	0.04	0.15	-0.16	-0.07	0.10	0.08	-0.06	-0.04

* $p < .05$
Note: N = neuroticism; E = extraversion; O = openness; A = agreeableness; C = conscientiousness; TS = task-oriented style; EM = emotional style; AV = avoiding style; LOC = locus of control; INTE = emotional intelligence

6.6.6. Gifted *versus* non-gifted L2 learners' personality factors

The results of the gifted L2 learners were compared to the results of the non-gifted L2 learners. The purpose of this comparison was to demonstrate whether there are any differences in the personality factors between the two groups of learners. If such differences were observed, it would be interpreted as evidence in support of the hypothesis that not only cognitive, but also personality factors differentiate gifted from non-gifted L2 learners. The results for the comparison are presented in table 6.13.

Table 6.13. *T*-test of differences between the gifted and non-gifted L2 learners (personality factors)

Variable	**Mean gifted**	**Mean non-gifted**	***t***	***df***	***p***	***n* gifted**	***n* non-gifted**	**SD gifted**	**SD non-gifted**
neuroticism	4.568	4.457	0.24	88	0.815	44	46	2.245	2.258
extraversion	5.227	5.804	-1.25	88	0.214	44	46	2.166	2.207

openness	6.159	5.565	1.41	88	0.161	44	46	1.627	2.287
agreeableness	4.955	5.500	-1.20	88	0.234	44	46	2.272	2.041
conscientiousness	5.818	5.326	0.96	88	0.341	44	46	2.490	2.386
task-oriented style	61.386	59.044	1.29	87	0.199	44	45	6.672	10.043
emotional style	45.295	43.533	0.80	87	0.421	44	45	10.917	9.617
avoiding style	42.886	43.489	-0.28	87	0.775	44	45	9.287	10.543
locus of control	2.909	3.733	-1.60	87	0.112	44	45	2.291	2.553
emotional intelligence	4.659	5.477	-1.83	86	0.070	44	44	1.976	2.205

No statistically significant differences in personality factors between the gifted and non-gifted L2 learners were observed; therefore, it is evident that these factors did not differentiate the subjects. However, some tendencies can be recognised. For example, a higher level of openness to experience and conscientiousness and a lower level of extraversion and agreeableness in the gifted L2 learners than in the non-gifted L2 learners. Locus of control of the gifted L2 learners was also higher, whereas their emotional intelligence was lower. The difference in emotional intelligence was close to statistically significant, with this of the non-gifted L2 learners being higher.

6.6.7. Learning styles

The following learning styles were tested: visual *versus* auditory *versus* tactile, intuitive *versus* concrete-sequential, closure-oriented *versus* open, global *versus* analytic (Oxford, 1995), and second language tolerance of ambiguity (Ely, 1995a). The descriptive statistics for the gifted L2 learners are presented in table 6.14.

Table 6.14. Descriptive statistics for the gifted L2 learners – learning styles

Variable	Mean	Minimum	Maximum	SD
visual	23.068	9.000	32.000	5.856
auditory	21.750	10.000	34.000	5.665
tactile	20.113	10.000	33.000	5.426
intuitive	25.090	12.000	37.000	5.130
concrete	21.659	4.000	31.000	6.246
closure-oriented	25.022	6.000	39.000	8.453

open	20.181	6.000	30.000	4.984
global	26.022	12.000	36.000	5.123
analytic	21.159	5.000	34.000	6.095
tolerance of ambiguity	27.136	11.000	40.000	6.363

The gifted L2 learners did not reveal strong style preferences. On a scale of 0-40 their mean scores ranged from 20 to 26. Visual preference was more common than auditory and tactile, intuitive was more common than concrete-sequential, closure-oriented prevailed over open and global over analytic. The level of second language tolerance of ambiguity was average. These results were somehow contradictory because the learners turned out to be intuitive and global on the one hand, and closure-oriented, on the other. This means that they try to find the main idea rather than focus on details, enjoy guessing meanings and abstract thinking, like to speculate about possibilities, avoid step-by--step instruction, and focus on tasks, meet deadlines, plan ahead and require explicit instruction at the same time. Probably, the way in which the statements are formulated in the test had some effect on the respondents. For example, it is more likely that a testee will choose a statement "I have a vivid imagination" or "I consider myself original" (intuitive), than "I behave in a down-to-earth way" or "I feel it is useless for me to think about the future" (concrete). On the other hand, gifted L2 learners might possess an array of different cognitive and learning styles which they adapt to a situation. It is suggested that good foreign language learners can operate outside the preferred styles, which is termed as *style stretching* (cf. Dörnyei, 2005; Oxford, 2001; Reid, 1995) (see Chapter Four, section 4.2.). What is more, culture and educational experience can significantly affect learning styles (Reid, 1998, p. xiii). For example, Japanese or Chinese teachers can value reflectivity, cooperation and teacher authority, whereas Polish teachers of the English language can attach importance to spontaneous communication. It is possible that gifted L2 learners, due to their multiple language learning experience, learn to stretch their styles to match different learning situations connected with various teaching styles and methods preferred by teachers of different languages. The correlation between the FL aptitude tests (the MLAT and the TZJ) and learning styles was non--significant.

6.6.8. Gifted *versus* non-gifted L2 learners' learning styles

Again, the results of the gifted L2 learners were compared to the results of the non--gifted L2 learners. In spite of a few statistically significant differences between the groups, both revealed the same tendencies, that is a slight dominance of the following

styles: visual, intuitive, closure-oriented and global, as well as an average level of second language tolerance of ambiguity. Ambiguity tolerance was higher[54] in the gifted sample and the difference with the non-gifted group was close to significant. From these data, it transpires that cultural factors and the system of education are responsible for the lack of differences between the groups and that they probably counterweigh other individual factors and experiences. The results are presented in table 6.15.

Table 6.15. *T*-test of differences between the gifted and non-gifted L2 learners (learning styles)

Variable	Mean gifted	Mean non-gifted	*t*	*df*	*p*	*n* gifted	*n* non-gifted	SD gifted	SD non-gifted
visual	23.07	24.55	-1.38	86	0.172	44	44	5.856	4.026
auditory	21.75	23.89	-1.96	86	**0.053**	44	44	5.666	4.489
tactile	20.11	23.02	-2.36	86	**0.021**	44	44	5.427	6.117
intuitive	25.09	27.43	-2.01	86	**0.048**	44	44	5.130	5.784
concrete	21.66	22.16	-0.40	86	0.687	44	44	6.247	5.326
closure-oriented	25.02	26.36	-0.81	86	0.419	44	44	8.454	6.949
open	20.18	23.02	-2.40	86	**0.019**	44	44	4.985	6.071
global	26.02	26.89	-0.79	86	0.433	44	44	5.124	5.150
analytic	21.16	21.86	-0.60	86	0.551	44	44	6.096	4.868
tolerance of ambiguity	27.14	29.27	-1.67	86	0.098	44	44	6.363	5.584

Note: Significant differences are in bold

An interesting tendency observed in the group of the non-gifted L2 learners was a number of significant correlations between FL aptitude and personality factors and learning styles. For example, MLAT 1 and MLAT 5 correlated negatively with neuroticism (r = -.32) and (r = -.34), respectively; MLAT 2 with extraversion (r = -.29), whereas MLAT 5 correlated positively with conscientiousness (r = .39). The TZJ and its subtests: Grammar and Vocabulary correlated positively with openness to experience: Vocabulary (r = .50), Grammar (r = .32), the TZJ (r = .45). Grammar correlated negatively with neuroticism (r = -.35) and with the emotional style of coping with stress (r = -.34). MLAT 2 correlated negatively with the following styles: visual (r = -.32), concrete (r = -.42) and global (r = -.32), and MLAT 1 correlated positively with the open style (r = .34). There were also a few significant correlations between the TZJ and

[54] In the Second Language Tolerance of Ambiguity test the scores are reversed – the lower the score, the higher the ambiguity tolerance.

the learning styles. For example, Grammar and TZJ general correlated with second language tolerance of ambiguity[55] (r = -.42). A plausible interpretation is that, unlike FL aptitude in the gifted L2 learners, FL aptitude in the non-gifted L2 learners is more affected by non-cognitive factors. It seems possible that the level of performance on a test task is mediated by some personality characteristics. The subtests including the memory component (MLAT 1 and 5), and Grammar were negatively affected by neuroticism, which is connected with negative affectivity. Anxiety involved in neuroticism produces negative learning outcomes (Corno et al., 2002; Dörnyei, 2005; McCrae & Costa, 2003). Grammar was also negatively correlated with the emotional style of coping with stress – weaker students are likely to employ emotional strategies when facing tasks perceived as difficult. On the other hand, it seems that openness to experience and conscientiousness, as well as second language tolerance of ambiguity have a positive effect on the 'mainstream' learners' performance.

6.6.9. Predictors of foreign language aptitude

In order to answer the question as to which cognitive abilities and personality factors have a predictive effect on the MLAT and TZJ scores, and to what extent those abilities and characteristics have a predictive effect on the MLAT and TZJ scores, the results obtained in the correlation matrix were subjected to a multiple regression analysis. The independent (predictive) variables were the WAIS-R (PL) general cognitive abilities and indices, WM, the personality factors from the Five Factor Model, the styles of coping with stress, locus of control, emotional intelligence and the learning styles. The dependent (criterion) variables were the MLAT and TZJ scales. The group of the gifted L2 learners was small and carefully selected; therefore, the results of the FL aptitude tests were not normally distributed. Accordingly, great caution must be exercised when interpreting the results. In the case of the cognitive factors, regression analyses results and their interpretation should be treated as tendencies in the studied problem rather than ultimate findings. The summary of the analyses is shown in tables from 6.16 to 6.44. For clarity of description only those factors which appeared relevant to predicting FL aptitude are presented in the tables. Tables from 6.16. to 6.20. present regression analyses for the MLAT with three independent variables (cognitive factors) introduced.

[55] In the case of tolerance of ambiguity a negative correlation means that as FL aptitude rises, the tolerance of ambiguity rises because scores in the tolerance of ambiguity test are reversed.

Table 6.16.

MLAT 1	BETA	*t* (45)	*p*
Verbal Comp. Index	-0.027	-0.17	0.863
Percept. Org. Index	0.064	0.43	0.667
Memory Index	0.444	3.17	**0.003**
R^2 = .200 adjusted R^2 = .146 F(3.45) = 3.753			

Table 6.17.

MLAT 2	BETA	*t* (45)	*p*
Verbal Comp. Index	-0.092	-0.56	0.575
Percept. Org. Index	-0.144	-0.91	0.364
Memory Index	0.298	2.01	**0.050**
R^2 = .102 adjusted R^2 = .042 F(3.45) = 1.714			

Table 6.18.

MLAT 4	BETA	*t* (40)	*p*
Verbal Comp. Index	0.122	0.75	0.453
Percept. Org. Index	-0.106	-0.68	0.497
Memory Index	0.302	2.06	**0.045**
R^2 = .120 adjusted R^2 = .062 F(3.45) = 2.059			

Table 6.19.

MLAT 5	BETA	*t* (45)	*p*
Verbal Comp. Index	-0.144	-0.94	0.348
Percept. Org. Index	0.181	1.24	0.219
Memory Index	0.467	3.40	**0.001**
R^2 = .229 adjusted R^2 = .178 F(3.45) = 4.468			

Table 6.20.

MLAT G	BETA	*t* (40)	*p*
Verbal Comp. Index	0.082	0.51	0.608
Percept. Org. Index	0.001	0.01	0.994
Memory Index	0.362	2.52	**0.015**
R^2 = .155 adjusted R^2 = .099 F(3.45) = 2.768			

The analysis of the results revealed that the results of MLAT 1, 2, 4, 5 and the general MLAT can be predicted from the WAIS-R (PL) results. The factors of intelligence explained from 4.2% (in the case of MLAT 2) to 17.8% (in the case of MLAT 5) of the variance in the results in the gifted L2 learners' group. What is more, neither the Verbal Comprehension index, nor the Perceptual Organisation index predicted the MLAT scores. Generally, as far as indices are concerned, the Memory and Resistance to Distraction index was the best predictor of the MLAT scores. Tables 6.21.-6.23. present regression analyses with four independent variables introduced.

Table 6.21.

MLAT 2	BETA	*t* (39)	*p*
Verbal Comp. Index	-0.071	-0.41	0.678
Percept. Org. Index	-0.228	-1.33	0.189
Memory Index	0.110	0.65	0.516
WM	0.372	2.13	**0.039**
R^2 = .154 adjusted R^2 = .068 F(4.39) = 1.784			

Table 6.22.

MLAT 3	BETA	*t* (39)	*p*
Verbal Comp. Index	0.152	0.87	0.386
Percept. Org. Index	-0.133	-0.76	0.449
Memory Index	-0.127	-0.74	0.462
WM	0.362	2.03	**0.048**
R^2 = .121 adjusted R^2 = .031 F(4.39) = 1.344			

Table 6.23.

MLAT G	BETA	*t* (39)	*p*
Verbal Comp. Index	0.100	0.62	0.536
Percept. Org. Index	-0.095	-0.59	0.558
Memory Index	0.211	1.32	0.191
WM	0.354	2.14	**0.038**
R^2 = .246 adjusted R^2 = .169 F(4.39) = 3.192			

Four independent variables (the Verbal Comprehension index, the Perceptual Organisation index, the Memory and Resistance to Distraction index from the Wechsler Intelligence Scale and WM) analysed in multiple regression explained from 3.1% (MLAT 2) to 16.9% (MLAT G) of the variance in the dependent variable. Among the four independent variables, only WM positively affected the aptitudes measured in the MLAT. Regression analyses for the TZJ are presented in tables 6.24.-6.26.

Table 6.24.

Discourse	BETA	*t* (45)	*p*
Verbal Comp. Index	0.415	2.61	**0.012**
Percept. Org. Index	-0.169	-1.11	0.274
Memory Index	0.042	0.29	0.774
R^2 = .149 adjusted R^2 = .093 F(3.45) = 2.646			

Table 6.25.

Vocabulary	BETA	*t* (45)	*p*
Verbal Comp. Index	0.335	2.18	**0.034**
Percept. Org. Index	0.196	1.33	0.190
Memory Index	0.015	0.11	0.912
R^2 = .212 adjusted R^2 = .159 F(3.45) = 4.043			

Table 6.26.

Grammar	BETA	*t* (45)	*p*
Verbal Comp. Index	0.098	0.62	0.533
Percept. Org. Index	0.152	1.01	0.318
Memory Index	0.314	2.21	**0.032**
R^2 = .175 adjusted R^2 = .120 F(3.45) = 3.188			

Two subtests of the TZJ, namely Discourse and Vocabulary, can be predicted from the Verbal Comprehension index. Verbal intelligence explained 9.3% of the variance in Discourse and 15.9% of the variance in Vocabulary. Grammar can be predicted from the factor of memory; the Memory and Resistance to Distraction index explained 12% of the variance in the Grammar subtest. What is more, the TZJ and its subscales were affected by the verbal, performance and full-scale IQ; however, their predictive effect was only approaching the significance level.

Effects of personality factors on the MLAT and the TZJ are presented in tables 6.27.--6.38.

Table 6.27.

MLAT 1	BETA	*t* (84)	*p*
neuroticism	-0.217	-1.90	0.061
extraversion	-0.083	-0.70	0.483
openness	0.231	2.21	**0.030**
agreeableness	-0.101	-0.93	0.353
conscientiousness	0.067	0.61	0.542
R^2 = .108 adjusted R^2 = .055 F(5.84) = 2.036			

Table 6.28.

MLAT 2	BETA	*t* (84)	*p*
neuroticism	-0.185	-1.67	0.098
extraversion	-0.361	-3.15	**0.002**
openness	0.198	1.94	0.055

agreeableness	-0.056	-0.53	0.594
conscientiousness	0.138	1.30	0.196
R^2 = .156 adjusted R^2 = .106 F(5.84) = 3.119			

Table 6.29.

MLAT 5	BETA	*t* (84)	*p*
neuroticism	-0.229	-2.06	**0.043**
extraversion	-0.162	-1.41	0.163
openness	0.166	1.62	0.109
agreeableness	-0.004	-0.04	0.972
conscientiousness	0.275	2.58	**0.012**
R^2 = .150 adjusted R^2 = .099 F(5.84) = 2.966			

Table 6.30.

Discourse	BETA	*t* (84)	*p*
neuroticism	-0.102	-0.89	0.375
extraversion	-0.245	-2.07	**0.042**
openness	0.192	1.83	0.072
agreeableness	0.129	1.19	0.237
conscientiousness	-0.078	-0.71	0.479
R^2 = .096 adjusted R^2 = .042 F(5.84) = 1.786			

Table 6.31.

Vocabulary	BETA	*t* (84)	*p*
neuroticism	-0.043	-0.40	0.691
extraversion	-0.205	-1.83	0.071
openness	0.387	3.88	**0.001**

agreeableness	-0.023	-0.22	0.826
conscientiousness	0.069	0.66	0.511
R^2 = .186 adjusted R^2 = .137 F(5.84) = 3.841			

Table 6.32.

Grammar	BETA	*t* (84)	*p*
neuroticism	-0.215	-1.93	0.057
extraversion	-0.191	-1.66	0.100
openness	0.287	2.82	**0.006**
agreeableness	-0.011	-0.11	0.917
conscientiousness	0.173	1.63	0.108
R^2 = .153 adjusted R^2 = .102 F(5.84) = 3.036			

Table 6.33.

TZJ G	BETA	*t* (84)	*p*
neuroticism	-0.142	-1.29	0.200
extraversion	-0.241	-2.13	**0.036**
openness	0.363	3.60	**0.001**
agreeableness	0.013	0.12	0.904
conscientiousness	0.095	0.91	0.368
R^2 = .175 adjusted R^2 = .126 F(5.84) = 3.567			

Table 6.34.

MLAT 1	BETA	*t* (85)	*p*
task-oriented	0.355	3.37	**0.001**
emotional	0.076	0.71	0.477
avoiding	0.001	0.01	0.996
R^2 = .118 adjusted R^2 = .087 F(3.85) = 3.810			

Table 6.35.

MLAT 5	BETA	*t* (85)	*p*
task-oriented	0.244	2.26	**0.026**
emotional	-0.025	-0.22	0.821
avoiding	0.171	1.61	0.111
R^2 = .081 adjusted R^2 = .049 F(3.85) = 2.518			

Table 6.36.

Vocabulary	BETA	*t* (85)	*p*
task-oriented	0.299	2.83	**0.005**
emotional	0.199	1.85	0.067
avoiding	-0.109	-1.04	0.298
R^2 = .109 adjusted R^2 = .078 F(3.85) = 3.495			

Table 6.37.

Grammar	BETA	*t* (85)	*p*
task-oriented	0.257	2.38	**0.019**
emotional	-0.059	-0.53	0.592
avoiding	0.108	1.00	0.316
R^2 = .079 adjusted R^2 = .047 F(3.85) = 2.456			

Table 6.38.

TZJ G	BETA	*t* (85)	*p*
task-oriented	0.257	2.36	**0.020**
emotional	0.069	0.62	0.535
avoiding	-0.031	-0.29	0.770
R^2 = .063 adjusted R^2 = .030 F(3.85) = 1.926			

Three personality factors had the strongest effect on FL aptitude, namely openness to experience, extraversion and the task-oriented style of coping with stress. Openness and the task-oriented style had a positive effect on FL aptitude, whereas extraversion affected FL aptitude negatively. Openness had a positive effect on MLAT 1, Vocabulary, Grammar and the TZJ. Its effect on MLAT 2 was close to significant. Extraversion had a consistently negative effect on FL aptitude. It affected MLAT 2, Discourse and the TZJ and its effect on Vocabulary was close to significant. The task-oriented style of coping with stress affected MLAT 1, MLAT 5, Vocabulary, Grammar and the TZJ. Other factors that turned out to be significant predictors of the aptitude scores were neuroticism and conscientiousness. Neuroticism affected negatively MLAT 5 and its effect on MLAT 1, MLAT 2 and Grammar were close to significant. Conscientiousness had a positive effect on MLAT 5.

Although no correlation between the learning styles and the FL aptitude tests occurred, it was possible that they have an effect on FL aptitude if introduced in a cluster. Emotional intelligence (INTE) was also introduced, as this concept seems to fit in with learning styles rather that personality factors. The effect of learning styles on FL aptitude is presented in tables from 6.39. to 6.44.

Table 6.39.

MLAT 3	BETA	*t* (40)	*p*
INTE	-0.030	-0.21	0.836
visual	0.090	0.39	0.697
auditory	0.030	0.16	0.875
tactile	0.148	0.87	0.388
intuitive	0.167	0.80	0.428
concrete	0.406	1.60	0.118
closure	-0.179	-0.69	0.497
open	-0.531	-2.27	**0.029**
global	0.073	0.30	0.768
analytical	-0.337	-1.26	0.216
tol. of ambiguity	0.026	0.17	0.869
R^2 = .281; adjusted R^2 = .083 F(11.40) = 1.425			

Table 6.40.

MLAT 5	BETA	*t* (75)	*p*
INTE	0.083	0.70	0.487
visual	-0.120	-0.70	0.486
auditory	-0.072	-0.51	0.611
tactile	0.034	0.24	0,814
intuitive	0,009	0,06	0.954
concrete	0.000	0.00	1.000
closure	-0.072	-0.37	0.709
open	-0.357	-2.02	**0.047**
global	0.248	1.46	0.148
analytical	0.296	1.70	0.093
tol. of ambiguity	-0.297	-2.58	**0.012**
R^2 = .169; adjusted R^2 = .048 F(11.75) = 1.396			

Table 6.41.

MLAT G	BETA	*t* (40)	*p*
INTE	-0.037	-0.26	0.796
visual	0.186	0.83	0.413
auditory	-0.007	-0.04	0.971
tactile	0.054	0.32	0.749
intuitive	0.300	1.46	0.151
concrete	0.357	1.43	0.161
closure	-0.537	-2.09	**0.043**
open	-0.745	-3.24	**0.002**
global	0.329	1.36	0.180
analytical	-0.047	-0.18	0.858
tol. of ambiguity	-0.135	-0.89	0.379
R^2 = .305 adjusted R^2 = .114 F(11.40) = 1.600			

Table 6.42.

Discourse	BETA	*t* (75)	*p*
INTE	-0.065	-0.59	0.558
visual	0.323	2.04	**0.045**
auditory	0.017	0.13	0.899
tactile	-0.072	-0.54	0.589
intuitive	-0.185	-1.32	0.190
concrete	-0.017	-0.10	0.922
closure	-0.283	-1.60	0.114
open	-0.167	-1.02	0.310
global	0.153	0.98	0.332
analytical	-0.241	-1.50	0.138
tol. of ambiguity	-0.283	-2.65	**0.010**
R^2 = .286 adjusted R^2 = .182 F(11.75) = 2.743			

Table 6.43.

Grammar	BETA	*t* (75)	*p*
INTE	0.008	0.07	0.944
visual	0.098	0.58	0.567
auditory	-0.131	-0.93	0.356
tactile	0.017	0.12	0.903
intuitive	0.026	0.17	0.864
concrete	-0.130	-0.70	0.485
closure	-0.188	-0.99	0.327
open	-0.228	-1.30	0.198
global	0.193	1.14	0.258
analytical	0.197	1.14	0.259
tol. of ambiguity	-0.382	-3.33	**0.001**
R^2 =.176; adjusted R^2 =.055; F(11.75) = 1.457			

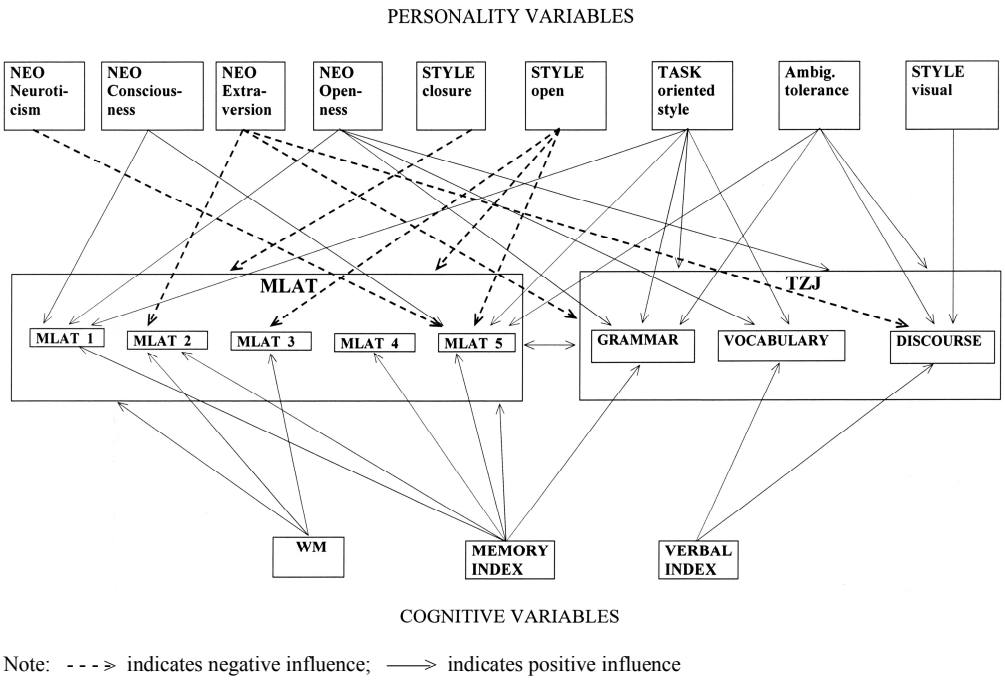
Table 6.44.

TZJ G	BETA	*t* (75)	*p*
INTE	-0.010	-0.09	0.932
visual	0.122	0.72	0.473
auditory	-0.071	-0.51	0.614
tactile	-0.047	-0.33	0.740
intuitive	-0.089	-0.59	0.556
concrete	-0.055	-0.30	0.765
closure	-0.179	-0.94	0.349
open	-0.194	-1.11	0.272
global	0.091	0.54	0.592
analytical	0.052	0.30	0.765
tol. of ambiguity	-0.340	-2.97	**0.004**
R^2 = .182; adjusted R^2 = .062; F(11.75) = 1.522			

Three learning styles, namely open, closure-oriented, and second language tolerance of ambiguity were found significant in predicting FL aptitude. The open style negatively affected MLAT 3, 5 and the general MLAT score. The closure-oriented style negatively affected the general MLAT score. The interpretation of this effect is difficult because both styles represent two opposite ends of a continuum. It is possible that learners with a balanced level of both styles performed better on aptitude tests. The case of tolerance of ambiguity is more interpretable, as it consistently affected MLAT 5, Discourse, Grammar and the general TZJ. Negative coefficients in this case mean that higher FL aptitude is accompanied by higher ambiguity tolerance. Discourse was also positively affected by the visual style, which can be tentatively attributed to the specificity of the tasks, which are typical verbal intelligence tasks depending on the comprehension of a text written in the mother tongue.

Summing up, the coefficients in multiple regressions were not very high, which indicates that most of the independent variables introduced in the equations are not very good predictors of FL aptitude tests scores. It emerges that WM (the Memory and Resistance to Distraction index and the PRSPAN) is the strongest predictor of the MLAT score, whereas verbal intelligence (the Verbal Comprehension index) is the best predictor of the TZJ score. Among the personality factors, openness to experience, conscientiousness, extraversion, neuroticism and the task-oriented style of coping with stress are

predictors of FL aptitude. Interestingly, openness to experience, conscientiousness and the task-oriented style of coping with stress are positively linked to FL aptitude, whilst extraversion and neuroticism are negatively linked to it. Finally, four learning styles, namely open, closure-oriented, visual and second language tolerance of ambiguity are predictors of FL aptitude. The open and closure-oriented styles are negatively linked to FL aptitude, whereas the visual style and ambiguity tolerance are positively linked to it. Figure 6.3. presents the predictors of FL aptitude.



Note: - - - ⇒ indicates negative influence; ⟶ indicates positive influence

Figure 6.3. A scheme of relationships between the independent variables (cognitive and personality variables) and the dependent variables (the MLAT and the TZJ)

The following section will present other data describing the gifted L2 learners obtained by means of the survey, psychological tests and questionnaires, as well as personal communication and psychological observation. At first, the gifted sample will be described from a dynamic perspective, that is one which includes quantitative-qualitative data and some important biographical information about critical events, choices, preferences and experiences which affected the development of their talent. Then, the cases of three talented participants will be presented. This presentation will also include both quantitative and qualitative data. Moreover, in accordance with the emic perspective (cf. Dewaele, 2009), that is one taking into consideration an individual's personal perception of his/her process of learning, self-descriptions of the subjects will be included.

6.6.10. The cognitive-affective profile of the gifted L2 learners

The quantitative analysis of the gifted L2 learners allows us to describe them as a sample of learners possessing the following cognitive characteristics:

- high FL aptitude;
- high verbal intelligence;
- high STM and WM abilities.

And the following personality characteristics:

- openness to experience;
- task-oriented style of coping with stress;
- internal locus of control.

In order to obtain a more complete profile of a gifted L2 learner, other characteristics were analysed using the data obtained from the survey (Appendix A) and from other tests described in the section 'Instruments'.

The first impression based on the surveys and interviews with the participants was that there were critical events and different experiences in their lives, which might have affected the development of their talent, such as, for example, journeys and family stays abroad, a change of school, language and culture, health problems, falling in love with a foreigner and many others. Twenty six (59%) of the participants had stayed abroad for at least a year (mean 2 years), and the longest stays were 7 and 8 years. One of the participants, who can be described as a nomad polyglot, is a good illustration of such an experience. This was a 25-year-old Polish-German bilingual (German dominant), raised in Switzerland and living in Poland for three years. She was also a member of the Swiss MENSA. At the time of the study, she declared the knowledge of 9 languages, including her L1s, Polish and German. The other languages were English and Spanish (near-native), Latin (advanced), French (intermediate), as well as Italian, Hungarian and Russian (basic). She earned her living teaching English and Spanish to adults. She had spent a few years in Ecuador, where she had worked as a teacher of English. She had also spent a couple of months in Spain, Belgium, Italy and Hungry. She had studied economics in Switzerland and physics in Poland but quit both after a year. Although her L1 was Polish (the language she had learned at home as the mother tongue), her declared level of Polish was lower than the level of German. Interestingly, her score on the TZJ test was 40 (93%), which was higher than that of the mainstream English Philology students (the non-gifted sample), for whom Polish was the L1 used in everyday communication. Her most prominent personality characteristics were conscientiousness and internality of control, for which she scored 100%.

Another interesting example is a 21-year-old third-year Japanese philology and first--year Indo-Tibetan philology student, learning 7 languages, who dreamt of working in a refugee camp in India. In 2009 she fulfilled her dream and started to work as a volunteer in India to help refugees from Tibet. There she met a Japanese with whom she fell in love and in 2009 she decided to give up studies and emigrate to Japan, where she is

living now. Not surprisingly, her preferred learning context was naturalistic − in the language-speaking country. Her most prominent characteristics were openness to experience and internal locus of control (scores 100%)[56].

A striking characteristic of the gifted L2 learners was their very high motivation to excel in foreign languages. All the participants turned out to be very motivated foreign language learners. Eight (18%) learners declared to be sufficiently motivated, 22 (50%) described themselves as very motivated and 14 (29) as highly motivated. Most of them were intrinsically motivated. Only 2 (4%) learners appeared to be more extrinsically motivated; In 4 (9%) cases there was a balance between extrinsic and intrinsic drives, and a vast majority − 38 (86%) were definitely intrinsically motivated. The subjects manifested a variety of motives to learn foreign languages, starting with the obvious ones such as "to find a job" or "I like it", to more sophisticated and elaborate explanations including biographical data (cf. Biedroń, 2011b).

One of the questions touched upon was self-efficacy of the gifted L2 learners, which reflected self-evaluation of their language abilities. Generally, the participants recognised themselves as highly able and competent foreign language learners. Only 6 (14%) evaluated their foreign language abilities as average, 29 (66%) as above average and 9 (20%) as superior. Phonetic abilities were assessed as high by 38 (86%) participants, 8 (18%) of whom decided that their abilities were very high; 39 (89%) participants declared that their grammar learning abilities were high and they did not have problems with learning a language structure. As many as 36 (82%) subjects evaluated their memory as good (among whom 3 (7%) as very good), and 8 (18%) as average. This means that the gifted L2 learners were not only competent, but also self-confident and aware of their high abilities. A good illustration of this fact is a self-evaluative statement by one of the participants (female, age 28, 11 languages, proficient in 4, doctoral student): "I am aware that my foreign language abilities are superior and that they are a genuine gift from nature. And I am not going to waste it". The participants were also asked to evaluate their foreign language learning anxiety on a scale of 1 to 5 (Appendix B). The mean result was 2.23, which indicates an average level of anxiety; however, only 6 (13.6%) participants evaluated their anxiety level as high or very high.

The information about the ages of starting to speak and read in their mother tongue confirms that FL aptitude and native language abilities have a common source. Fourteen participants declared that they started to speak around their first year of life and 30 of them started to read around the fourth-fifth year of life. Some of them remembered being taught to read and write by their siblings or grandparents. Obviously, these data are approximate and subjective because only some of the participants' parents were able to recollect them; however, some parents remembered their children starting to speak "early, much earlier than other children".

[56] For a detailed description see Biedroń and Szczepaniak (2009).

As far as L1 knowledge is concerned, there was a query about marks in the Polish language and problems with Polish grammar or orthography (or another L1). Most of the participants (40, that is 91%) declared that they were good or very good at Polish, only 2 (4.5%) admitted that they had had some problems with Polish as a school subject, and 3 males (6.8%) had problems with orthography. These results accord with the hypothesis that FL aptitude is a residue of native language abilities (cf. Carroll, 1973).

It is believed that parental support and conducive environmental conditions facilitate talent development (cf. Sękowski, 2004). As many as 36 participants (82%) answered positively to the question "Did your parents particularly care about your intellectual development?" What is more, they gave examples of different didactic games and activities devised by their parents and siblings. On the other hand, only a few of their family members knew a foreign language well − usually brothers and sisters. Consequently, their parents were able to teach them a foreign language only in a few cases. Although the participants were not inquired about the economic strain in their families, many of them mentioned that their parents could not always afford private lessons for their children and many of the participants had a part-time job during their studies to earn their living.

The participants were also asked what method of learning they like best. This question was asked before filling in the questionnaires, so the participants were able to freely express their preferences. The answers provided embraced all possible methods, tasks, situations and tools (a communicative classroom, self-teaching, self-talk, reading, writing, TV, the internet, computer programs, games, etc.), but as many as 36 (82%) participants indicated immersion or contacts with a native speaker as the most effective means of acquiring linguistic proficiency. In fact, 26 (59%) participants had spent more than a year abroad and a majority of them considered living abroad an effective method of acquiring a foreign language (cf. Biedroń, 2011a). Interestingly, the gifted L2 learners emphasised the importance of explicit instruction in teaching grammar, as well as extended practice, dictionary work, and extensive reading and writing in order to acquire a foreign language structure. Among vocabulary learning strategies, the most popular were memorisation strategies, embracing rote memorisation and repetition, associative mnemonic strategies (associations with a word in the native language or a visual image), making up sentences with a word, creative writing, creative story-telling, extensive reading, watching films and programmes, computer-assisted learning, learning from native speakers and dictionary work. These choices indicate that the gifted L2 learners were aware of the fact that learning a foreign language requires sustained effort and systematic work.

Awareness of one's needs and the ability to take responsibility for the process of learning are associated with learner autonomy (Benson & Voller, 1997). It turned out that the gifted L2 learners possessed all the prerequisites for autonomy, that is they were gifted, experienced, motivated, aware and mature. The *Adjective Check List ACL* (Juros et al., 1987) was used to find out the rank of the psychological need for autonomy among other psychological needs. The scale includes such needs as the need for aggression, achieve-

ment, dominance, change, abasement, deference and others. The score on the need for autonomy scale was 57.477 on a scale of 1 to 100. It was a moderately high result, but the highest of all the scores on all 37 need scales. This score refers to all domains of life and is not limited to foreign language learning. However, the fact that the need for autonomy was the dominant need of the gifted L2 learners indicates that they can be independent and aware foreign language learners, ready to take responsibility for their learning process.

Another typical characteristic of gifted and talented people is creativity. This trait was measured by the *Revised NEO-FFI Personality Inventory* (Zawadzki et al., 1998) − the openness to experience factor and by the *Adjective Check List ACL* (Juros et al., 1987) − the Creative personality trait, which is defined as the desire to do and think differently from the norm and a talent for originality. Moreover, the learners were asked about their artistic talents and hobbies. As has already been stated (see section 6.6.5.), the participants' score on openness to experience was moderately high. In the ACL test, the score of the gifted L2 learners was 55 on a scale of 1 to 100. It can be observed that the sample was, the same as in the case of openness, a little above average on the creative personality scale. These results suggest versatility, unconventionality and individuality of the sample (cf. Biedroń, 2010a).

Artistic interests, hobbies, activities and talents were declared by 33 (75%) participants. Most of them were interested in music or painting. Nineteen people played, or used to play, a musical instrument; 6 of these had graduated from a music school (3-12 years of study). Two people prided themselves on a vocal talent, 6 liked and practised dancing, and 5 believed that they were talented in painting or drawing. Theatre and acting was a hobby of 2 participants, 2 people wrote short stories, and 1 was interested in photography, 1 in cooking, and 1 in playing and designing linguistic board games. Most of the participants declared that they were interested in the history, culture, religion and literature of the target language country. This was especially emphasised by Oriental philology (Chinese and Japanese) students.

Summing up, besides the cognitive and personality factors possessed by the gifted L2 learners, their most significant characteristics obtained by means of the survey and the questionnaires were the following:

- high motivation;
- high self-efficacy;
- a moderate level of foreign language learning anxiety;
- an early age of starting to speak and read in their L1;
- high first language ability;
- an awareness of their own needs;
- a need for autonomy;
- a variety of artistic interests.

6.6.11. Gifted L2 learners – three case studies

In line with Dörnyei (2009), an individual-level analysis has an advantage over a statistical analysis in that it takes into account these apparently irrelevant pieces of information, which are capable of producing a more complete description of a subject's profile. In order to provide a more detailed picture of a gifted L2 learner, three case studies of the most talented participants, Alice, Joanna and Maria, will be presented. Two of them are faculty members in language departments of two leading Polish universities and one is an ESL teacher in the United States. The data come from tests, questionnaires, interviews and the psychological observation.

Alice

At the moment of the study, Alice was a 31-year-old assistant professor in the Scandinavian Languages Department at one of the leading universities in Poland. Alice was a perfect candidate for the study − a professional linguist, a teacher and a proficient language learner. She graduated in Norwegian and received her PhD in linguistics at the age of 29. Alice was a quadrilingual proficient in two foreign languages. Her native language was Polish. Her L2 was Norwegian, which she had mastered to level C2. She had lived in Norway for 4 years. Her L3 was English, which she had learned to level C2 (Certificate in Proficiency English). She was also communicative in German (B2).

Alice started to learn languages well after the critical period. She started to learn English at the age of 14, German at the age of 15 and Norwegian at the age of 20. Alice learned languages by herself, on private courses, at school, on university courses and abroad. Learning foreign languages was her hobby and passion. Her favourite techniques of learning were contacts with native speakers and reading books. She acquired each subsequent language with greater ease, which was probably the result of aptitude, persistence and motivation. As she claimed, the fact that she had learned only Germanic languages, as well as her metalinguistic knowledge of morphosyntax, facilitated the process of learning.

Alice started to speak very early; according to her parents she spoke in sentences at the age of two. She began to read and write in Polish when she was four. Her parents knew foreign languages, but they were not professional linguists. Her father spoke English fluently and her mother was communicative in Russian. Alice was an only child. Her parents strongly stimulated her development by reading books to her, playing games and devoting much time to her. She was a very good student and never had problems with Polish grammar. She evaluated her FL aptitude as very high. Especially in the field of phonetics she strived to achieve a native-like level. She prided herself on being taken for a native speaker of Norwegian. Alice's motivation was very high and connected with

her professional career. Her foreign language learning anxiety was low. She perceived herself as a practical, planning and closure-oriented, but at the same time holistic, intuitive and imaginative person. Psychological tests confirmed these self-observations.

As far as her FL aptitude is concerned, Alice can be described as a talented L2 learner and an accomplished multilingual. She obtained the maximal and close to maximal scores in MLAT 1, 2 and 5. Her general score was 178 (93%). In the TZJ she scored 100% of correct answers. She was also tested with the Wechsler Intelligence Scales, in which she gained very high results: the Verbal Comprehension index was 141 and the Memory and Resistance to Distraction index was 142 (the 3rd SD above the mean). It is worth mentioning that she finished all the tests well ahead of time. According to the psychologist conducting the test, she solved the tasks quickly and effortlessly. Her score on the PRSPAN was maximal.

As regards personality factors, the subject was characterised by ambiversion (i.e. a balanced level of extraversion/introversion) and quite a high level of neuroticism. Such a combination means that the subject is flexible in adapting to temporary situations and changing moods accordingly. These characteristics enable her to function well in situations demanding active engagement in social relationship and cooperation in a group, as well as working in solitude. She might display a tendency to overreact emotionally inadequately to a stimulus. Her significant feature was openness. Being open to new experience, curious of the world and new challenges, she easily adapts to changing situations. Another significant trait was conscientiousness. A high scorer on this trait is characterised by strong will, persistent in completing personal goals, meticulous, dutiful, reliable and thoughtful. Her most significant needs were those for autonomy and aggression. This indicates that the subject is a very independent and assertive person responsible for life situations. Surprisingly, she chose the avoiding-oriented style of coping with stress as often as the task-oriented style, which means that although she usually concentrates on the task and searches for methods which would hasten finding a solution to the problem, she may tend to procrastinate. Her locus of control was definitely internal. Internality of control indicates that the subject believes that she holds responsibility for all life events. Another significant characteristic was high emotional intelligence, which indicates that she can recognise and interpret her own and others' emotions well.

Summing up, Alice was a talented L2 learner and a very proficient foreign language user. She was very intelligent, with a dominance of verbal intelligence, which was revealed in early speaking and reading at the age of 4, as well as the intelligence test. Her memory was outstanding. Her most significant personality factors were neuroticism, openness, conscientiousness and internality of control.

Joanna

Joanna was a 33-year-old Polish woman, who, at the time of the research, had lived in her target language country for 7 years. She was an English philology graduate. She finished her studies with top marks. She used the English language almost exclusively, both at home and at work. Joanna was an ESL teacher in a secondary school in the United States. The language level of the subject – a recorded excerpt of speech – was very highly evaluated by three independent native speakers. The average score was 9 points on a 10-point scale; the language level was assessed as near-native. The psychologist noted a process of supplanting the native language of the subject – Polish – by the language that she used regularly – English. Joanna often resorted to English terms when defining words, and, as was concluded by the psychologist and as she herself declared, she thought in English. This is quite an interesting phenomenon, bearing in mind that Joanna started to learn English relatively late – after 14; apart from short trips, she had never been abroad, and she emigrated as an adult.

Joanna started to speak at the age of 2.5 and read in the first class of primary school. She was an only child and her parents had always been keenly interested in her development and education; however, they virtually knew no foreign languages. At the time of the study, her husband and children were English-speaking, and English was her everyday communication language. She was always very good at Polish and never had problems with Polish orthography.

As regards choices and preferences, her significant characteristic was very high assimilative motivation – her ultimate target was a full assimilation in the target language country. What is more, she liked learning languages, which gave her a great deal of satisfaction. Joanna naturally chose immersion as the most effective method of learning. She strongly opted for a communicative approach in foreign language learning, which was probably the result of not only emigration, but also a course in methodology during her studies, emphasising this method as the most effective, as well as her occupation. Joanna claimed that she loved her job which gave her a lot of satisfaction. Like most of her colleagues, she spent much time with her students on extracurricular activities, such as, for example, trips, picnics, visits to museums or sport games. She also worked with students-immigrants helping them to assimilate in the new school. Learning a foreign language was easy for her and the easiest skills were, not surprisingly, speaking and listening. As she declared, she did not have special preferences for learning grammar and vocabulary, as she acquired these subsystems naturally. Joanna had both very specific learning preferences and learning styles. The intuitive and global styles prevailed, spontaneity and organisation were in balance. Ambiguity tolerance was quite high. She rightly perceived herself as impulsive, spontaneous, emotional and practical at the same time. She accurately evaluated her language aptitude as high. She declared no anxiety in learning and using a language.

As far as her cognitive abilities are concerned, Joanna represented a moderately above-average intelligence; the profile of verbal abilities was balanced, whereas the profile of non-verbal abilities was not. The subject gained very high scores in the MLAT. Her results in Parts 1, 2 and 5 of the MLAT investigating STM and phonetic abilities were maximal; in Part 3 (vocabulary), she scored 90% and in Part 4 (grammar sensitivity) 76%. Joanna's total was 173. Her score ranked in the 99 percentile. In the TZJ, her results were placed in the ninth sten (84%). She gained the lowest scores for Grammar and Vocabulary: 73% and 83%, respectively. These results indicated the dominant language of the subject – English.

Joanna was a very emotionally stable person, characterised by well-developed emotion control. Her most significant characteristic was extraversion, that is a high need for external stimulation, activity, sociability and ease in establishing personal contacts. This score indicates that the subject is open and direct in communicating needs and feelings, and can also be self-centred. Her second important feature was openness to experience. She was also quite a conscientious person, persistent and systematic. Her most developed need was that for autonomy. This means that she is independent, self-confident, stubborn and resolute. A need for change was also high, which means that the person is perceptive, spontaneous and quick in her reactions. Her locus of control was definitely internal. Such a score indicates that she believes that she holds responsibility for all life events. The task-oriented style prevailed; however, the avoiding style was also present. This means that she usually establishes strategies of action, but she also tends to procrastinate.

To sum up, Joanna was a very talented foreign language learner. Joanna had a score of 90% of correct answers in the MLAT, which is an outstanding result (cf. Ehrman, 1998). In the third part (vocabulary), which is the most predictive for speaking, the results were 33 in Ehrman's study and 45 in the case of Joanna. Joanna was a prototypical extravert, open to new experience, self-confident, liking changes and active.

Maria

Maria was a 26-year-old assistant in the Chinese Language Department. She was a doctoral student of the Chinese language and a fifth-year student of Arabic philology. She was a polyglot, able to communicate in 11 languages. Her native language was Polish. Her L2 was Chinese, which she had mastered to level C2. Her native-like proficiency at speaking was confirmed by both native and non-native co-workers, speakers of the Chinese language. She was also advanced in English (Certificate in Advanced English), German (C1) and Arabic (C1). Her declared knowledge of other languages – Swedish, Italian, Japanese, Croatian, Russian, Hebrew and Turkish (A2/B2) – was confirmed by positive (good and very good) marks in her student record book and in school reports. She started to learn Chinese at the age of 20.

Maria learned languages virtually under all conditions: by herself, at private lessons and on private courses, at school, on university courses, and during a scholarship abroad. Learning foreign languages was her hobby and passion. She acquired each subsequent language with greater ease, which was probably the result of aptitude, persistence and motivation. As she claimed, she found learning Slavonic languages the most difficult because of their similarity to Polish. Learning new writing systems was not difficult for her.

She started to speak very early, but she was not able to provide the exact date. She began to read and write in her native language when she was 4. At the age of 5, she was fluent in these skills. Her parents and grandparents did not know any foreign languages, but they strongly stimulated her development by giving her 'adult' books, games, puzzles and construction toys and answered all her questions. She was a very good student and never had problems with Polish grammar.

Maria's motivation to learn languages was very high. She gave many reasons for learning foreign languages, such as, for example, interest, hobby, profession, aptitude, curiosity and a need for new challenges. As far as her learning preferences are concerned, Maria strongly believed that a professional foreign language user should first have a strong formal educational background and then master a foreign language in the natural environment, not neglecting formal instruction at any stage of learning (dictionary work, grammar instruction with a handbook). Maria had had plenty of opportunities to test her speaking skills in the target language country: Chinese during a 1-year scholarship in China, Arabic during a few 1-month stays in Saudi Arabia and Italian and German during stays in Italy and Austria.

Maria was a typical individualistic learner who preferred formal methods, explicit grammar instruction accompanied by a lot of exercises and memorising lists of words. She chose to learn by reading and usually learned words in context. She liked to use her favourite proverbs and idioms in different languages. She considered her strategies efficient; however, she underlined the role of communication with native speakers. The preference for formal instruction might be the result of methods preferred by oriental teachers (Grammar-translation and audiolingualism), as well as the introverted personality type represented by Maria.

Maria was a perfectionist. Especially in the field of phonetics she strived to achieve native-like level. She prided herself on being taken for a native speaker of Chinese – a tone language, especially difficult for a European. She perceived herself as a hard-working, well-organised, careful, thoughtful, reliable, analytical and orderly person. Psychological tests confirmed these observations. Maria evaluated her linguistic aptitude as very high. As she declared, "Comparing myself to others I realise that learning foreign languages comes faster and with greater ease to me, which I consider a real gift from nature. I think my linguistic abilities are high and I am not going to waste them." Her level of foreign language learning anxiety was relatively low.

Maria had a large intellectual potential, but particular subtests scores were very dif-

ferent. Very well-developed verbal reasoning, very rich vocabulary and a very high score in Memory and Resistance to Distraction index (130) outlined Maria's cognitive profile. In the WM test (PRSPAN), Maria achieved an outstanding result of 100% of recalled words. The subject gained very high scores in both the MLAT and the TZJ. Her score in Part 1 of the MLAT was 93%, whereas in Parts 2 and 5 it was 100%. In Part 3, she scored 68% and in Part 4 − 66%. Her score ranked in the 99 percentile. In the TZJ, she answered all the questions correctly.

As far as her personality is concerned, Maria was a very introverted and serious person keeping distance in interpersonal contacts. She was a reflective individual who preferred to work alone. She was emotionally balanced, calm, doing well in difficult, stressful situations, and her emotional reactions were adequate to a situation. Maria's other significant trait was high conscientiousness. High scorers on this trait are characterised by strong will, persistent in completing personal goals, meticulous, dutiful, reliable and thoughtful. Her openness to experience was average – this means that the subject is practical, keeping balance between conservative values and fascination with the new. Her interests might be unconventional. Her agreeableness was low. Such a score means that she can be sceptical, competitive, and often aggressive in personal relationships. She revealed a high need for achievement, which indicates that she is hard-working and goal-directed. Other highly developed needs were those for endurance, order, aggression and autonomy. This indicates that the subject is hard-working, effortful, persistent in achieving her goals, keeping to the plan, independent, autonomous, stubborn and indifferent to the feelings of others. Her need for aggression was also high, which indicates that she tends to be competitive rather than cooperative. The emotional intelligence quotient of the subject was average. Maria also displayed a medium level of internal control. This, in turn, means that she generally believes in her control over life situations; however, she might search for reasons for her failures outside herself. She chose mainly the task-oriented coping style. This means that in stressful situations she concentrates on the task, searches for methods which would hasten finding a solution to the problem. She treats stress as a challenge.

To sum up, Maria is an example of a talented foreign language learner, whose most striking cognitive feature is outstanding memory. Her STM (Digit-Symbol Coding, Digit-Span, MLAT 1 and 5), as well as WM (the PRSPAN, backward Digit-Span) results provided evidence for her possession of an efficient central executive and a capacious phonological loop. Her analytical and phonetic abilities were also well developed. Maria preferred traditional learning methods. She was an introverted, very hard-working, intelligent and autonomous foreign language learner.

All the three subjects were gifted foreign language learners and very proficient foreign language users. Two of them, Alice and Maria, were very intelligent, with a dominance of verbal intelligence, which was revealed in early speaking and reading at the age

of 4. They were characterised by very good memory and high phonetic abilities. As far as personality features are concerned, they were orderly, autonomous, controlling, consistent and analytical. They preferred individual work and traditional methods of learning. The third person, Joanna, displayed a diametrically different cognitive-emotional profile. Her intelligence was only above average; her memory was good, but only with respect to verbal material. She was extraverted, sociable and cooperative. These characteristics enabled her to achieve near-native fluency in speaking. Joanna definitely preferred group work, communicative tasks and immersion. Such a differentiation was probably the result of personality, but also of a teaching method promoted by a teacher. All the three learners were very conscientious, well-organised and hard-working; They had the feeling of control over a situation and coped well with stress. These positive features might be connected with their profession – all the three subjects were teachers of a foreign language. In line with Dörnyei's (2005) suggestion, two of the subjects, Alice and Joanna, displayed high openness to experience associated with high intellectual curiosity. All the three learners were very highly motivated and interested in the target language and the target language culture. They can be described as mature, autonomous, persistent, ambitious and competitive. Probably these factors in connection with high aptitude determined their success in learning foreign languages.

6.7. Discussion

The present chapter has been devoted to reporting the findings of a study conducted on gifted L2 learners, which sought to determine what cognitive and personality factors correlate with and predict FL aptitude. In line with this goal, fifteen hypotheses were formulated. For the sake of clarity, the findings of the study are discussed in accordance with the hypotheses.

H1. *Gifted L2 learners will score high on all FL aptitude tests*. The results presented in section 6.6.1. clearly show that the gifted L2 learners have strong ability. Their mean MLAT score ranked in the 99th percentile. They scored very high in MLAT 1 (95.5%), MLAT 2 (94.2%) and MLAT 5 (92.6%). The results in MLAT 3 and 4 were consistently lower, owing to the fact that English was not an L1 for the participants and that the level of difficulty of these subtests is higher as compared to Parts 1, 2 and 5. A similar tendency was observed in research on English speakers for whom Parts 3 and 4 were also the most difficult (cf. Ehrman, 1998; Novoa et al., 1988). On the basis of these observations, it can be assumed that if the MLAT was adapted for the use with Polish learners, the results would have been much higher, comparable to those in the TZJ. In the case of the TZJ, all the results were very high, but far less diversified than those in the MLAT. The mean score for the full scale was 94% of correct answers and the 'ceiling effect' occurred, which might have been expected, owing to the fact that the test

was not devised as a tool for the selection of gifted learners. Similarly to the MLAT, where Part 4 measuring grammar sensitivity turned out to be most difficult for the participants, in the TZJ the most difficult was Grammar, partly measuring inductive learning ability.

Moreover, significant differences in both tests were detected between the gifted and non-gifted foreign language learners, with those of the gifted learners being significantly higher. The differences were the greatest in the TZJ (the general score, Grammar and Vocabulary) and the smallest in MLAT 2. Differences between the groups were striking. For example, in Vocabulary 28 (64%) gifted L2 learners answered all the questions correctly, whereas in the non-gifted group only 4 (5%) people gained such a score. Accordingly, in Grammar 12 (27%) gifted L2 learners scored 100% and in the non-gifted group, only 2 (2.5%). Moreover, in the non-gifted group many of the learners scored below 50%, which was never the case in the gifted group. In MLAT 2 the results were much less differentiated, which means that the phonetic aptitude test was easy for both groups of learners. In line with Skehan (1998), this result can be treated as evidence in support of the hypothesis that phonetic aptitude is independent of intelligence and of other language abilities. Summing up, it is concluded that the gifted L2 learners have strong phonological, memory and analytical abilities, as well as a wide range of L1 vocabulary. Therefore, Hypothesis 1 is fully corroborated.

H2. *Gifted L2 learners will score high on intelligence tests (comparing to the norm); They will score higher on the Verbal Comprehension index and the Memory and Resistance to Distraction index than on the Perceptual Organisation index.* The hypothesis set with respect to the role of IQ in gifted L2 learners is fully confirmed. It turned out that the IQ of the participants was high, with the verbal intelligence being higher than the performance and with high Memory and Resistance to Distraction index which measures STM and WM. These results confirmed that the IQ of the gifted L2 learners is higher than that in the normal Polish population. Contrary to Skehan's (1998) claim that gifted L2 learners are not characterised by a very high IQ level, the present study provides evidence that high and very high intelligence accompanies high FL aptitude.

Research on the relationship between FL aptitude and intelligence is surprisingly limited, given the importance of this factor in human cognitive abilities in general and in FL aptitude in particular (cf. Carroll, 1993; Grigorenko et al., 2000). Two main theories dominate the discussion of the role of intelligence in FL aptitude. The first theory limits the effect of intelligence exclusively to analytic abilities (cf. Sasaki, 1996; Skehan, 1998), whereas the other, based on early research on gifted L2 learners (cf. Novoa et al., 1988), ignores its role in the development of linguistic talent. In has to be emphasised that most studies examining the relationship between linguistic abilities and other cognitive abilities have focused only on performance (fluid) and verbal (crystallised) IQ (see Chapter Three, section 3.1.3.), neglecting the third IQ domain – memory, which is surprising, given its relevance to linguistic giftedness. This line of reasoning separates intel-

ligence from memory, which is a fundamental mistake because memory is an integral part of intelligence (cf. Brzeziński et al., 1996; Hornowska, 2004; Nęcka, 2003; Wechsler, 1997). The assumption guiding the study reported here was that analyses of the results of the Wechsler Intelligence Scale and correlations between the subtests of the Wechsler Intelligence Scale and FL aptitude components can explain a portion of variance in FL aptitude among learners.

H3. *Gifted L2 learners will obtain very high or high scores on the following Wechsler Intelligence subscales: Vocabulary, Similarities, Information and Comprehension (verbal IQ).* This hypothesis was based on an inspection of the Wechsler Intelligence Scale subtests measuring verbal intelligence (Brzeziński et al., 1996), which include abilities similar to those measured by FL aptitude tests. The verbal scales measure crystallised intelligence, which partly depends on genetic factors and partly on acquired knowledge. Especially, the measure of Vocabulary, which indicates verbal comprehension, a native language proficiency, a range of vocabulary and intellectual readiness to define words, is highly saturated with the *g* factor. Analogically, both FL aptitude tests, that is the MLAT and the TZJ, include a measure of vocabulary; however, the measure of vocabulary in the MLAT is totally different from those in the Wechsler Scale and the TZJ. Evidence for a correlation between verbal IQ and FL aptitude was provided by Sasaki (1996). Moreover, FL aptitude is believed to be a residue of native language abilities (cf. Carroll, 1993; Sparks & Ganschow, 2001).

This hypothesis is also fully corroborated. The highest result on the verbal scale was obtained in Comprehension (the third SD above the norm) and in Vocabulary, Information and Similarities – the second SD above the norm. This indicates that verbal abilities in the gifted L2 learners are very well developed. They have a wide range of vocabulary in both Polish and English, are good at defining words, are able to classify and create concepts, perceive relations between them, and differentiate between important and unimportant information. They are also good at logical and abstract thinking, analogical reasoning and drawing conclusions. Their abilities involve efficient retrieval and reproduction of memorised verbal material. These characteristics are ascribed to people who read a lot and are well-educated (cf. Hornowska, 2004).

H4. *Gifted L2 learners will obtain high scores on the following Wechsler Intelligence subscales: Arithmetic, Digit-Span and Digit Symbol Coding (the Memory and Resistance to Distraction index).* These subtests measure STM and WM, focusing of attention and resistance to distraction – abilities important in learning a foreign language (cf. Robinson, 2002b; Skehan, 2002). In line with the results of previous research conducted by the present author, it was expected that the participants' results on these tests would be not as high as those on verbal intelligence tests because they are based on numerical material (cf. Biedroń & Szczepaniak, in press). This hypothesis is partly confirmed. The results of the memory subtests were high, but comparable to those obtained in the verbal scales. This indicates a balanced high level of the gifted L2 learners in verbal and mem-

ory abilities. Moreover, in the case of tests based on numbers, emotional factors might have had an impact on the participants' performance. The most difficult subtest was Arithmetic, which was probably the result of emotional tension. Some of the subjects' low confidence with respect to mathematical abilities evoked anticipation of failure. This discouraged them and negatively influenced their performance. The memory abilities as measured by the Wechsler Scale were high and in some talented L2 learners amazingly high. Half of the participants scored over 130 points in the Memory and Resistance to Distraction index, which is a very high result – the third SD above the mean. Four participants whose scores were close to the maximum (between 144 and 150 points) were very advanced polyglots, the highest scoring in the MLAT.

H5. *Gifted L2 learners will obtain very high scores on all STM and WM tests. Their scores on memory tests will be significantly higher than the scores of non-gifted learners, that is mainstream English philology students* (cf. Dörnyei, 2005; N. Ellis, 1996; Sawyer & Ranta, 2001). In the previous study, Biedroń and Szczepaniak (in press) tested STM and WM abilities in gifted foreign language learners. The analysis revealed that STM and WM abilities in the gifted L2 learners were higher than in the non-gifted L2 learners. Moreover, the gifted L2 learners obtained higher scores than the non-gifted L2 learners on memory tests that are based on linguistic material than on tests based on numerical material (see Chapter 2, section 2.7.). In the present study, the results of the gifted L2 learners in MLAT 1, MLAT 5 and the PRSPAN, which measures WM, were compared to those of the non-gifted L2 learners. As expected, in all memory tests significant differences between the groups were observed, with those of the gifted L2 learners being much higher. Therefore, Hypothesis 5 is confirmed. As has already been mentioned, the gifted L2 learners possess very high verbal memory capacity, which fully conforms to the theoretical background and the empirical findings (cf. Ioup et al., 1994; Miyake & Friedman, 1998; Obler, 1989; Robinson, 2002b; Sawyer & Ranta, 2001; Schneiderman & Desmarais, 1988b; Skehan, 1998). The results of both studies are in line with Kane et al.'s (2008) hypothesis that WM and STM are much more domain--specific in people with high IQ, for example university students, than in those from lower IQ groups. The group of the gifted L2 learners comprised highly selected foreign language learners, characterised by high general and high verbal IQ.

A strong correlation between L1 WM capacity and L2 WM capacity, and between WM capacity and L2 proficiency has been consistently reported by researchers (see Chapter Three, section 3.2.3.) but, generally, evidence for such a correlation with STM is scarce. On the other hand, the accuracy of measures of WM capacity and STM span is debatable. Kane et al. (2008) argue that some STM span tasks seem to measure executive control, which is a part of WM. The results of the present study accord with Kane et al.'s (2008) and Engle et al.'s (1999) conclusion that neither STM nor WM tasks are pure reflections of these constructs. To the extent that STM tasks demand controlled attention, they also reflect the WM construct. Moreover, the test results reflect individual

differences between the participants with regard to their intelligence or the level of cognitive development. As a result, what is clearly a STM task for one participant could be a WM task for another. This can be observed in MLAT 1, MLAT 5, Digit-Span backward and the PRSPAN – the tests in which a participant has to hold in memory an item for a period of time from a few seconds to a few minutes and to perform some operations on the same or different material simultaneously. It is possible that some of the participants relied on efficient mnemonic strategies worked out in the process of learning languages, which can be used unconsciously. Given the foregoing, great caution should be exercised in analysing data and drawing conclusions regarding measurements of memory capacity.

On the basis of the memory tests, it is concluded that the participants have a highly efficient phonological loop, whose function is to store unfamiliar sound patterns while more permanent memory records are being constructed (Baddeley et al., 1998, p. 158). The phonological loop is a limited-capacity system relying on LTM and the knowledge of an L1 (see Chapter Three, section 3.2.3.). Acquiring new words requires prolonged learning, especially in the case of the acquisition of a phonologically novel material by adults with a mature phonological system. The research confirms the advantage of polyglots over less advanced learners to rely on the knowledge of all the languages they know, which facilitates the learning of subsequent languages.

The high score in the PRSPAN, a test of WM which requires a great amount of attention, confirms that the central executive works more efficiently in gifted L2 learners. Variation in WM capacity causes significant variation in general intelligence and executive attention is the central factor in this variation (cf. Kane et al., 2008). The central executive triggers and sustains a goal-directed behaviour by maintaining relevant information in an active state or retrieving that information under conditions of interference, distraction, or conflict. This means that the learners who score high on WM capacity tests, like the PRSPAN, are more able to notice and select relevant information and to inhibit irrelevant information, which can make them more capable of noticing corrective feedback (cf. Mackey et al., 2002; Robinson, 2002b). Summing up, the extraordinary memory abilities of the gifted L2 learners confirm Skehan's assumption that the most significant characteristic of exceptionally successful learners is the possession of unusual verbal memory (1998). However, on the basis of the results of this study it is not possible to decide whether superior memory abilities in gifted L2 learners are inborn or if, rather, they evolved as a result of the multiple experience of learning languages.

H6. *The number of languages which gifted L2 learners have learned will correlate with FL aptitude factors.* According to Ehrman (1998, p. 50), the subjects who score high on the MLAT tend to have studied foreign languages previously (cf. Grigorenko et al., 2000). The participants of the study were multilinguals who spoke four-five languages, being advanced in two of them on the average. Contrary to Ehrman's findings, FL aptitude as measured by the MLAT was not correlated with the number of languages

the participants had learned, irrespective of their proficiency level. On the other hand, the number of the previously learned languages correlated significantly with the TZJ general score and its subtests, which might suggest that the factor of verbal intelligence, which is partly measured by the TZJ, affected the learners' success. In view of the fact that the verbal intelligence of the subjects was excellent and that the TZJ correlated with both the number of languages previously learned by the participants and the number of languages at an advanced level, it is hypothesised that in the case of the gifted L2 learners, being at the same time students of languages or professional linguists, the factor of verbal intelligence significantly affects their success in learning languages. This hypothesis needs further empirical investigation.

Another interesting conclusion that can be drawn on the basis of the present study and the previous findings (cf. Ehrman, 1998; Grigorenko et al., 2000) is the dynamic character of FL aptitude, which substantially increases with each acquired language. This hypothesis, if confirmed, would undermine the stability of the construct as well as its assumed independence of experience and metalinguistic awareness of a testee (cf. McLaughlin & Nayak, 1989; Nayak et al., 1990; Kemp, 2001). In general, Hypothesis 6 is only partly confirmed, as only the TZJ correlated with the number of languages previously learned by the participants.

H7. *Gifted L2 learners will score high on openness to experience and conscientiousness (the Five Factor Model)*. Among the Five Factors of personality proposed by McCrae and Costa (2003), openness to experience, due to its relationship to intellectual functioning and high dependence on genetic factors, seems to be the most powerful modifying personality variable that affects FL aptitude. On the other hand, conscientiousness, related to impulse inhibition, self-discipline and motivation (cf. Corno et al., 2002; Dörnyei, 2005), is intuitively ascribed to successful language learners. As has already been stated in the introduction, the relationship between FL aptitude and personality factors and learning styles is poorly investigated; therefore, hypothesising about their impact on the development of giftedness is tentative.

Hypothesis 7 is partly confirmed. Although the gifted L2 learners gained the highest scores on openness and conscientiousness, these variables placed them in the average rank. A high score on openness means that the subjects can be creative, imaginative, curious, flexible, novelty seeking, untraditional and interested in art, whereas a high score on conscientiousness indicates that they can be systematic, efficient, organised, responsible, reliable, persevering and self-disciplined. All these characteristics are likely to exist in the gifted L2 learners, but their level is moderately high. What is more, no statistically significant differences in personality factors between the gifted and non--gifted L2 learners were observed, although both openness and conscientiousness were lower in the non-gifted sample. Because in the previous study (cf. Biedroń, 2010b), on a partly different sample of non-gifted learners, a statistically significant difference in openness to experience between the groups was observed, it was suggested that this

factor can modify FL aptitude. This hypothesis was confirmed by a regression analysis in which openness turned out to explain a small, but statistically significant part of the variance in FL aptitude. Moreover, 75% of the gifted L2 learners declared artistic interests, hobbies, activities and talents, such as playing a musical instrument, painting, singing and dancing, which indicates a reasonable degree of creativity involved in this factor.

Summing up, no strong evidence has been found that linguistically gifted individuals are more conscientious than less gifted individuals, which suggests that motivation, effort and good organisation of work cannot compete with natural giftedness. A variable much more promising for further investigation is openness to experience connected with intellectual curiosity and flexibility, which are likely to foster strategy development and autonomous behaviour.

H8. *Gifted L2 learners will score high on the task-oriented style of coping with stress.* Similarly to the results on openness and conscientiousness, the score of the gifted L2 learners on this variable fell within the average range, although definitely dominated the two other, the emotional and avoiding styles. No statistically significant difference in this style between the samples was observed, but the score of the non-gifted L2 learners was lower. Hypothesis 8 is partly confirmed. The task-oriented coping is a response leading to problem resolution by purposeful confrontation, cognitive restructuring or changing the situation This means that gifted L2 learners do not avoid confrontation in a stressful situation, but try to constructively solve the problem. This method of problem-solving is connected with the controllability dimension, the subjectively perceived coping ability and the subjective perception of academic stress (cf. Chapter Four, section 4.1.5.).

H9. *Gifted L2 learners will score high on internality of control*. This factor, like the styles of coping with stress, is related to general functioning of a person; however, there is evidence that it facilitates academic success (cf. Arlin & Whitley, 1978). A study on successful foreign language learners (Biedroń, 2008) revealed that they are internally-oriented attributing their success to controllable, high, sustained effort. As expected, Hypothesis 9 is corroborated. The gifted L2 learners are internals, that is they attribute life events to internal factors or factors which are controllable, for example effort and determination. The task-oriented style of coping with stress and internality of control, accompanied by high motivation, assertiveness and openness to experience are the qualities identified in gifted autonomous learners (cf. Betts, 2009; Housand, 2009).

H10. *Gifted L2 learners will score high on emotional intelligence.* Despite quite promising recent research results on emotional intelligence in foreign language learners (cf. Dewaele et al., 2008), the present study did not confirm that this variable affects FL aptitude. The score of the gifted L2 learners was average, which means that this factor might facilitate the process of foreign language learning, but not in the case of the gifted L2 learners. Thus, Hypothesis 10 is evidently rejected.

H11. *Gifted L2 learners' scores on openness to experience, conscientiousness, the task--oriented style of coping with stress, locus of control and emotional intelligence will be higher than the scores of non-gifted L2 learners*. This hypothesis is partly supported. As has been explained above, none of the personality factors revealed statistically significant differences between the gifted and non-gifted L2 learners. On the other hand, all the factors, apart from emotional intelligence, were higher in the gifted sample. The lack of statistically significant differences does not entitle the researcher to draw any definitive conclusions as regards personality factors in gifted L2 learners and confirms the non-linear relationship between personality factors and success in learning a foreign language suggested in the dynamic systems theory (cf. Dörnyei, 2009). What makes the matter even more complex, personality factors measured in this study are non-language-specific, which might have affected the results. Finally, it is possible that certain factors appear with greater intensity in particular groups of individuals, for example, university students or language professionals. In this case, they would depend on other variables, independent of FL aptitude. In order to analyse these complex relationships further research on larger samples with normal distributions of FL aptitude is needed.

H12. *Gifted L2 learners will score high on the analytic style (Ehrman & Oxford, 1995; Oxford, 1990b) and second language tolerance of ambiguity (Ehrman, 1998; Ehrman & Oxford, 1995).* According to Dörnyei (2005), learning styles are partly based internally and partly result from personality traits, past learning experiences, abilities and skills. The analytic style is associated with step-by-step, controlled and planned mood of working, a preference for logical thinking and thorough explanation. Contrary to the results of research by Oxford (1990b), and Ehrman and Oxford (1995), in the present study the analytic style was not higher in the gifted sample than other cognitive learning styles, on the contrary, it was lower than its counterpart – the global style. What is more, the result of the non-gifted sample was almost identical to the result of the gifted sample. Therefore, it is concluded that the analytic style does not contribute to success in learning a foreign language, at least with respect to the studied samples. In fact, the non-gifted L2 learners scored higher on all the learning styles measured by the SAS (Oxford, 1995) than the gifted L2 learners, which excludes any plausible interpretation of the relationship between FL aptitude and cognitive learning styles.

A slightly different situation was observed in the case of second language tolerance of ambiguity. Although the level of this style was average in both groups and did not differentiate them, the gifted L2 learners turned out to be slightly more tolerant of ambiguity than the less gifted subjects, the difference being on the verge of statistical significance. What is more, this style predicted some variance in FL aptitude, in that higher levels of FL aptitude are accompanied by higher levels of ambiguity tolerance. Second language tolerance of ambiguity is a personality learning style (Dörnyei, 2005), which enables a learner to accept inconsistencies in the target language, that is to be more flexible and open to new experience. In this regard, this style seems to resemble the

personality trait of openness to experience. As in both tests the gifted learners gained higher results than the non-gifted learners, it is possible that personality characteristics measured by these tests facilitate SLA. Summing up, only the second part of Hypothesis 12 is confirmed.

H13. *FL aptitude factors will correlate with cognitive factors (WM and intelligence).* According to Sasaki (1996) and Skehan (1998), analytic abilities are generally intelligence-dependent, whereas memory and phonetic abilities are not. This suggests that analytic abilities should correlate more significantly with general IQ score than other language abilities. Interestingly, only Grammar (the TZJ) correlated with the general IQ, whereas MLAT 4 measuring grammar sensitivity did not. In fact, most of the MLAT (except for Parts 2 and 3) correlated with the intelligence scales, namely verbal, performance (non-verbal) and the Memory index, in which case the correlation was the highest. Generally, there were more and stronger correlations between the general MLAT, MLAT 1, MLAT 4 and MLAT 5 and the memory scales than the other IQ scales. This observation is in contrast with Sasaki's and Skehan's conclusions because it provides evidence for a significant influence of the third intelligence factor – memory – on FL aptitude. This indicates that taking into account intelligence tests measuring only general or verbal *versus* non-verbal intelligence offers limited information about the relationship between FL aptitude and intelligence. If a three-factor solution, that is one including the factor of memory, is applied, the pattern of correlations turns out to be different.

In a similar vein, the TZJ correlated with all the intelligence scales, but its correlations with the general IQ and the verbal IQ were stronger than those of the MLAT. Only Grammar, which measures inductive learning ability, correlated more strongly with the memory subtests than other TZJ scales. This suggests that the pattern of correlations depends to a great extent on a task type in a particular subtest. The TZJ includes tasks more reflecting crystallised (knowledge, vocabulary) and general intelligence, whereas the MLAT reflects intelligence to the extent that it measures the factor of memory. The MLAT general score correlated with WM capacity and the correlations between MLAT 1 and 5 measuring memory and WM were close to significant. Analogically, the TZJ correlated positively with WM (especially Grammar, including inductive ability task). The positive correlation between WM and FL aptitude is interpreted as evidence supporting the hypothesis that WM is a part of FL aptitude. Summing up, both FL aptitude tests correlated with a number of intelligence tests as well as WM, which fully corroborates Hypothesis 13.

H14. *There will be few correlations between personality factors and FL aptitude factors.* This hypothesis assumed the absence of a relationship rather than its presence between FL aptitude and personality. It was based on Dörnyei's (2005, 2009, 2010) assumption that personality factors interplay with foreign language learning outcomes in a non-linear way and his view on individual differences within a dynamic system theory

paradigm (see Chapter Four, section 4.4.). This hypothesis is confirmed. Personality factors in the gifted L2 group did not correlate with FL aptitude. However, in the non--gifted group a few correlations were found, which suggests that in learners with a normal distribution of FL aptitude, personality factors can work as catalysts, facilitating or debilitating the learning outcomes. Neuroticism and the emotional style of coping with stress in general negatively affected FL aptitude tests, especially those testing memory, whereas openness to experience and conscientiousness as well as second language tolerance of ambiguity revealed a positive effect.

H15. *Memory and intelligence will explain some variance in FL aptitude, whereas among personality factors only openness to experience is likely to explain some variance in FL aptitude. Learning styles will probably not explain variance in FL aptitude.* This hypothesis was the most tentative one, as it was based only on indirect evidence and theoretical knowledge. What is more, the sample of the gifted L2 learners was small and the distribution of cognitive abilities (intelligence and FL aptitude) was not normal; therefore, all the analyses and conclusions must be treated with caution, rather as tendencies than ultimate answers. As we can see in figure 6.3., illustrating the relationships between the independent variables (cognitive and personality factors) and the dependent variables (the MLAT and the TZJ), the best cognitive predictors of FL aptitude components measured by the MLAT were the memory factors (the Memory and Resistance to Distraction index and WM), whereas the best predictor of the TZJ was verbal intelligence. This implies that the memory factors explained some variance in the MLAT score; WM explained 16.9% of the variance in the general MLAT and the Memory and Resistance to Distraction index explained 9.9% of the variance in the general MLAT. Verbal intelligence explained from 9.3% to 15.9% of the variance in the TZJ subtests.

Owing to the inclusion of the non-gifted learners' scores on personality tests in the regression analyses, the number of observations increased and some interesting tendencies were observed. Openness to experience turned out to be quite a good predictor of FL aptitude explaining from 5.5% of the variance in MLAT 1 to 12.6% of the variance in the TZJ. Other personality factors which positively affected FL aptitude were conscientiousness (effect on MLAT 5), the task-oriented style of coping with stress (effect on MLAT 1, 5 and the TZJ) and a personality learning style – second language tolerance of ambiguity. This style explained some variance in MLAT 5 and the TZJ.

Two personality factors, namely extraversion and neuroticism negatively affected FL aptitude. The subtests including the memory component (MLAT 1 and 5) and Grammar were negatively affected by neuroticism connected with negative affectivity. As has already been stated, anxiety involved in neuroticism produces negative learning outcomes (Corno et al., 2002; Dörnyei, 2005; McCrae & Costa, 2003). The negative effect of extraversion on FL aptitude accords with this line of research which interprets it as a factor rather negatively correlated with the learning outcomes (cf. Dewaele, 2009; Dörnyei, 2005).

Among learning styles, two turned out to be negatively correlated with FL aptitude – open and closure-orientedness. This impact is rather difficult to explain, especially the negative effect of the open style, bearing in mind that the factor of openness to experience and second language tolerance of ambiguity had a positive effect on FL aptitude. A plausible explanation is that the specificity of the SAS questionnaire resulted in this ambiguity. Statements associated with the closure-oriented style sound like attributes of a person 'I want to be' and those linked to the open style like characteristics of a lazy and disorganised person (cf. Appendix C). It might be that the choice of the statements reflected rather wishful thinking than the real situation. Therefore, it seems that the SAS is not a very reliable measure of learning styles. Summing up, Hypothesis 15 is confirmed as far as the role of intelligence, WM and personality factors as predictors of FL aptitude is concerned. The case of learning styles is ambiguous and seems to fit in with the dynamic systems theory in which the relationships among individual differences are dynamic and non-linear (cf. Dörnyei, 2009).

As far as the qualitative part of the study is concerned, the gifted L2 learners emerge as highly motivated, hard-working, persistent, self-efficacious, creative, self-aware and autonomous foreign language learners. The early ages of starting to speak and read in their L1 indicate high inborn verbal ability on the one hand, and parental investment of time and energy in their children intellectual development, on the other.

In the second part of the study, three cases of the most talented participants were described. In general, all the three learners fit in with the general profile which emerged from the quantitative analysis in the previous section. Their common characteristic was a high level of FL aptitude, higher for Parts 1, 2 and 5, and lower for Parts 3 and 4 of the MLAT. The TZJ score of two participants, Alice and Maria, was maximal; in the case of Joanna it was lower, which can be attributed to the high correlation of the TZJ with verbal intelligence which is partly dependent on L1 knowledge. As Joanna used mainly English, her mother tongue was deteriorating. Alice and Maria possessed a very high IQ, with verbal intelligence being much higher than performance, as well as astounding memory. Among personality traits, conscientiousness, internality of control and the need for autonomy were shared by all the three subjects; Alice and Joanna were also open to new experiences. Their preferred learning techniques and strategies were varied, but this should be rather attributed to their different personalities, occupations, and, generally, life situations. It is important to emphasise that the participants were born and raised in middle-class, mainstream-society families in which parents' priority is the education of their children as well as supporting their intellectual, emotional and social development. Even if the parents did not know any foreign languages and did not have a university degree, they perceived education as a value. In such homes children have a chance to fulfil their intellectual potential and to develop a positive self-image. These conditions, next to a natural gift, are necessary for a talent to develop (cf. Gagné, 2000; Sękowski 2004). Concluding, a high

level of FL aptitude or intelligence is a gift from nature, but through interpersonal interactions and personal choices these natural gifts transform into talents.

6.8. Limitations of the study

The design of the study, the choice of participants, instruments and, consequently, the conclusions derived from it suffer from some limitations which should be addressed in the concluding section. The first problem regards the design of the study, which was correlational and differential and, therefore, did not indicate the cause-effect relationship between the factors. In order to obtain data referring, for example, to the impact of learning languages on WM development, an experimental design should be applied and a longitudinal study starting in early childhood of the participants conducted. In such conditions a researcher would be able to compare the effect of learning languages on WM capacity provided he/she was able to control for all variables. Such a study would be very difficult, if not entirely impossible, to conduct for various reasons. First of all, due to its complexity, it will have to be limited to one or two independent variables; secondly, the dropout of the participants could terminate its completion; and, finally, the researcher might not be able to monitor all possible variables, such as the health of the participants, their family situation or economic constraints. What is more, given that nowadays all children start learning a foreign language at the age of 7, it would be impossible to examine them before this time because of the lack of reliable instruments. The final argument against the experimental design is the lack of empirical evidence in support of the hypothesis related to the possibility of a quantitative rise in cognitive abilities in general (cf. Carroll, 1993; Jensen, 1997; Kane et al. 2008). Therefore, in line with the previous empirical research conducted in the field of individual differences (cf. Abrahamsson & Hyltenstam, 2008; Dewaele, 2007; Ehrman, 1998; Ehrman & Oxford, 1995; Piechurska-Kuciel, 2008; Sasaki, 1996), the present author chose a correlational and differential design to present the profile of a gifted L2 learner and to emphasise in what respects he/she differs from the normal population. What is more, the regression analyses applied in the study indicate what cognitive and personality factors and to what extent affect FL aptitude, which contributes to the understanding of the predictors of linguistic giftedness. Nonetheless, it transpires that the possibility of trainability of FL aptitude is a problem definitely worth further investigation; especially, the possible rise in analytic and memory abilities in multilinguals. A study on large samples of mono-, bi- and multilinguals aimed at empirical investigation of the relationship between the number of languages they have learned or the level of linguistic advancement and cognitive variables would contribute to the discussion on FL aptitude pliability and trainability.

Another shortcoming of the present study was a small sample of the gifted participants who represented a restricted range of cognitive abilities, FL aptitude and intelli-

gence. Purposeful sampling, required for the present research paradigm, does not adequately represent a normal population and, consequently, any conclusions drawn from regression analysis are tentative. The specificity of the problem in question imposed this restriction. Linguistic talents are quite rare and it is difficult to gather a sizeable group to conduct a statistical analysis. Moreover, no transparent criteria for selection of linguistically gifted individuals have been offered since Schneiderman and Desmarais's study in 1988. There are also practical problems connected with researching individual differences. Non-psychologist researchers cannot conduct most of psychological tests, including all intelligence and personality tests. This involves the necessity of cooperation with a psychologist, which substantially increases the costs of the research and, consequently, limits the number of participants. The problem of the small number of participants was partly solved by adding a sample of 'non-gifted' L2 learners, which multiplied the number of observations and increased the distribution of results.

The third problem is connected with the reliability of instruments. The American version of the Modern Language Aptitude Test (MLAT) was used because at the moment of the study there was no Polish version of the MLAT, or its equivalent. According to its authors (Carroll & Sapon, 2002), the MLAT is a test designed for native or near-native speakers of English. Near-native (C1/C2) proficiency in English was required from the participants; therefore, this criterion was met. However, it cannot be excluded that the test measured partly the knowledge of English and only partly FL aptitude. Even if this was a case, all the participants accepted for the study scored within the 97-99 percentile, which indicates their high linguistic aptitude. Moreover, in order to ensure the validity of measures, a Polish test of FL aptitude – the TZJ was applied. This test includes parts testing grammar (analytic ability) and vocabulary thus complementing the most difficult and the least reliable for Polish users Parts 3 and 4 of the MLAT. Besides, next to the tests scores, other quantitative and qualitative criteria for selection were used, specifically proficiency scores, the number of languages they had learned, language learning history and recommendation of their teachers. In line with the previous research results, most of the participants were professional linguists (cf. Abrahamsson & Hyltenstam, 2008).

A problem that restrains research on FL aptitude is the lack of a modern, standardised and normalised FL aptitude test for the use with the Polish population. Such a test should not be limited to the testing of three basic aptitudes: analytic, phonetic and memory (cf. Rysiewicz, 2008), but should take into account advances in SLA knowledge, including WM and noticing abilities. Without a reliable and valid instrument to measure FL aptitude, chances for progress in this domain of science are slight.

Another problem which is difficult to resolve was the establishing of the linguistic level of the participants speaking oriental languages. In the case of most modern languages there are certificates unified according to the Council of Europe norms. Moreover, at Polish universities, modern European languages are taught and evaluated according to the Council of Europe norms. It might, therefore, be assumed that a person

who has graduated from the best Polish universities, such as Adam Mickiewicz University in Poznań, Warsaw University, Gdańsk University, the Jagiellonian University in Kraków, and the University of Silesia, in a European language and with the highest mark, will be at level C1 or C2. In the case of oriental languages, the norms can be less transparent, due to the specificity of the process of learning. In addition, students usually start learning at the first year of studies, from level 0. For example, in the case of Chinese, the HSK (http://www.hsk.org.cn) exam result can be taken into account, as well as the rate of progress, as evaluated by teachers. It should be emphasised that contrary to recent studies on near-native L2 learners (cf. Abrahamsson & Hyltenstam, 2008), it was not the present author's intention to evaluate the ultimate attainment of the participants with the aim of finding evidence in support of or against the CPH. Instead, the purpose of this study was to establish what factors make gifted learners so exceptional. In accordance with this goal, a step-by-step procedure of selection with the FL aptitude tests scores as the final criteria was applied. Thus, although the participants who did not score above the 95th percentile on the MLAT were excluded from the research, which ran the risk of eliminating talented learners on the basis of their insufficient advancement in English, it guaranteed a high balanced level of FL aptitude in the selected sample.

A reflection that emerges from the evaluation of the FL aptitude tests is that they are always heavily influenced by the dominant language of the participant as well as his/her learning experience. An illustration of this observation is the case of Joanna, described in section 6.6.11., who scored very high on the MLAT, whereas her scores on the TZJ and the Wechsler verbal scales were lower, due to the process of supplanting of her L1 − Polish with English. It seems that in such cases of bilingualism the choice of a language in which a test is conducted is dubious because the participant can be more efficient in some verbal operations in the language he/she uses on a daily basis (for example defining concepts or spelling) and weaker in some other tasks, which he/she naturally performs in the mother tongue (like arithmetic).

Apart from the uncertainties described above, there exist many other problematic issues connected with the reliability of cognitive tests. One of them is the level of difficulty – generally far too low for gifted participants, which results in the ceiling effect. Evidently, although the MLAT is recommended as the best available predictor of language learning success and of extremely good and bad language learners (cf. Ehrman, 1998), the test, like all cognitive ability tests, was not devised to measure the extremes, but to diagnose educational problems and to predict the rate of learning (Carroll & Sapon, 2002). Originally, the MLAT was constructed to measure the possible rate of progress by a participant who has not learned a foreign language before. The same restriction applies to the Wechsler scales, which are designed for a normal (that is average) population.

Another problem is connected with the usefulness of cognitive ability/aptitude test application in the case of a successful adult language learner. According to Housand

(2009), highly able adults and older students are recognised on the basis of their remarkable achievements in a domain of activity. This criterion can be considered a sufficient indicator of high abilities. Appealing as it seems, this categorisation is difficult to apply empirically because of the vagueness of the terminology; Who is to decide what 'remarkable achievement' is?

Taking all these methodological dilemmas into consideration, the most reasonable solution seems to be applying multiple, qualitative and quantitative selection and evaluation criteria to ensure the proper choice of participants. Nevertheless, no instrument or procedure allows a researcher to convincingly distinguish between simply gifted and profoundly talented L2 learners. Evidently, the research on linguistic giftedness is in its infancy and further investigation is needed to specify the term 'talent for languages'. As has already been mentioned, little research addressing exceptionally talented foreign language learners has been conducted, and cognitive and affective factors probed generally. In view of the scarcity of research on predictors of FL aptitude, inconsistent criteria for selection and methods of investigation and evaluation of gifted L2 learners, and first and foremost the total lack of a contemporary definition of a gifted foreign language learner, the present study was intended as a contribution to the discussion of the problem of linguistic giftedness.

Conclusion

The aim of this chapter has been to present and report the findings of a study conducted on 44 gifted L2 learners, which sought to determine what cognitive and personality factors affect FL aptitude. The first section presented the objectives of the study, followed by the research hypotheses formulated in section 6.2. Fifteen hypotheses were formulated: six concerning cognitive factors, five − personality, one − learning styles and three − the relationship between the different factors. Next, the subjects of the study were described. There were two samples of the subjects: the gifted L2 learners and the non-gifted L2 learners. In the subsequent section, the procedures of data collection and analysis were described, followed by the description of the research instruments. Altogether, fifteen instruments were implemented, including four cognitive ability tests, five personality tests, and three learning styles tests. The next sections were devoted to the description of the research results. The statistical analyses included descriptive, correlational and differential statistics, followed by the qualitative-quantitative account of the gifted sample and the description of three case studies. Finally, the findings of the study and its limitations were discussed.

The closing part of the book will proceed to present the conclusions from the study, directions for further research, as well as pedagogical implications referring to the selection and guidance for gifted and talented foreign language learners.

CONCLUSIONS AND IMPLICATIONS

The aim of this book has been to address the poorly explored problem of linguistic giftedness in adult foreign language learners. In accordance with this goal, the first chapter was intended to introduce basic terminology connected with human cognitive abilities, as well as to present the concept of FL aptitude against the background of research on intelligence. The second chapter focused on empirical research on FL aptitude, presenting the development of FL aptitude tests, FL aptitude models and controversies related to it, which led to the reconceptualisation of the construct. Three contemporary models of FL aptitude were presented: Skehan's (1998) Processing Stage Model, Robinson's (2002b) Aptitude Complex Model and Sternberg's (2002) model of FL aptitude as a dynamic concept. In addition, an overview of the empirical research aiming to investigate the impact of native language learning ability and the age factor on FL aptitude was touched upon. This was followed by the discussion of the findings of selected empirical research on different aspects of FL aptitude, with emphasis on the most promising concepts in FL aptitude research, namely analytical abilities, WM and noticing ability, in Chapter Three. In Chapter Four, the focus of attention was shifted to non-cognitive and borderline aspects of linguistic giftedness, specifically, personality factors and learning styles and strategies. These factors are generally considered to be weak predictors of FL aptitude, and, therefore, a dynamic systems theory paradigm was discussed as an alternative model to the traditional statistical analysis. Chapter Five presented and discussed the findings of empirical research on gifted L2 learners. This chapter reviewed the definitions of talent and giftedness, methods of identifying and the criteria for selection of gifted individuals, and neurological discoveries referring to brain functioning in gifted L2 learners. Finally, Chapter Six reported the findings of an empirical study aimed at examining the relationship between FL aptitude and cognitive factors, personality factors and learning styles in 44 gifted L2 learners, that is those who possess a high level of FL aptitude. In view of the scarcity of research on cognitive and personality characteristics of gifted L2 learners, it was decided to focus on cognitive variables, namely intelligence and WM, as well as some personality variables, which, due to their relationship to intellectual functioning, can affect the development of linguistic talent.

The following variables were tested: openness to experience, conscientiousness, extraversion, agreeableness, neuroticism (the Five Factor Model), locus of control, style of coping with stress and emotional intelligence. The tested learning styles included the cognitive styles measured by the SAS (Oxford, 1995) and a personality style – second language tolerance of ambiguity. These data were subjected to statistical analyses.

In line with Dörnyei's (2009) perspective on individual differences reflecting the dynamic systems theory, other factors, such as learning strategies and preferences, psychological needs, creativity, motivation, learner autonomy as well as different biographical details were analysed with the aim of obtaining a more complete picture of a gifted adult foreign language learner. Consequently, the empirical study consisted of two parts, the quantitative and the qualitative-quantitative, including three case studies of the most talented L2 learners. The research conclusions can be summarised in four points:

1. The gifted L2 learners excel in all cognitive ability tests, including FL aptitude, intelligence and memory. Their intelligence is significantly higher than the intelligence of the normal Polish population. Their FL aptitude and WM are significantly higher than those of the non-gifted L2 learners;
2. Two cognitive factors, namely memory and verbal intelligence perform a special role in the development of linguistic giftedness. The gifted L2 learners do extremely well in STM and WM tests as well as in all verbal intelligence tests. It is supposed that their abilities are inborn, but also develop as a result of the prolonged language learning experience affecting brain functioning and anatomy;
3. Personality and other non-cognitive and environmental factors perform a secondary role in the development of linguistic giftedness. They affect the development of FL aptitude non-linearly, dynamically interacting with inborn capacities and acting as catalysts. The most influential for the development of FL aptitude is the personality trait of openness to experience, which is closely connected with intellectual flexibility and curiosity;
4. Generally, all of the analysed cognitive and personality factors are not very good predictors of FL aptitude because they explain only a small part of variance in FL aptitude. This suggests that FL aptitude as measured by the available tests is relatively independent of other variables. On the other hand, statistics can explain only a part of the phenomenon of linguistic giftedness. Chances and possibilities created by the environment as well as personal choices of the participants definitely affected the development of their talent.

In the light of the present empirical study and the relevant literature, the definition of a linguistically talented foreign language learner proposed by contemporary researchers (cf. Skehan, 1998) appears to be inadequate, vague and incomplete. Linguistic talent defined as an exceptional ability to achieve native-like competence in a foreign language relatively quickly and after puberty is, generally, a mythical, non-existing phenomenon, a sort of a Holy Grail sought by learners, teachers and researchers. Analysing the defini-

tion of exceptional FL aptitude and the empirical research it transpires that none of the talented learners described in the literature fulfilled all the requirements included in the definition of linguistic talent (cf. Chapter Five, section 5.3.).

First of all, the discussion among researchers as to whether or not it is possible to achieve native-like competence in an L2 is more vigorous than it has ever been. The adherents of the option of native-like achievement after puberty believe that the incidence of post-pubertal native-like attainment is quite common and independent of aptitude (cf. Birdsong, 2005; Bongaerts, 2005), whereas their opponents argue that the incidence of native-like attainment is close to zero, even if the age of onset is pre-pubertal, and that these rare cases of near-native competence result from high FL aptitude (cf. Abrahamsson & Hyltenstam, 2008; DeKeyser, 2000). Secondly, the term 'relatively quickly' is probably the most subjective one in all SLA literature. If a Polish learner masters Russian during a 100-hour course, is it quickly, comparing to another learner fluent in Chinese after 10 years of study? Not surprisingly, this criterion has never been taken into consideration by researchers. For example, in Abrahamsson and Hyltenstam's study (2008) the age of onset of the participants varied from < 1 and 47, and the mean length of exposure was 25 years (cf. Ioup et al., 1994). Finally, the time restriction connected with the critical period (Lenneberg, 1967) is rather vaguely defined and varied for different linguistic aspects (cf. Long, 2011). Moreover, as Abrahamsson and Hyltenstam (2008) found, none of the late learners (> 12) performed within the native-speaker range and only half of the early L2 learners (1-11) overlapped with native speakers in all linguistic aspects (cf. Chapter Five, section 5.3.3.), which indicates that no foreign language learner after the critical period is able to achieve fully native competence in all aspects of an L2.

Although, due to the remarkable scarcity of research, it is very difficult to redefine exceptional linguistic giftedness/talent, it appears that such an attempt is necessary at least to provoke a discussion on this fascinating phenomenon. The main characteristics of a gifted adult L2 learner have been summarised above in four points. A definition of a gifted L2 learner can be formulated as follows: *A gifted foreign language learner is a person who, owing to his/her exceptional inborn gift for learning languages, especially capacious verbal WM, as well as expertise in learning foreign languages, is able to learn any foreign language to a near-native level of competence given proper motivation, time and conducive environment.* Obviously, this definition is far from complete and needs much empirical investigation.

Among many aspects of FL aptitude that have yet to be investigated, the most promising seems to be the problem of the role of WM as a predictor of success in learning a foreign language. The concept of WM has ushered in a new era in FL aptitude theory and research. WM is especially important and timely in SLA research in general. First of all, new techniques developed in cognitive science and neuroscience have contributed to the understanding of the role and variation in WM. Secondly, there are still many con-

troversies regarding the nature of WM implicated in language comprehension. Moreover, WM variance predicts learning disability as well as intellectual functioning of children and adults. Finally, the technological advancement has contributed to the understanding of the neural basis of individual and age-related variation in WM. The functioning and roles of different aspects of memory are by no means fully explored and the need for further research, especially on WM as a language ability, is repeatedly voiced in the literature (cf. Skehan & Wen, 2009). It also seems that neurological research using modern methods such as fMRI might provide many interesting insights into memory functioning and eventually change our perspective on cognitive factors in SLA. In view of these facts, it would be interesting to examine the impact of the phonological loop capacity and the central executive effectiveness on the learning outcomes using a number of instruments based on different types of material in diversified samples. Such a study design would require the devising of new instruments for measuring various aspects of memory, as well as valid tests to establish the linguistic level of participants or their FL aptitude level.

Another interesting issue is personality of gifted L2 learners. As has been explained in Discussion, some analyses of the non-cognitive factors indicated interesting tendencies. For example, the problem of openness to experience as a variable differentiating learners of different levels of FL aptitude. Further research on larger samples of learners with normal distributions of FL aptitude could explain some aspects of the poorly researched problem of personality effect on FL aptitude. There are grounds to believe that the findings of neurological research on gifted L2 learners can contribute to the ongoing debate on the relationship between FL aptitude and brain functioning. Linguistic giftedness is probably determined by a specific brain anatomy or greater brain plasticity in talented foreign language learners (cf. de Bot, 2006; Golestani et al., 2011). Evidence from neurological studies suggests that high FL aptitude might result from both inborn functional and structural characteristics, and an individual brain response to an individual experience of learning a language. Differences in brain activation and anatomy between faster and slower learners have been discovered in a number of studies (see Chapter Five, section 5.4.). In all likelihood, neuroscience will revolutionise our understanding of FL aptitude. Another fascinating field of research is connected with phonetic abilities. It seems that this very complex problem is gaining popularity among researchers, especially, in the context of neurological research findings (cf. Golestani et al., 2011; Reiterer, 2009). A thorough investigation of this group of abilities was beyond the scope of this book and would require a separate volume.

Research on FL aptitude and linguistically gifted L2 learners is still not free from stereotypical beliefs. There is a widespread assumption among Polish foreign language teachers and some SLA researchers that cognitive factors are irrelevant variables in the language learning outcomes which depend rather on teaching methodology and learner motivation than on the inborn factor of aptitude. This reasoning is, in most part, the leg-

acy of Krashen (1981b) and his dogmatic view on the process of learning languages as dependent mostly on natural communication which leads to success. Accordingly, FL aptitude is perceived as insignificant and, at best, relevant only in a formal setting. Moreover, any attempts aiming at classifying and categorising people with regard to their abilities are intuitively perceived as anti-egalitarian and socially unfair because of their connections to genetic determinism and resulting from it inequality. Such a perception of FL aptitude is more popular than of other human abilities. For example, the uneven distribution of mathematical, musical or sport talents does not provoke such strong emotions and is usually perceived as a natural variation among humans. Such reasoning is probably the result of the common knowledge that everybody becomes a master of at least one language – the mother tongue, which makes a strong case for the possibility of a native-like level of attainment in every other language. Unfortunately, this line of reasoning is falsified on the basis of our knowledge of human cognitive abilities development. Most researchers agree that human learning is subject to some limitations connected with a continuous decline in WM, reasoning ability and attention span, which starts around puberty and gradually decreases our learning ability making the process of learning more difficult, more effortful and less successful in terms of ultimate attainment (cf. Birdsong, 2006; Long, 2011). What is more, adult L2 learners probably no longer have access to innate mechanisms for implicit language acquisition and have to rely on general cognitive mechanisms for explicit learning, which means that for them it is very difficult, if not virtually impossible, to attain a native-like proficiency level (cf. Bley--Vroman, 1988). As a result, native-like attainment in adult learners is rare (cf. Abrahamsson & Hyltenstam, 2008; DeKeyser, 2000).

Does this mean that the majority of adult foreign language learners are doomed to failure if they are not given a natural gift of exceptional FL aptitude? Fortunately, FL aptitude explains a large part, but not all of the outcomes of learning a foreign language. Other factors, such as motivation, effort and persistence are necessary for success to occur (cf. Moyer, 2007). Even a very high level of FL aptitude does not guarantee that a person will learn a foreign language well if he/she does not devote many hours to practice and training. All gifted and talented individuals emphasise their personal engagement and hard work as prerequisites for their success.

Some recommendations that should guide teaching a foreign language have been offered by Robinson (2002b, 2007) in his *aptitude-treatment interaction* approach to FL aptitude. As he argues, FL aptitude constitutes sets of abilities or aptitude complexes, which are differentially related to learning under different psycholinguistic processing conditions. Accordingly, different learners might possess different abilities facilitative under specific learning conditions, but less effective under others. Pedagogic intervention should be directed at creating an optimal environment for the individual learner needs. Robinson stresses the importance of various focus on form techniques, such as, for example, recasting and input flooding in the case of more memory-oriented learners,

and explicit rule teaching in the case of more analytically-oriented individuals to fit their aptitude profiles. Although such interventions would pose serious organisational problems, they would undoubtedly provide useful insights into the construct of FL aptitude.

In line with the contemporary views of talent development, a natural gift and personal devotion are insufficient if the environment is not conducive (Gagné, 2000; Sękowski, 2004). In this respect, pedagogical intervention is one of the factors, which, next to parenting style of rearing, socio-economic status or significant events, affect the development of giftedness. There are many areas in which teachers can help their learners achieve their potential. A list of recommendations that should guide teachers who work with gifted pupils is offered by Bates and Munday (2005, p. 3), who give suggestions referring to the identification of gifted pupils, developing a school policy for guidance and advice, creating challenges in the classroom, and the involvement of parents. They argue that, in order to create a conducive environment for a talent to develop, schools should consider: (1) raising awareness among teachers, headmasters and parents of the needs of talented pupils; (2) developing procedures for the identification of talented pupils; (3) monitoring the progress of identified pupils; and (4) developing strategies for challenging and supporting talented pupils.

Unfortunately, in the Polish educational context the educational needs of gifted learners are often unrecognised, partly due to the belief that gifted children will achieve their potential without the need for a pedagogical intervention, and partly because of economic constraints. Quite often, gifted children fail to reach their potential and do not make the progress they are able to make. The reasons for this unfavourable situation are various, including effects of the home and school environment, health or economic problems and different deficits, such as ADHD or dyslexia, which can cause underachievement of gifted individuals. Able underachievers need special support and intervention to develop intellectually, socially and emotionally. In the Polish educational context the process of identifying linguistically gifted individuals can be very difficult due to noticeable differences among pupils starting their primary education. In economically underdeveloped areas the access to pre-school education is limited, which causes barriers at the beginning of primary school connected with great disproportions in educational level of the pupils. As a result, some children still have problems with their own language, whereas some others not only write and read in Polish, but also have already started learning a foreign language in a private school. The only possible solution to this problem seems compulsory pre-school education as well as an increase of expenditure on eliminating educational barriers.

Recently, we can witness a growing recognition of the importance of identification and development of talents in Poland. The Polish Ministry of Education has introduced a new complex system of working with talented learners and announced school year 2010/2011 the year of talents (http://efs.men.gov.pl/projekt-strona-glowna/item/261). The programme that is going to last from the 1st of February 2010 to the 31st of Decem-

ber 2013 involves legislative and methodological changes aimed at identifying gifted and talented learners, creating opportunities for their development and raising awareness among authorities, educators and parents of the needs of talented pupils. Summing up, identification of gifted individuals and creating opportunities for their development is a necessary investment in the future of the world of the twenty-first century and a challenge for educators.

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APPENDICES

Appendix A

SURVEY

Imię i nazwisko (Name): Wiek (Age): Płeć (Gender):

1. W jakim wieku zacząłeś/zaczęłaś uczyć się języków obcych i przez ile lat się ich uczyłeś/uczyłaś/uczysz? (język + wiek + ile lat)
   (When did you start to learn foreign languages? How long have you been learning them? (language + starting age + how many years)
2. Jakie dokumenty potwierdzają Twoją znajomość języków (certyfikaty, oceny w indeksie)? Na jakim poziomie znasz każdy z języków, których się uczyłeś/uczyłaś/uczysz? Określ poziom jako: elementarny (podstawy), komunikatywny, zaawansowany.
   (What documents confirm your knowledge of foreign languages (certificates, marks in the student record book)? Classify your level in each language: elementary, communicative, advanced)
3. Gdzie uczyłeś/uczyłaś/uczysz się języków obcych? (kurs, lekcje prywatne, samodzielnie, studia, etc.)
   (Where have you been learning languages? (courses, private lessons, self-teaching, studies, etc.))
4. W jakim celu uczysz się tych języków?
   (Why are you learning these languages?)
5. Co studiujesz/studiowałeś/studiowałaś? Co wpłynęło na wybór kierunku?
   (What do/did you study? What made you choose this subject?)
6. Czy wcześnie zacząłeś/zaczęłaś mówić jako dziecko (w jakim wieku)? Kiedy zacząłeś/zaczęłaś czytać?
   (At what age did you start to speak and read in your mother tongue?)
7. Czy rodzice szczególnie dbali o Twój rozwój: dawali ci rozwijające zabawki, książeczki, dużo z Tobą rozmawiali, wymyślali zabawy dydaktyczne?
   (Did your parents particularly care about your intellectual development, for example, by giving you educational toys, books, spending much time talking to you or devising didactic games?)

8. Czy byłeś/byłaś dobry z polskiego (lub innego języka ojczystego)? Czy miałeś/miałaś problemy np. z ortografią?
   (Were you good at Polish (or another L1)? Did you have any problems with orthography?)
9. Czy Twoi rodzice, dziadkowie i rodzeństwo znają języki obce?
   (Do your parents, grandparents or brothers and sisters speak any foreign languages?)
10. Czy miałeś/miałaś okazję sprawdzenia znajomości języków w naturalnym środowisku? Jeśli tak, to jak długo i gdzie przebywałeś/przebywałaś?
    (Have you had an opportunity to test your languages abroad? If yes, how long and where did you stay?)
11. Czy uważasz, że przebywanie wśród rodzimych użytkowników języka jest bardziej efektywne niż nauka formalna?
    (Do you think that learning from native speakers is more useful than formal study?)
12. Jaką metodą najbardziej lubisz się uczyć?
    (How do you best like to learn?)
13. Czy nauka gramatyki jest dla ciebie trudna? Jak uczysz się gramatyki?
    (Is learning grammar difficult to you? How do you like to learn grammar?)
14. W jaki sposób uczysz się nowego słownictwa?
    (How do you learn vocabulary?)
15. Czy uważasz, że masz dobrą pamięć?
    (Do you have good memory?)
16. Czy nauka wymowy jest dla Ciebie trudna? Czy nauczyciel mówił Ci, że masz „ucho do języków”? Czy Ty sam/sama uważasz, że jesteś dobry/dobra fonetycznie?
    (Is pronunciation difficult to you? Did your teacher tell you that you have an ear for languages? Do you think you are good at phonetics?)
17. Czy masz jakieś pasje, zdolności, np. gra na instrumencie?
    (Do you have any hobbies, talents, e.g. playing a musical instrument?)
18. Czy nauczyciele mówili Ci, że masz zdolności lingwistyczne? Czy Ty sam/sama uważasz, że jesteś uzdolniony/uzdolniona w tym kierunku?
    (Did your teachers tell you that you are linguistically talented? Do you think so?)

Appendix B

MOTIVATION AND STRATEGIES QUESTIONNAIRE (MSQ) (Ehrman, 1996)

Aptitude and Motivation

1. How do you rate your own ability to learn foreign languages relative to others in general?
   a. poor
   b. below average
   c. average
   d. above average
   e. superior

2. How motivated are you to learn this language/languages (language you are learning now)?
   a. not very much
   b. sufficiently
   c. very
   d. highly

3. Please mark those that apply to you (TL = Target language, the language you are studying now):
   a. meeting a programme requirement
   b. getting a payment for proficiency
   c. need it to do my job
   d. want to be top of my class/group
   e. hope to get an award
   f. language learning is fun
   g. like country where the TL is used
   h. this is a real challenge
   i. enjoy talking with TL people
   j. love to learn something new
   k. other motivations: .....

4. I would say my anxiety about learning this language is:
   a. none at all
   b. not very much
   c. a fair amount
   d. a lot
   e. really nervous about it

5. My anxiety about speaking in class (asking and answering questions, giving reports etc.) or at work is about this level:
   a. none at all
   b. not very much
   c. a fair amount
   d. a lot
   e. really nervous about it

Appendix C

STYLE ANALYSIS SURVEY (SAS) (Oxford, 1995)

Please use the following scale to rate each item: 1 − never, 2 − sometimes, 3 − very often, 4 − always. Write 1, 2, 3, or 4.

I. HOW I USE MY PHYSICAL SENSES TO STUDY OR WORK

1. I remember something better if I write it down
2. I take lots of notes
3. I can visualise pictures, numbers, or words in my head
4. I prefer to learn with video/DVD or TV more than with other media
5. I underline or highlight the important parts I read
6. I use colour-coding to help me as I learn or work
7. I need written directions for tasks
8. I get distracted by background noises
9. I have to look at people to understand what they say
10. I am more comfortable when the walls where I study have posters or pictures

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11. I remember things better if I discuss them out loud
12. I prefer to learn by listening to a lecture, rather than by reading
13. I need oral directions for tasks
14. Background sounds help me think
15. I like to listen to music when I study or work
16. I can easily understand what people say even if I can't see them
17. I remember better what people say than what they look like
18. I easily remember jokes I hear
19. I easily identify people by their voices
20. When I turn on the TV, I listen to the sound more than watching the screen

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21. I'd rather just start doing things rather than pay attention to directions
22. I need frequent breaks when I work or study
23. I move my lips when I read silently
24. I avoid sitting at a desk when I don't have to
25. I get nervous when I sit still too long
26. I think better when I can move around
27. Manipulating objects helps me to remember
28. I enjoy building or making things
29. I like a lot of physical activities
30. I enjoy collecting cards, stamps or other things

II. HOW I HANDLE POSSIBILITIES

1. I have a vivid imagination
2. I like to think of lots of new ideas
3. I can think of many different solutions to a problem
4. I like multiple possibilities and options

5. I enjoy considering the future events
6. Following a step-by-step procedure bores me
7. I like to discover things rather than have everything explained
8. I consider myself original
9. I am an ingenious person
10. It feels fine if the teacher or boss changes his plan

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11. I am proud of being practical
12. I behave in a down-to-earth way
13. I am attracted to sensible people
14. I prefer realism instead of new, untested ideas
15. I prefer things presented in a step-by-step way
16. I want a class or work to follow a clear plan
17. I like concrete facts, not speculations
18. Finding hidden meanings is frustrating or irrelevant to me
19. I prefer to avoid too many options
20. I feel it is useless for me to think about the future

III. HOW I APPROACH TASKS

1. I reach decisions quickly
2. I am an organised person
3. I make lists of things I need to do
4. I consult my lists in order to get things done
5. Messy, unorganised environments make me nervous
6. I start tasks on time or early
7. I get to places on time
8. Deadlines help me organise work
9. I enjoy a sense of structure
10. I follow through with what I have planned

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11. I am a spontaneous person
12. I like to just let things happen, not plan them
13. I feel uncomfortable with a lot of structure
14. I put off decisions as long as I can
15. I have a messy desk or room
16. I believe deadlines are artificial or useless
17. I keep an open mind about things
18. I believe that enjoying myself is the most important thing
19. Lists of tasks make me feel tired or upset
20. I feel fine about changing my mind

IV. HOW I DEAL WITH IDEAS

1. I prefer simple answers rather than a lot of explanations
2. Too many details tend to confuse me
3. I ignore details that do not seem relevant
4. It's easy for me to see the overall plan or big picture
5. I can summarise information rather easily
6. It's easy for me to paraphrase what other people say
7. I see the main point very quickly
8. I am satisfied with knowing the major ideas without many details
9. I can pull together (synthesise) things easily
10. When I make an outline, I write down only the key points

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11. I prefer detailed answers instead of short answers
12. It is difficult for me to summarise detailed information
13. I focus on specific facts or information
14. I enjoy breaking general ideas down into smaller pieces
15. I prefer looking for differences rather than similarities
16. I use logical analysis to solve problems
17. My written outlines contain many details
18. I become nervous when only the main ideas are presented
19. I focus on the details rather than the big picture
20. When I tell a story or explain something, it takes a long time

Appendix D

SECOND LANGUAGE TOLERANCE OF AMBIGUITY SCALE (Ely, 1995a)

Please, use the following scale to rate each item: 1 – strongly disagree, 2 – disagree, 3 – agree, 4 – strongly agree (write 1, 2, 3, or 4). TL – the target language.

1. When I'm reading something in the TL, I feel impatient when I don't totally understand the meaning.
2. It bothers me that I don't understand everything the teacher/native speaker says in the TL.
3. I don't like when there are many exceptions to rules.
4. It's frustrating that sometimes I don't understand completely some TL grammar.
5. I don't like the feeling that my TL pronunciation is not quite correct.
6. It bothers me that even though I study the TL grammar, some of it is hard to use in speaking and writing.
7. When I'm writing in the TL, I don't like the fact that I can't say exactly what I want.
8. It bothers me when the teacher/native speaker uses a TL word I don't know.

9. When I'm speaking in the TL, I feel uncomfortable if I can't communicate my ideas clearly.
10. I don't like the fact that sometimes I can't find the TL words that mean the same as some words in my own language.
11. One thing I don't like about reading in the TL is having to guess what the meaning is.

STRESZCZENIE

Zdolności do nauki języków obcych, należące do grupy specjalnych zdolności poznawczych, stanowią zespół cech, które spośród wszystkich czynników indywidualnych mają największą trafność prognostyczną co do wyniku nauki języka obcego. Pojęcie zdolności językowej wywodzi się z psychologii cech indywidualnych i stanowi element szeroko definiowanego pojęcia ogólnej zdolności poznawczej, czyli inteligencji. Niemniej jednak zdolności językowe są częściowo niezależne od inteligencji, jak również wykazują znaczne zróżnicowanie ilościowe i jakościowe, jeżeli chodzi o ich występowanie u poszczególnych osób.

Cel niniejszej pracy stanowi przedstawienie współczesnego stanu nauki na temat specjalnych zdolności językowych oraz omówienie wyników badania przeprowadzonego na 44 ponadprzeciętnie uzdolnionych dorosłych uczniach języka obcego. Efektem tego jest zaproponowanie modelu zdolności językowych, uwzględniającego czynniki poznawcze i osobowościowe, a także definicji ponadprzeciętnie uzdolnionego ucznia języka obcego.

Wybór zmiennych poddanych analizie oparty został na trzech paradygmatach teoretyczno-empirycznych: (1) współczesne teorie zdolności językowych (Carroll, 1993; Robinson, 2002b; Skehan, 2002); (2) współczesne teorie rozwoju zdolności specjalnych (Gagné, 2000; Renzulli, 1986; Sękowski, 2002); (3) badania empiryczne osób ponadprzeciętnie uzdolnionych językowo (Abrahamsson i Hyltenstam, 2008, 2009; Birdsong, 2007; Bongaerts i in. 2000; Ioup i in. 1994; Smith i in. 2011).

Monografia składa się z sześciu rozdziałów, z których pierwszych pięć omawia teoretyczne podstawy zagadnienia, ostatni natomiast stanowi raport z badania osób ponadprzeciętnie uzdolnionych językowo. Celem rozdziału pierwszego jest wykazanie, iż pojęcie zdolności językowej należy rozważać w szerszym kontekście badań nad zdolnościami poznawczymi. W rozdziale tym omówione zostały podstawowe pojęcia dyscypliny, najważniejsze modele hierarchiczne i modele czynników równorzędnych inteligencji, metody pomiaru zdolności poznawczych, a także biologiczne i środowiskowe źródła różnic indywidualnych.

Rozdział drugi stanowi przegląd wybranych zagadnień z badań nad zdolnościami językowymi w kontekście zmian w definiowaniu tych zdolności i rozwoju nowych trendów

w dyscyplinach językoznawstwa stosowanego i psychologii poznawczej. Głównym celem tego rozdziału jest przedstawienie ewolucji pojęcia zdolności językowej oraz współczesnego stanu wiedzy na jego temat. W tej części kolejno przedstawione zostały: powstanie pierwszych koncepcji zdolności językowych i testów służących pomiarowi tychże zdolności (Carroll, 1959), rozwój badań nad zdolnościami w drugiej połowie XX wieku, kontrowersje wokół pojęcia zdolności, współczesne modele zdolności językowych, możliwość treningu zdolności językowych, wpływ czynnika rodzimego języka oraz wieku na zdolności językowe. Rozdział zamyka przegląd badań nad zdolnościami językowymi w Polsce.

Rozdział trzeci, stanowiący poszerzenie tematyki rozdziału drugiego, skupia się na trzech poznawczych aspektach zdolności językowej: zdolnościach analitycznych, pamięciowych i procesach uwagi. Wybór tych konkretnych grup zdolności podyktowany został przede wszystkim znacznym zaawansowaniem badań empirycznych w wybranym obszarze, przy jednoczesnym słabym zgłębieniu takich zagadnień, jak pamięć robocza, stanowiąca istotny element zdolności językowych. Celem tego rozdziału jest wykazanie wpływu czynnika pamięci roboczej na przyswajanie języka obcego. Rozdział przedstawia kolejno wyżej wymienione grupy czynników ze szczególnym uwzględnieniem zdolności pamięciowych, które stanowią podstawę ponadprzeciętnych uzdolnień językowych.

Rozdział czwarty omawia najbardziej kontrowersyjny aspekt zdolności językowych – czynniki osobowościowe. Celem tego rozdziału jest wskazanie na rolę czynników pozaintelektualnych w rozwoju zdolności językowych. Wszystkie współczesne modele zdolności uwzględniają rolę czynników osobowościowych i środowiskowych w rozwoju talentu. Pominięcie tego istotnego aspektu byłoby zawężeniem pola badawczego do czynników poznawczych, które nie wyjaśniają w pełni procesu rozwoju zdolności językowych. Cechy osobowościowe omówione w niniejszym rozdziale obejmują: otwartość na doświadczenie, sumienność, ugodowość, ekstrawersję i neurotyzm (*Pięcioczynnikowy model osobowości*; McCrae i Costa, 2003), umiejscowienie kontroli, style radzenia sobie ze stresem, inteligencję emocjonalną, kreatywność, motywację, autonomiczność, a także czynniki poznawczo-osobowościowe, czyli style uczenia się. Ponieważ czynniki osobowościowe zazwyczaj wykazują słabe związki liniowe ze zdolnościami językowymi, zaproponowano teorię systemów dynamicznych jako alternatywę dla analiz statystycznych, aby wykazać wpływ tych czynników na zdolności językowe.

Ostatni, piąty rozdział teoretyczny przedstawia kluczowy problem niniejszej monografii, czyli badania nad osobami ponadprzeciętnie uzdolnionymi i utalentowanymi językowo. Celem autorki jest przedstawienie wniosków i kontrowersji wynikających z tych badań. Na początku rozdziału omówione zostały pojęcia zdolności poznawczej i talentu oraz metody identyfikacji i selekcji osób ponadprzeciętnie uzdolnionych. W kolejnych sekcjach opisano badania nad jednostkami utalentowanymi językowo, badania grupowe i badania wielowymiarowe. Rozdział kończy przegląd badań neurologicznych dotyczących funkcjonalnych i anatomicznych różnic w funkcjonowaniu mózgów osób na różnych poziomach zdolności językowych.

Rozdział szósty przedstawia i omawia wyniki badania przeprowadzonego przez autorkę, którego celem było przeanalizowanie związków pomiędzy zdolnościami językowymi a czynnikami poznawczymi i osobowościowymi. Badanie przeprowadzono na dwóch grupach uczniów: ponadprzeciętnie uzdolnionych i przeciętnie uzdolnionych. Składało się ono z dwóch części: statystycznej analizy danych oraz analizy jakościowo-ilościowej, mającej na celu nakreślenie pełniejszego obrazu badanej grupy. Część jakościowa omawia trzy studia przypadku osób utalentowanych językowo. Efektem badania jest próba stworzenia modelu predykatorów zdolności językowych. W ostatniej sekcji rozdziału omówione zostały problemy i ograniczenia związane z realizacją projektu badawczego.

Monografię zamyka podsumowanie, zawierające wnioski płynące z badania, sugestie co do kierunku rozwoju badań nad zdolnościami językowymi oraz implikacje pedagogiczne. W tym rozdziale autorka proponuje definicję osoby ponadprzeciętnie uzdolnionej językowo.

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