Pathways to language: Same talent, different cognitive profiles

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Abstract

This article argues for the existence of two, not necessarily complementary, ways of learning language. Drawing on detailed data from two successful young L2 learners, it provides evidence of two possible pathways, both of which may lead to successful L2 learning, a road that exploits social and communicative strengths, and one based on extracting regularities from the input through sensitivity to (statistical) patterns in the individual's environment. Both have been independently argued to account for first language acquisition. This is, however, the first evidence from L2 acquisition found in the profiles of two Slovene young learners of English. Cases of language talent offer a lense through which we can study what traits in the individual's cognitive profile account for success in language learning, and, on a broader level, can inform our understanding of how language is supported by more domain-general learning capacities and mechanisms, and what processes are involved.

Keywords: language talent, cognitive profile, intra-modular dissociations, statistical learning, grounded cognition

Resumen

Este artículo argumenta la existencia de dos modos de aprender una lengua, no necesariamente complementarios. Se basa en datos pormenorizados de dos aprendices jóvenes de L2, y presenta evidencias de dos posibles caminos, que pueden llevar a un aprendizaje exitoso de L2. Uno de ellos se basa en la extracción de regularidades del *input* a través de sensibilidad de modelos (estadísticos) en el contorno del individuo. Se ha argumentado que los dos caminos están en la base del aprendizaje de la primera lengua. En este artículo, sin embargo, se presenta la primera evidencia de la adquisición de L2, en los perfiles de dos jóvenes aprendices de inglés. Tales casos de talento para el lenguaje ofrecen una lente a través de la cual se puede estudiar cuáles son los rasgos del perfil cognitivo del individuo que dan como resultado el éxito en el aprendizaje de lenguas, y, a un nivel más amplio, puede mejorar nuestra comprensión de cómo la lengua se basa en capacidades y mecanismos de aprendizaje de dominios amplios, y cuáles son los procesos que implica.

Palabras clave: talento para las lenguas, perfil cognitivo, disociaciones intro-modulares, aprendizaje estadístico, base cognitiva

1. Introduction

The extent to which language depends on more basic cognitive mechanisms is still a matter of debate (Hauser, Chomsky and Fitch, 2002; Pinker and Jackendoff, 2005). In this respect, the crucial question is whether evidence can be found that language is highly specialized and modularized in the brains of language users (Rabaglia, Marcus and Lane, 2011; Mahon and Cantion, 2011). A related issue is whether specialization is there from the start (in a hard-wired fashion) or emerges gradually as a result of exposure to language, and with growing linguistic experience. While there is evidence that language and other cognitive systems may dissociate doubly in certain developmental disorders (e.g., Language Impairment (LI) and Williams Syndrome (WS)), closer detailed investigation has suggested that this is an over-simplification (Stojanovik, Perkins and Howard, 2006; Stojanovik, 2006). Thus, the linguistic profiles of individuals with spared structural language and proverbially pronounced conversational skills (e.g., Williams Syndrome) display unusual problems both in structural language competence (complex syntax), but also in figurative language comprehension, prosody and conversation skills (Stojanovik, 2006; Martens, Wilson and Reutens 2008). This evidence suggests that language and other cognitive systems may be more closely linked than assumed on a double dissociation view. Furthermore, it can be stipulated that, rather than trying to establish dissociations between language and the rest of cognition, such cases suggest a search for (the) subtle intra-modular dissociations inside language. Our own research in cognitive and linguistic profiles of linguistically talented individuals with high-functioning autism has demonstrated parallel strengths and weaknesses in areas of cognition (as measured by standard tools, WISC-IV) and language competence (measured by detailed structural language and comprehension tests) (Vulchanova et al., 2012; Vulchanova et al., 2013). Furthermore, we have shown that even in the cases of language talent, certain areas of language competence can be systematically compromised (e.g., as figurative language processing in Autism Spectrum Disorder (ASD), Vulchanova et al., 2014), demonstrating a dissociation between structural language and pragmatic aspects of language. Such dissociations between different domains of language competence provide evidence of the complex nature of language and its structure, in line with structuralist views of language suggesting finer hierarchies/levels of language function (Benveniste, 1966).

2. What can cognitive profiles tell us about language?

The question of whether what is measured through a standard IQ testing tool (Wechsler scales (WAIS/WISC/WASI), Kaufmann Brief Intelligence Test (KBIT)) correlates with language skills in the native language, or a second language, is an open one. Even the question of whether there exists a general factor, such as *g*, representing an individual's overall level of intelligence, has not found a definitive

answer and has been discussed extensively (Rabaglia, Marcus and Lane, 2011). What is of interest for the current article are instances of so-called "uneven" or what we refer to as "spiky" profiles (Vulchanova et al., 2012; Vulchanova et al., 2013), and their relation to language. While typical individuals display a relatively consistent level of performance on intelligence tasks across all domains tested, in certain cases, it is possible to observe differences within an individual profile which reach a level of significance when compared to the population from which the sample was drawn (Wechsler, 2003; Naglieri, 1993). This is exactly the pattern that we have found in a series of case studies of linguistically talented young individuals with high-functioning autism, where performance between domains is characterised by peaks and troughs (Vulchanova, Talcott and Vulchanov, 2014). Our research in the cognitive and linguistic profiles of children and young adults with high-functioning autism with language talent evidences very high overall intelligence, as measured on standard IQ tests, yet this profile across subtests is characterized by peaks and troughs (Vulchanova et al., 2011; 2012). Often, despite the talent for learning languages, the cognitive strengths of such individuals are more pronounced in the non-verbal domains, such as in matrix reasoning, spatial arrangements, and tasks involving number processing. More interestingly, the language profiles of the individuals we have studied, demonstrate characteristic patterns of strength and weakness, in a way that parallels the peaks and troughs in the cognitive profile. The peaks are in the areas of the lexicon, morphology and syntax, and literal interpretation (compositional semantics). The troughs in the linguistic profile apply to advanced syntax, and text comprehension at the global level. We interpret these findings in terms of the Weak Central Coherence (WCC) account of autism (Frith and Happé, 1994). From this account, the presence of a local processing bias is evident in the ways in which autistic individuals solve common problems, such as assessing similarities between objects and finding common patterns, and may therefore provide an advantage in some cognitive tasks compared to typical individuals. In our work, we extend the WCC account to language, and provide evidence for a connection between the local processing bias and the acquisition of morphology and grammar (Newport, 1988).

In addition to displaying spiky profiles, also prominent in these individuals is the apparent absence of correspondence between performance on verbal IQ tasks, and performance on PIQ tasks. All, however, invariably display unusual skill at mastering second languages, with some boasting as many as five foreign languages in their language portfolio. Another common denominator in these individuals' profiles is the apparent ease with which they master these languages, suggesting a special trait underlying language learning.

Talent at foreign language learning is a fascinating topic for the general public, yet, there is no consistent tradition of studying it, and often we rely on proverbial evidence.

A recent study reports the case of a 21 year-old Polish girl who has command of seven languages, most of them to an expert degree (Biedron and Szczepaniak, 2009; Obler, 1989). However, cases of younger individuals are quite rare. A methodological problem in this type of research is the distinction between talented children and children with a developmental deficit. For instance, in research on reading, the category of precocious readers, i.e. children who learn to read fast and effortlessly at a very young age, and prior to school instruction, is often hard to distinguish from hyperlexia, a condition co-occurring in the context of (high-functioning) autism (Jackson, Donaldson and Cleland, 1988; Saldaña, Carreiras and Frith, 2009).

Another puzzle in cases of linguistically talented individuals is providing an account of how they learned the languages they know. Quite often, these are unusual circumstances, such as e.g., from television or from playing computer games. While research suggests that such channels are inadequate to provide the kind of input necessary for a child to learn their native language (Zimmerman, Christakis and Melitzoff, 2007), the high degree of proficiency observed in language talented children suggests that alternative accounts ought to be sought. It is likely that such individuals employ implicit learning and consolidate their knowledge through practice and exposure to domain-specific knowledge (Wallace, Happé and Giedd, 2009). Indeed, there is evidence that implicit learning may support L2 learning as well (Ellis, 1994; Saffran, 2012; Treffers-Daller and Callude, under revision). Even though scarce, reports of so-called incidental successful foreign language learning in children offer some evidence. Such cases typically acquire the second language prior to structured instruction at school and may attain quite adequate levels of proficiency (Lefever, 2012). Invariably, these children appear to have learned through exposure to television and/or computer games. Such sources of target language input are increasingly gaining importance. A recent large-scale foreign language learning study in Europe documents that the next best predictor of foreign language proficiency outside of school among young learners is viewing subtitled L2 films on TV (Lindgren and Muñoz, 2013). Such evidence is compelling and in need of explanation.

In this article, drawing on evidence from a detailed comparative case study of two linguistically talented children, I argue three points. The first point is that such cases of language talent offer a rare glimpse, as if through a magnifying glass, into the mechanisms that, in all likelihood, underlie language acquisition. The second, related, point, concerns the possibility of establishing a parallel between traits in the overall cognitive profile and language learning skills. The third point that offers itself as a conclusion, based on the presented evidence, is that there are at least two pathways that lead into language acquisition, one based on the ability to find (statistical) patterns in the rich environmental input, including also language input (Newport, 1990; Pelluchi, Hay and Saffran, 2009, among others), the second one emerging through following

on regularities of social and communicative behavior, as strongly argued for by usage-based theories with an emphasis on early social experience and the importance of communicative cues (Tomasello, 1992, 2000, 2003).

3. The Cases

3.1 Participants

Two girls with a talent for foreign language learning participated in this study, PS (14;2 years at the time of study), and NJ (12;9 years at time of study). Both are Slovenian, and are characterized by multiple languages spoken in their environment (Serbian/Bosnian/Croatian). Remarkably, none of the parents or others in the immediate surroundings of the two participants speak English. Yet, both have learned English, apparently outside of school (as can be assessed by what the Slovenian curriculum offers for those ages). This was further ascertained in the detailed interviews conducted prior to the language testing (Hasselø, 2013).

3.2 Materials and Method

Both participants were tested on a number of tests. To establish the girls' language competence in the L1, a standardized language test (The SGP-PS) was completed. To establish the proficiency level in English, we conducted an English language test designed for native speakers (TOLD-I:4), and, in addition, we used a sentence repetition task, which is a popular tool for testing, among other things, (more advanced) grammar competence. In order to establish the participants' cognitive profile we conducted an intelligence test using a standardized version of WISC-III. The materials are presented in detail below.

3.2.1 SGP-PS L1 Test

The SGP-PS is a Slovenian language competency test and a general language and written communication test. Form B was used in the current study (SGP-PS) (Marjanovic Umek, L. and Fekonja Peklaj, U., 2011). This test is used as a screening and testing instrument in the Slovenian context for children and adolescents for testing general language skills and written language. The first sub-test consists of writing a story from a picture. Scores are based on an assessment of orthography, syntax, and form and content of the story. The second sub-test assesses meta-vocabulary; the third sub-test assesses ability to compose meaningful sentences. Merging sentences is targeted in the fourth sub-test, while explaining metaphors is the task in the fifth

sub-test. The last sub-test measures written skills in a dictation format. Assessed in this latter sub-test is spelling, punctuation marks and use of capital letters. Two of the SGP-PS sub-tests are paralleled in nature by the L2 test we used, TOLD-I:4. These are the test of transforming meaningless sentences into meaningful ones, and the meta-vocabulary test, which taps word understanding. This makes it easier to compare the performance across the L1 and the L2.

3.2.2 L2 test - Test of Language Development –Intermediate: Fourth Edition

TOLD-I:4 test is a test designed to test language development in English as L1. The test is standardized for American English, ages 8-17;11 years. Testing L2 users and learners with an L1 test might seem inappropriate, given the general gap between L1 and L2 performance. Our aim was to establish the English proficiency level of the two participants, and, in the absence of an L2 test suitable to provide the kind of data that we needed, we converged on TOLD-I:4. Also it was useful for the study to be able to compare to native fluency (Hammill and Newcomer 2008). One problem with using the TOLD-I:4 are certain cultural and geographical aspects, especially in the testing of vocabulary. Things such as mailboxes (and the way they look) or animals (e.g., turkeys in the context of Thanksgiving) that are commonplace in the USA, might not be so in Slovenia. These cultural aspects and differences might have influenced some of the vocabulary scores, but are less likely to have had an impact on the remaining sub-tests, which mostly target grammar and semantic skills (Hammill and Newcomer 2008).

TOLD-I:4 consists of six sub-tests. The first sub-test is Sentence Combining, where participants are asked to combine two or more sentences into one sentence with the same meaning (syntax). The second sub-test is Picture Vocabulary - participants hear expressions and are encouraged to choose which of six pictures matches best the (meaning of the) expression. The third sub-test is Word Ordering - participants hear a string of isolated words and are expected to form a sentence that makes sense by using all of the words they've heard. Dropping a word from the original string is penalized. An example is "game, who, the, won" which is expected to produce "Who won the game?". The fourth sub-test is Relational Vocabulary. Here the focus is on semantic relations among words, and the participant is expected to produce a common denominator (a hyperonym) that covers the meaning of 3 related words. An example is "elm, cedar, oak" which are all category "tree". The fifth sub-test is Morphological Comprehension and involves grammaticality judgments. As such, it tests metalinguistic and grammar competence. Participants are to determine whether a sentence is grammatically correct or incorrect. An example is "We ma**ked** some pudding". The sixth sub-test is Multiple Meanings. The goal is to test participants'

lexical knowledge and sense of homonymy in language. An example is /raIt/ which can correspond to the spellings "right/ write/rite". Participants, who are aware of the possibility of phonological overlap and the existence of different lexical items or multiple senses, will produce the following meanings: correct (=right1), the dominant hand of most people (=right2), conservative politics (=right3), a ceremonial act (=rite) and more (Hammill and Newcomer, 2008).

Results in TOLD-I:4 are first calculated as raw scores, then converted into scaled scores by a formula given by the test instructions. These scores are then divided into 7 blocks ranging from 1-3 points which is "very poor" to 17-20 points corresponding to "very superior" (Hammill and Newcomer, 2008).

3.2.3 L2 Sentence Repetition Test

This test consisted of repeating English sentences with increasing degree of difficulty and was designed specifically for the study. It was in part based on a previous test used in research with young learners of English as L2 in Norway (Dahl, 2014). In the original version, the sentence repetition test was used in a sample of 6-year-old first-graders in Norway. For this reason, the easiest sentences in the original test were replaced by more complex sentences. In addition, half of the sentences included a mistake, the idea being that participants will spontaneously correct the mistake, if they became aware of it. This elicitation technique is quite common in research in L1 grammar acquisition (Karmiloff and Karmiloff-Smith, 2001).

3.2.4 The Wechsler Intelligence Scales for Children

The intelligence test used in this research was WISC III, (Slovenian adaptation and standardization from 2001). This is an established test to measure intelligence performance in children and adults. The first version, the Wechsler-Bellevue Intelligence Scale was published in 1939 and this original test was aimed at adults. WISC-III is a later development and is aimed at the age group 6-16 years (Wechsler, 1991).

In the framework of the development of WISC III, the definition of intelligence employed by Wechsler is: "an individuals' ability to adapt and constructively solve problems in the environment" (Wechsler, 1991). What is essential about this definition is that intelligence is not seen as a measurement of capacity, but rather a measurement of performance. In this way the test's ambition is not to measure the quantity of intelligence, but intelligence as performance. Thus, it is the ability to make use of intelligence, when presented with a new environment that the test is meant to reflect.

WISC-III, together with many other intelligence tests, regards the measurement of intellectual performance as a measurement of a multidimensional construct. In this way, rather than seeing intelligence as a single characteristic, WISC-III treats it as different types of intellectual functioning. In alignment with current ideas, WISC-III, treats intelligence as several different and independent measures of intellectual functioning, and as independent factors, e.g., "h, f, g, a, d", rather than specific factors that make up a general "G" (Wechsler 1991).

The Wechsler Intelligence Scales (Slovenian adaption form 2001) have two different sets of subsets grouped in two different areas. There are 6 subsets within the verbal scales area and seven in the performance scale area. The verbal scales consist of tests that measure vocabulary (language), reasoning, general knowledge, and memory skills. The performance scales measure problem-solving skills, spatial understanding and sequencing. As such, it does not deviate from the original English version.

Before testing informed consent was received by the parents of both girls (Hasselø, 2013).

4. Results

4.1 The Wechsler Intelligence Scale for Children

4.1.1 PS' Results

PS's cognitive abilities are generally high and fall in the average to above average level range. However, her cognitive profile displays a rather sharp discrepancy, in that her verbal comprehension skills are much higher than her perceptual reasoning skills. PS's verbal conceptualization, verbal knowledge and verbal expression skills, which include: answering to verbal questions that concern familiarity with facts, meanings of words, verbal reasoning and ability to express one's thoughts verbally, are better than nonverbal thinking and visual-motor coordination. The latter include integration of visual stimuli, nonverbal reasoning, use of visual-spatial and visual-motor skills for solving problems that are not part of school knowledge. It is common that people have discrepancies between verbal and nonverbal abilities, but this difference is usually not so prominent. Only 10 % of children have so much higher verbal abilities in comparison to nonverbal abilities, as is the case with PS (Trstenjak, 2012). PS is extremely good at verbal concepts and has extremely good retrieval from long-term memory. On the other hand, her short-term memory and her spatial intelligence are relatively weak points in her profile in contrast to other very high scores.

Table 1: WISC-III profile PS (Age 14;2)

WISC-IIISI subtests				Raw scores		
Information	26			14		
Similarities	25			18		
Vocabulary	45			17		
Comprehension		28			14	
Picture completion	22			9		
Picture arrangement	41			13		
Block design	43			9		
Object assembly		35			14	
Mazes	20			6		
Arithmetic	18			4		
Digit span	14			6		
Coding		60			10	
Symbol search		34			14	
Scales 90% confidence level						percentile
Verbal scale	67			121	93	114-125
Performance scale	55			106	68	99-112
Full scale	**122**			**114**	**86**	**106-119**
Factors						
Verbal Comprehension	63			132	99	122-136
Perceptual organization	45			107	69	99-114
Freedom form distractibility	10			72	3	68-83
Processing speed	24			111	78	102-117

According to available Slovenian norms (from 2001) for appropriate age group.

4.1.2 NJ's Results

NJ's nonverbal performance is considerably higher than her verbal performance. In detail, her performance on tasks such as solving new problems quickly and operating in the visual-motor communication channel are very high, and only 2% of the population perform better than her. Her verbal performance on the other hand, where she is to use information and verbal reasoning, are below average, and her scores are in the lowest

4% of the population. Clearly we observe a sharp disassociation between performance skills and verbal skills in NJ's profile. Such strong dissociation occurs only in 1% of children her age. Furthermore, a clear weakness in Comprehension can be observed, with a scaled score of 1, which is extremely low. Her strength is the visual channel of data processing, while the auditive channel is altogether relatively weak. This means that NJ can receive, integrate, memorize and express information more efficiently when it is presented in the visuo-spatial channel. NJ can work fast, her processing speed and psychomotor speed apparently contribute to her high performance on the nonverbal subtests. She also used shorter time than she was granted on most of the subtests. PS, as already shown, displays clear strengths on tasks that involve and rely on verbal processing, and is weaker on visual-spatial reasoning. Thus, the cognitive profiles of the two participants appear to be the exact opposite of each other.

Table 2: WISC-III profile NJ (Age 12;9)

WISC-IIISI subtests Scaled scores				Raw scores		
Information	16			5		
Similarities	14			12		
Vocabulary	32			10		
Comprehension		13			1	
Picture completion	24			12		
Picture arrangement	45			17		
Block design	41			11		
Object assembly		37			16	
Mazes	21			10		
Arithmetic	15			2		
Digit span	10			3		
Coding		63			14	
Symbol search		35			16	
Scales 90% confidence level						percentile
Verbal scale	30			76	4	72-83
Performance scale	70			124	98	115-129
Full scale	**100**			**100**	**48**	**94-106**
Factors						

Verbal Comprehension	28			83	12	78-91
Perceptual organization	56			122	97	112-127
Freedom form distractibility	5			58	0.4	56-71
Processing speed	30			127	97	115-131

Figure 1. visualizes the results from performance on the WISC-III subscales for both participants. The first observation is that, while NJ excells on Perceptual Organization, and has a much poorer performance on Verbal Comprehension, PS has the exact opposite overall profile. In her case, Verbal comprehension is a clear strength, whereas Perceptual Organization is much weaker, in comparison. This overall difference in profile between the two girls is best represented in their contrasting results on two sub-tests, Comprehension (which is part of the Verbal Comprehension Index) and Picture Completion (a central component in the Perceptual Organization Index). Concerning performance on individual subscales, the profiles of the two participants appear more similar, with similar peaks and troughs, and in particular, similar very poor performance on the two Freedem From Distractability tests.

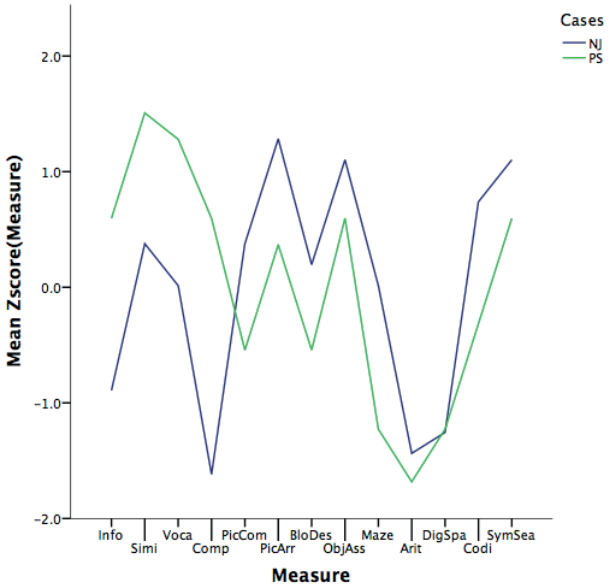

Figure 1. WISC-III profile of PS and NJ, showing deviation in performance on each WISC-III subscale of psychometric ability from the mean scaled IQ score for each participant.

4.2 SGP-PS L1 Test

4.2.1 PS' Results

In general, PS' scores on the Slovenian language competency test are only slightly below average (as can be seen by a z-score = -.591). This is comfortably within the range of typical performance for her age group. What pulls her overall score down is her performance on dictation and specifically, punctuation. Her performance on the tests that target language competence proper is much better. Her general language competence and written Slovene language skills are similar to an average child her age. PS took 10 minutes to write the story (the exact time limit), but completed all the other tasks in the L1 test in much quicker given the time that was available.

Table 3: PS's scores on Slovenian language competency test: General language test and written communication, form B

Subtests Scaled scores			Raw scores	Quartile ranks	Time used/time available
Write a story form the picture					
Orthography	10		1		
Syntax		10		1	10 min/10 min
Form and content		14		3	
Total for story		34			
Meta-vocabulary		16		3	6 min 40 sec/8 min
Meaningful sentences		15		4	3 min 13 sec/8 min
Merge sentences		10		3	6 min 18 sec/8 min
Explain metaphors	1		2		2 min/6 min
Dictation					
spelling		9		1	
punctuation marks	7		1		no time limit
capital letters	11		1		
Total for Dictation	27		1		
Total score	107		1		

Centile: 4 (90 % confidence interval: 3 to 5) z-score: –0,591 (90 % confidence interval: –0,92 to –0,12)

4.2.2 NJ's Results

In general, NJ scored very much below average on the Slovenian language competency test. Her combined language competence and written Slovene language

skills, as measured by the SGP-PS test, are significantly lower than average children her age, as revealed by a z-score of -2,970. NJ has higher scores on meta-vocabulary, syntax and form and content in the picture story, but achieves very low scores on the other factors tested. The written story she produced was brief.

NJ used some circular, tautological and non-informative explanations of the words in the meta-vocabulary test. An example is her explanation of the word *sad*: "*Sad* is when you are sad". In the "meaningful sentences test", she corrected some sentences, but failed to see that anything was wrong with the others. Some of NJ's corrections were not precise enough, given that she only saw one part/aspect of the error in the sentence. When merging sentences, she repeatedly used the same subordinating conjunctions, and even though her responses were quick, her results were flawed as a result of oversimplification. She did poorly when explaining metaphors, and the explanations she provided were mostly literal, and, as such, incorrect. In the dictation, NJ used mostly correct spelling (except for capital letters at the beginning of sentences and punctuation).

Table 4: NJ's scores on Slovenian language competency test: General language test: written communication, form B

Subtests Scaled scores			Raw scores	Quartile ranks	Time used/time available
Write a story form the picture					
Orthography	5		1		
Syntax		10		1	10 min/10 min
Form and content		12		2	
Total for story		27		1	
Meta-vocabulary		11		1	5 min 30 sec/8 min
Meaningful sentences		5		1	5 min 22 sec/8 min
Merge sentences		5		1	7 min 35 sec/8 min
Explain metaphors	0		1		3 min/6 min
Dictation					
spelling		5		1	
punctuation marks	3		1		no time limit
capital letters	4		1		
Total for Dictation	12		1		
Total score	70		1		

Centile: -1 (90 % confidence interval: -1 to 1) z-score: –2,970 (90 % confidence interval: –3,04 to –2,09)

4.3 Test of Language Development –Intermediate: Fourth Edition

4.3.1 PS' Results

PS' results on the TOLD-I:4 test are quite even, with no significant peaks in performance. Performance on the Sentence Combining sub-test is a clear strength, where she performs in the 37% of native –speaking children that age. On that test, her overall performance is at the level of an American 8;3 year-old child.

Table 5. TOLD-1:4 Subtest Performance PS

Subtests	Raw scores		%ile	Ranks	Scaled scores
Sentence combining	18		37		9
Picture vocabulary	28		5		5
Word ordering		16		16	7
Relational vocabulary		13		16	7
Morphological Comprehension		11		9	6
Multiple meanings	20		9		6

4.3.2 NJ's Results

NJ's profile is uneven, with significant peaks and troughs. She performs poorly on the Relational Vocabulary task, while she peaks on Morphological Comprehension. This task taps grammar competence, through grammaticality judgments. Here, NJ outperforms 90% of 10 year-old native speakers. Her accuracy on this task is remarkable, however, apparently, consistent with her strengths in pattern-finding, as revealed in the WISC-III results. Her average performance on TOLD-I:4 is comparable to that of an American 10,3 year-old child.

Table 6. TOLD-1:4 Subtest Performance NJ

Subtests	Raw scores		%ile	Ranks	Scaled scores
Sentence combining	19		37		9
Picture vocabulary	45		25		8
Word ordering		13		9	6
Relational vocabulary		5		1	3
Morphological Comprehension		41		91	14
Multiple meanings	26		37		9

4.4 Sentence Repetition Test

This test was expected to tap understanding of the sentences in the L2, along with the ability to spot, and automatically correct, grammatical mistakes included in half of the sentences. In addition, such tasks typically test Working Memory (WM) capacity.

4.4.1 PS' Results

PS repeated the 10 first sentences without problems and she also did this in a fluent manner, showing that she understood the content. PS started struggling, however, when the sentences became longer. She could not remember the more complex sentences, and therefore failed to repeat the full sentences correctly. Regarding the spontaneous correction of the mistakes, she did not correct any mistake, though she hesitated and apparently noticed some of them. The most surprising discovery was her inability to remember the sentences; this pulled down her performance, which was lower than first anticipated.

4.4.2 NJ's Results

NJ showed better working memory skills than PS. She also automatically corrected all the mistakes in the sentences. Her performance on this test is consistent with the results of TOLD-I:4 and the specific strength at grammar, as well as the WISC-III visuo-spatial and pattern-finding strengths.

5. Discussion

These two cases of apparent talent at second language learning come to demonstrate two different cognitive profiles, both of which, however, are consistent with success at language learning. The first participant, PS has clear strengths on verbal skills and all types of tasks involving verbal reasoning. She excels on information, vocabulary, finding similarities among concepts. Her weakness is in the domain of visuo-spatial reasoning. The dissociation between her verbal and performance intelligence scores is greater than expected (found only in 10% of children that age). In contrast, the other participant, NJ, excels on visuo-spatial tasks, and those relying on pattern-finding. These abilities are paralleled by very good performance on L2 grammar, as revealed by the Morphological comprehension test in TOLD-I:4 and an overall performance on the L2 test within the range of 10 year-old native speakers of English. She is also very good at noticing grammar mistakes in the L2 and can spontaneously correct them, as revealed by her results on the L2 sentence repetition task.

These contrasting profiles suggest that the cognitive resources both required for, and recruited in, language learning fall in (at least) two different types. The first type reflects the ability to process and retain information, most probably acquired through active social interaction. This is clearly seen in PS' active social profile. She is perceived by both care-givers, teachers and peers as outgoing, very social, and communicatively capable (cf. also detailed psychological assessment, Trstenjak, 2012). In her cognitive profile there is a clear strength for verbal comprehension (scaled score of 132), and compared to similarly aged children, she is in the 99 percentile of the population. Social and communicative skills are emphasized in usage-based and social-pragmatic theories of language acquisition (Tomasello, 2000, 2003). In such approaches, the ability to attend to, and use social and communicative cues is seen as crucial in successful language development. These approaches are also consistent with Situated and Embodied Cognition theories (Barsalou, 2008, 2010; Glenberg and Gallese, 2012; Glenberg et al., 2013; Zwaan, 1999), where both language and cognitive development emerge through the individual's interaction with the environment and through experience. It seems then, that social and communicative skills against somewhat lower visuo-spatial skills, are sufficient for successful language learning, both in the L1 (as seen by PS' results on the SGP-PS Slovene test), as well as in a second language (as demonstrated by a level of English corresponding to 8 year-old native speakers in TOLD-I:4).

The second cognitive profile displays clear strengths in the visuo-spatial and pattern-finding domain at the expense of dissociating with verbal reasoning. This profile is consistent with the ability to see patterns in language in the domain of grammar. NJ's composite PIQ score is 124 placing her in the 2 percentile of the population., while her verbal comprehension is extremely poor. The latter result is paralleled by her results on the L1 test in Slovene, demonstrating somewhat limited L1 resources. Yet, NJ excels on L2 grammar, as revealed by the TOLD-I:4 overall results, placing her within the group of 10 year-old native speakers of English, and, especially, her skill at spotting L2 grammar mistakes and correcting them. This profile is consistent with accounts of language acquisition that highlight the importance of statistical learning. According to Saffran, Aslin and Newport (1996), statistical learning is "our ability to make use of statistical information in the environment to bootstrap language acquisition". Recently, it has been suggested that statistical learning can be involved in L2 learning, and can account for observed outcomes in L2 competence (Ellis, 1994, 2013; De Keyser, 2008; Saffran, 2012; Treffers-Daller and Calude, under review). Statistical or implicit learning has already been suggested to be especially relevant at higher levels of proficiency, when L2 learners become increasingly more sensitive to the statistical features of the L2 input, and can, thus, make use of them. Here we observe, however, an interesting paradox. Our two participants are still very

young, and with less experience in the L2. Thus, the ability to exploit the L2 statistical patterns, in NJ's case can only be explained by her higher level of proficiency, but not so much by greater exposure. One possible account is that, due to her young age, she can still use more general cognitive mechanisms available also for L1 acquisition (e.g., statistical learning, WM). Alternatively, it can be stipulated that higher levels of L2 proficiency can boost L2 performance, leading to still higher levels of proficiency, as demonstrated by NJ's level of L2 competence, which is comparable to that of 10 year-old native speakers. What is clear, however, is that superior pattern-finding skills as demonstrated by performance on Object Assembly, Symbol Search, Coding (WISC-III) can confer strengths in the area of grammar acquisition, as shown in previous research (Vulchanova et al., 2013).

It deserves mention that, despite the clear contrast in overall cognitive profile which has emerged from the psychometric data, the two participants share a problem in Freedom From Distractability, which is an all-time trough for both of them. Furthermore, they both show good performance on Object Assembly, Picture Arrangement and Symbol Search. The first two tasks belong in the Perceptual Organization Index of the WISC-III and indicate ability to process patterns. The latter task is indicative of more general processing capacity. It can be argued that both types of capacities support language learning and may, thus, form a common shared core, which is, in all likelihood, necessary for language acquisition. It is then not surprising that both participants in that study display a similar pattern of performance on tasks that tap these capacities.

What remains a puzzle is NJ's poor performance on the L1 language test. In particular, semantic skills emerge as clear troughs in L1 competence (seen in metaphors test, meaningful sentences). To the extent that the focus in this test is not specifically grammar, but rather written language skills (e.g., dictation, composition), it is difficult to assess to what extent it contradicts the findings from the L2 tests.

6. Conclusions

This article has provided evidence of two possible pathways, both of which may lead to successful L2 learning, a road that exploits social and communicative strengths, and one based on extracting regularities from the input through sensitivity to (statistical) patterns in the individual's environment. Both have been independently argued to account for first language acquisition. This is, to the best of our knowledge, the first evidence from L2 acquisition found in the profiles of two Slovene young learners of English. Their success at learning English may have an alternative, but likely, explanation, in terms of the multilingual environment in Slovenia, where

many languages are spoken and understood. Bi-/multilingualism is known to confer a number of cognitive advantages, such as improved attentional control, superior performance on symbol operations (Bialystok, 1999, 2001; Bak, Vega-Mendoza and Sorace & , 2014; Rodriguez-Fornells et al., 2006; Costa, Hernández and Sebastián-Gallés, 2008; Adesope et al., 2011), better working memory (Baddeley, Gathercole and Papagno, 1998; Perani, 2005), which may, in turn, facilitate the acquisition of further languages. However, while the causal link between bilingualism and such cognitive advantages is clear, the direction of causality is still an open question requiring further targeted research.

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