Predicting proficiency in signed language interpreting

A preliminary study

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An empirical study was designed to identify which perceptual-motor, cognitive and personality factors may underlie both acquisition of a signed language as a B language and development of signed language interpreting skills. If abilities that are potentially needed are found, a previous assessment of candidates' potential for developing signed-language interpreting skills could be useful in identifying which students are likely to obtain good results during training. Perceptual-motor and cognitive skills, personality factors and academic background were hypothesized as possible predictors of success. Results showed that perceptual-motor and cognitive abilities are more important than personality traits in predicting proficiency in learning a signed language and developing signed-language interpreting abilities. Perceptual-motor coordination is the most reliable factor for predicting signed language proficiency, followed by other cognitive and personal factors.

Keywords: signed language interpreting, predictor, proficiency, perceptual-motor coordination, cognitive skills, personality

Introduction

Signed language interpreting (SLI), a growing area within the field of interpreting, involves interesting research issues for psychologists and interpreters who investigate the cognitive basis of the interpreting process.

Our study focuses on investigating which perceptual-motor and cognitive abilities and which personality factors may be specific to signed language interpreting, and follows the line of similar studies conducted in the United States during the 1970s. Our goal is to determine if there is a group of aptitudes (perceptual-motor,

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cognitive and personal) that can predict whether a candidate for an SLI training programme where no prerequisite skills are set for admission is likely to succeed in acquiring both signing skills and interpreting techniques. Moreover, we want to identify which of these aptitudes make a specific contribution to interpreting proficiency in the signed modality, independently of their contribution to proficiency in the signed language itself.

Aptitude testing before interpreter training may contribute towards assessing candidates who may not be sufficiently well prepared or who may just want to improve their prospects in a particular interpreting programme (Bowen & Bowen 1989), and testing procedures have in fact been designed for this purpose (Bernstein & Barbier 2000). Similarly, if we can identify reliable predictors of signed-language acquisition and of developing SLI skills, we could test them before training in order to know which students have a better or worse chance of success. More generally, a knowledge of aptitudes which may be relevant to the acquisition of signing and interpreting skills may contribute to creating a baseline for interpreter-training curricula (Humphrey 1994).

Our research is being conducted in the context of vocational training programmes for sign language interpreters in Spain where, unlike most other spoken- and signed-language interpreting courses, language- or interpreting-related skills are not tested before training or required for admission. At the beginning of training, students either attend an intensive learning sequence (290–350 hours) in Spanish Sign Language (LSE, Lengua de Signos Española), or receive both LSE and interpreting lessons at the same time during the initial period, before focusing on specialized interpreting. Nevertheless, we have observed individual differences in the LSE classroom that severely constrain the acquisition of good signing skills, such as trouble with perceptual-motor coordination, articulation speed, spatial visualization and mental rotation of signs. These difficulties in learning a signed language by adults have been reported by instructors of American Sign Language and LSE (Álvarez et al. 2001; Baker-Shenk & Cokely 2002). Despite intensive language practice and great personal effort to improve, students find it hard to overcome these difficulties and, in comparison with the other students, they attend interpreter training with a lower degree of confidence in their B-language skills. Moreover, we have observed individual differences in the interpreting classroom that might be related to skills that are not language-specific. In fact, it is widely accepted that an individual with optimal language skills will not necessarily become an interpreter.

This study is intended to identify prerequisites for successful learning of LSE as well as for successful development of SLI skills. No similar research on this topic has been done so far in LSE interpreting and there is generally very little research available about other signed languages. Our study, therefore, has an exploratory nature and is aimed at serving as a platform for future research.

In the next section we first discuss differences between spoken- and signed-language interpreting with regard to training and selection procedures, differences that corroborate the need for modality-specific evaluation. We then discuss the theoretical basis that guided our selection of certain abilities as predictors of success in acquiring both signed-language and interpreting skills. Accordingly, we will review evidence on abilities related to the visual-spatial modality and its effect on memory and attentional mechanisms, and on those that are specific to the comprehension and production of a signed language. Finally, we will look at abilities selected as predictors in previous studies.

Training programmes for signed language interpreters

Comparative studies of SLI training across different countries point to significant differences which are of interest to researchers as well as professionals (Napier 2004). When it comes to Spain, for example, whereas spoken-language interpreting programmes are usually designed so that trainees are able to perform this challenging task by the end of a training period, the situation of SLI training programmes seems far less consistent. Since 1995, SLI training in Spain has been provided through a national vocational programme comprising two academic years, which is arguably similar to the first ASL/English interpreting courses held at community-college level in the United States in the mid–1970s. A few postgraduate "hothouse courses" (Pollitt 2000: 68) in LSE interpreting have recently been held at the university level as well.

Not surprisingly, the length of training presents a problem, as a two-year programme is not enough to meet the demands of the profession (Roy 2000). In fact, many interpreter training programmes conducted today in countries with a well-established signed language interpreting profession are university-level courses and comprise three or four academic years (Napier 2004; Niska 2004).

Entry-level requirements are another point of discussion which helps contextualize our research. The nature of the selection processes and aptitude testing before interpreting education has been widely examined in the literature on spoken-language interpreting (Longley 1978; Moser-Mercer 1985; Bowen & Bowen 1989; Gerver et al. 1989; Longley 1989; Gringiani 1990; Lambert 1991; Martin & Abril 2002) and, to a lesser extent, also in the literature on signed language interpreting (Frishberg 1986; Humphrey 1994). It is known that each educational institution may set its own requirements according to private or public policies and the characteristics of the (spoken- or signed-language) interpreting course. Still, notwithstanding the lack of standardized admission criteria, we found general agreement among professional organisations of spoken- and signed-language interpreters concerning the need to establish some admission criteria. AIIC (2003)

recommends that candidates for conference interpreter training should be selected through an entrance exam evaluating specific knowledge and aptitudes. Similarly, in 1995 the Conference of Interpreter Trainers (CIT) included proficiency in ASL and English as a prerequisite for ASL/English interpreter education in the United States. It has been suggested that selection criteria should take the length of training into account (Bowen & Bowen 1989; Seleskovitch 1999); i.e. it seems that the shorter the training period, the more proficient the candidate should be at the outset. According to Seleskovitch (1999: 61): to succeed at a sixth-month programme "students must be mature, highly talented, very knowledgeable and have a broad background knowledge of each subject under discussion".

By contrast, vocational SLI training in Spain lacks admission criteria for linguistic fluency (in LSE and Spanish) and interpreting-related skills. Spoken-language interpreting programmes have generally assumed that language learning should take place before actual interpreter training (Bowen 1989). Indeed, SLI training programmes in Australia and Britain, for example, are requiring a certain level of signed-language fluency for admission (Napier 2004).

Moreover, it has been highlighted that a solid command of working languages is required to ensure that difficulties as a result of poor linguistic competence are not carried over into interpreting classes (Shaw et al. 2004). According to Jacobs (1996), reaching a high level of proficiency in a signed language such as ASL may require the student to attend more than 1,350 hours of learning, and even then the level may not be satisfactory. Based on this view, Quinto-Pozos (2005: 160) has recently argued the need to re-examine the expectation that "interpretation students will possess the proficiency in the language after 4 years or less of classroom instruction to perform appropriately as interpreters." Educational institutions in Spain would do well to re-examine SLI programmes where students are deemed to become proficient in LSE within 300 hours of formal LSE instruction. The problem may be compounded by the practice of introducing LSE lessons at the same time as interpreter training. Experts in the field of SLI have highlighted that this approach leads to unsuccessful results and affects professional standards (Patrie 1989; Monikowski 1994; Monikowski & Winston 2003).

The educational context of SLI training in Spain is clearly linked to the fact that professionalisation of SLI is a relatively recent development. It was only in 1987 that the first official service of LSE interpreters was created in Madrid and, as mentioned above, no formal training was offered until 1995. In fact, recognition of LSE as the natural language of the Spanish Deaf community is still incomplete. As the legal situation evolves, there is also a need to improve SLI training programmes, including the introduction of an assessment tool for the evaluation of entry-level students in skills that might play a role in the successful acquisition of both signing and interpreting abilities.

Selecting possible predictors

Predictors of LSE proficiency

Since the late 1970s, a sizeable body of psycholinguistic evidence has accumulated with regard to the use of the visual-gestural modality of language perception and production and its effect on language processing. It is on the basis of this evidence that predictors of a successful acquisition of LSE skills were selected.

In working with ASL, Emmorey (see 1993, 1998 for a review) noted the importance of processing motion and faces as well as imagery as essential components in the perception of signed languages. Motion seems to play a very important role within signed languages because it conveys phonological, morphological and lexical contrasts. Studies with deaf signers show that their visual attention is spatially distributed and that they have developed a better capacity to detect changes in the visual periphery as a result of using vision for getting both linguistic and environmental information (Quittner et al. 1998). However, this evidence has also been associated with the fact that detecting and interpreting movement in the visual periphery is necessary during signed-language comprehension or production because signers do not track the hands but rather look at the face (Siple 1978). In fact, it is essential to pay attention to facial features to understand signed sentences, as linguistic facial expressions play a significant role in the syntax and morphology of signed languages (see Baker-Shenk 1985 for ASL and Chapa 2001 for LSE). For example, raised brows are used to mark topics of discourse, and furrowed brows to create wh-questions. These linguistic expressions differ from emotional expressions, which do not have a grammatical function but convey information about characters during role-playing. Facial expression is thus a very important factor in the evaluation of LSE proficiency.

Other visual abilities such as mental rotation have also been found to be crucial for signed-language comprehension and production. According to Emmorey. (1993), while speakers consider left and right directions with regard to themselves, signers encode them spatially and perform a 180° rotation while comprehending descriptions of spatial scenes or locations. In fact, enhanced performance in mental rotation tasks has been found to depend on signed-language skill level (Talbot & Haude 1993). The difficulty associated with mental rotation (*rotation effect*) seems to disappear in native signers due to the practice of a visuospatial language (Emmorey et al. 1998). However, given the individual differences in performing mental rotation during signed-language production and comprehension observed in students of elementary signed language skills, we hypothesized that spatial skills could predict signed-language proficiency. Language-processing differences due to the visuospatial modality led us to hypothesize that nonverbal intellectual skills contribute to success in learning a signed language to a proficient level.

Motor skills have been claimed to be a necessary skill for LSE production (Álvarez et al. 2001), but no evidence exists so far. Baker-Shenk and Cokely (2002) have argued that visual or motor difficulties are to be expected at the beginning of signed-language instruction, and that students need a certain amount of time to adjust to these. We agree, but have observed that not all students "adjust" as expected. This in turn has direct implications for programmes training students of LSE and of signed-language interpreting, which is why we propose that perceptual-motor coordination should be investigated as a factor in the acquisition of a signed language.

Observations in the LSE classroom have also led us to consider that certain personality factors could be important for successful acquisition of a signed language, in view of the demands of interacting with fellow students and later with Deaf people (Humphrey 1994) Interpreting students learning LSE from scratch need to overcome initial feelings of foolishness or embarrassment in order to develop good skills in the production and comprehension of facial expression. We have found that some students remain inhibited throughout the LSE learning sequence and do not overcome their feelings of unease. Moreover, they report little or no contact with deaf people or with the Deaf community. We hypothesized that an interpersonal trait such as extroversion could promote successful acquisition of a signed language. In the field of Second Language Acquisition (SLA) research, personality variables such as extroversion and communication apprehension have been related to a wider personality trait called "willingness to communicate", which has been conceptualised as an important variable for second-language learning (MacIntyre et al. 1998).

Predictors of SLI proficiency

Predictors of the successful acquisition of interpreting skills were selected on the basis of "qualities", "skills", "abilities" or "aptitudes" discussed in the literature as essential to the spoken- or signed-language interpreter's profile (AIIC 2003; Brisau et al. 1994; Darò 1995; Frishberg 1986; Herbert 1964; Kurz 1999; Lara & de los Santos 2000; Lonsdale 1997). Since these aptitudes are not classified or else classifications vary across authors, we have followed AIIC's division into knowledge and aptitudes. *Knowledge* includes language skills and cultural background; *aptitudes* comprise personal and cognitive skills related to the interpreting task (see Table 1 for a detailed description).

We have also considered aptitudes evaluated in previous studies intended to identify predictors of success in interpreting performance (Table 2), and have been guided by experts' and professional interpreters' statements about the qualities that comprise a spoken- or signed-language interpreter.

Table 1. Knowledge and aptitudes mentioned in the literature for spoken- and signed-language interpreters

	Knowledge	Aptitudes	
LINGUISTIC	High command of A & B languages ↔♥ Specific vocabulary ↔	Efficient input segmentation ↔ Attentional division ↔ Use of language-pair-specific strategies ↔ Predictable properties of language ↔ Change translation strategies ↔ Verbal fluency ↔♥ Processing speed ↔♥	COGNITIVE
CULTURAL	Knowledge of A & B cultures ↔♥ Cultural background ↔♥	Good long- and short-term working memory ↔♥ Powers of concentration ↔♥ Capacity to sign and talk simultaneously ♥	
ACADEMIC	University degree or equivalent ↔ -	Adapt without delay to different speakers/ signers, situations and subjects ↔♥ Pleasant voice and public-speaking skills ↔♥ Stress resistance and self-control ↔♥ Team work ↔ Professional distance ↔♥ Likes to be well-informed ↔ Diplomacy ↔ Good self-concept ↔ -	PERSONALITY

↔ Aptitude mentioned for spoken-language interpreters (AIIC 2003; Kurz 1999; Lonsdale 1997; Darò 1995; Brisau et al.1994; Herbert 1964).

♥ Aptitude mentioned for signed-language interpreters (Lara & de los Santos 2000; Frishberg 1986)

As Table 2 shows, cognitive, linguistic and personality factors have been evaluated as predictors of successful spoken or SLI performance. But unlike in spoken-language interpreting, *perceptual* and *psychomotor* factors have also been considered.

Results from previous studies intended to predict successful performance in spoken-language interpreters indicated that verbal skills (verbal fluency and a rich vocabulary) are important factors for developing simultaneous interpreting and memory span for consecutive interpreting (Gerver et al. 1989). So too are a strong motivation and the ability to grasp the links between various sequences and to analyze, reprocess and summarize the incoming message (Gringiani 1990).

Earliest studies searching predictors of successful SLI performance reported no definite findings but revealed that personality traits may be useful in predicting interpreting performance (Frishberg 1986) and that interpreters have higher IQs than the general population (Rudser & Strong 1986). Recent attempts to find

Table 2. Knowledge and aptitudes investigated as possible predictors of interpreting proficiency

Spoken-language interpreting (Lambert 1991; Gringiani 1990; Gerver et al. 1989; Longley 1989; Moser-Mercer 1985)	
Knowledge (Linguistic and cultural)	**Aptitudes (cognitive and personal)**
High command of A & B languages	To grasp meaning rapidly Processing of connected discourse Attentional division Working memory Logical memory Language accuracy Oral expression
Cultural background	Stress resistance Self-confidence Assertiveness

Signed language interpreting (Frishberg 1986; Rudser & Strong 1989)		
Perceptual skills	**Psychomotor skills**	**Cognitive skills**
Spatial visualization and manipulation of objects Perceptual-motor coordination based on immediate memory	Manual dexterity To look at complex configurations and respond to parts	Auditive short-term memory Information processing Expressional fluency
Linguistic skills	**Personality**	
undetermined	Stress resistance Assertiveness	

a psychological profile of sign language interpreters have also shown that these professionals are cognitively superior, namely in problem solving, motor control, mental concentration, attention to detail and abstract reasoning skills (Seal 2004). No significant evidence regarding the personality of the interpreter is available so far, perhaps because there is not an "ideal" personality (Lara & de los Santos 2000: 32). However, we have observed individual differences in the interpreting classroom regarding levels of anxiety, risk-taking and motivation for further learning, which lead us to investigate if there are specific personality traits that could be important for trainees to succeed in the acquisition of SLI skills.

Bearing in mind the psychological traits investigated in these studies, we hypothesized that a group of perceptual-motor, cognitive and personality factors could be predictors of successful acquisition of interpreting skills in students entering a signed-language interpreter training course in which no previous command of LSE was required.

Method

Participants

The participants in our study were 28 students from two different SLI programmes. 27 of the participants were female and one was male. Their ages ranged from 18 to 38 years and the average age was 23.5. They were native Spanish speakers and differed in academic level upon admission: ten participants had a three-year university degree in primary school education; another ten had a five-year university degree either in philology, pedagogy or translation and interpreting studies; and six participants had only a high school diploma. Only those with no prior knowledge of LSE were included, as it was assumed that prior knowledge was liable to affect participants' choice of strategy. Sixteen participants were students in their first year of a two-year course and ten were students in an intensive ten-month course. Instruction time dedicated to LSE and SLI techniques in the two courses was similar. We administered a battery of tests either individually or by groups. Test sessions were carried out during the first two months of training. The same person administered and scored the tests according to the standard procedures for their use. Once all tests had been scored, comprehensive individual reports were elaborated on the basis of test results. Each participant was mailed his or her own report. The participants did not receive any financial reward for their participation in this research.

Tests and predictors

We hypothesized the following psychological factors as predictors (Table 3):

1. *Perceptual-motor coordination*. We designed a new test of pseudosigns — grammatically correct but meaningless signs in LSE (see samples in Appendix 1) — in order to measure perceptual-motor coordination skills. A set of 14 pseudosigns was invented in collaboration with Deaf native teachers of LSE according to the formational parameters (hand configuration, movement, place of articulation and orientation) described for LSE. The pseudosigns were videotaped and shown on a TV screen at 10-second intervals, and each participant was asked to watch and repeat (imitate) each of them as it was presented. Because pseudosigns do not convey any semantic meaning, we thought that the participant's immediate imitation would reveal fine motor coordination skills (imitating formational parameters) and visual discrimination abilities, such as mental rotation and visual immediate memory. Participants' individual performances were scored by the researchers and the native Deaf teachers who collaborated in designing the pseudosigns. Positive scores were given to

perfect immediate imitations of pseudosigns. Negative scores were given to imitations that were incorrect according to LSE formational parameters (hand configuration, place of articulation, orientation and movement), and also to manually correct imitations that were not rotated, or ones that showed delayed performance or initial hesitation in motor action.

2. *Cognitive skills*. The 11 subtests from the Wechsler Adult Intelligence Scale (WAIS) (Wechsler 1995) were adopted as predicting variables for knowledge and aptitudes relevant to spoken- and signed-language interpreting, as discussed in the previous section. The WAIS is intended to measure verbal and performance abilities of an individual and is one of the most widely used intelligence assessments. Six verbal subtests measure acquired knowledge, verbal reasoning and working memory (*Information*, *Comprehension, Similarities, Arithmetic, Digit Span* and *Vocabulary*), and five measure spatial processing, attentiveness to detail and visual-motor integration (*Picture Completion, Block Design, Digit Symbol Coding, Picture Arrangement* and *Object Assembly*). In

Table 3. Tasks and skills evaluated as possible predictors of success

Pseudosigns Test	**(perceptual motor coordination)**		
Cognitive skills	Verbal WAIS tasks	Comprehension (acquired knowledge and verbal reasoning)	Similarities (capacity of abstraction and generalization of concepts by using associative thinking
		Digit Span (auditive short-term memory)	Vocabulary (cultural background and verbal expression)
	Visuospatial WAIS tasks	Block Design (spatial processing and visual motor integration)	Picture Completion (visual discrimination and attentiveness to detail)
		Picture Arrangement (quick processing of visual information by using logical and sequential thinking, and visual accuracy)	
Personality MMPI scales		Social Introversion (tendency to avoid social intercourse; lack of self-confidence; apathy; difficulty in making decisions)	Dominance (social initiative, self-confidence, capacity to face external pressure and emotional stress; persistence and responsibility)
		Social Responsibility (social participation; capacity to accept one's own behavioural consequences; identifies with a group and shows integrity	
Academic background			

order to avoid multicollinearity, after obtaining the correlation matrix for the predicting variables, we selected a subset of these variables to perform a multiple regression analysis (see Results section).

3. *Personality factors*. Five non-clinical scales from the *Minnesota Multiphasic Personality Inventory* (MMPI) (Hathaway & McKinley 1971) were taken as predicting variables: *Social Introversion, Self-Strength, Dependence, Dominance* and *Social Responsibility.*
4. Since the participants in our study had different educational qualifications, *academic background* was also adopted as a predictor to see if intellectual maturity gained through education (Zimmerman & Woo-Sam 1997) could be a precondition for success in SLI training.

We did not use participants' final examination results in LSE and SLI techniques as criteria, since these were derived from two different training programmes, and had been produced at different points in the respective programmes. Moreover, the teaching staff varied slightly from one programme to the other, and we therefore expected that evaluation criteria might be different. Instead, a trainer teaching SLI in both programmes was asked to issue individual evaluation ratings for both LSE skills and SLI techniques of each participant at the end of the training period. These ratings were found to display high positive correlations with official examination results (Table 4), and the overall statistical pattern of results was similar in the two analyses.

Table 4. Correlations between marks in the courses and ratings for SL and SLI

Variable	MARKSLI	MARKSL	RATSL	RATSLI
MARKSLI	1.00	0.70	0.85	0.92
MARKSL	.70	1.00	.80	.73
RATSL	.85	.80	1.00	.93
RATSLI	.92	.73	.93	1.00

MARKSLI = final mark for SLI in the courses; MARKSL = final mark for SL in the courses; RATSL = evaluation rating for SL; RATSLI = evaluation rating for SLI

Study design

A multiple regression analysis was carried out with 12 predictors as variables: Comprehension WAIS (W_COMP), Similarities WAIS (W_SIM), Digit Span WAIS (W_DIGIT), Vocabulary WAIS (W_VOCAB), Block Design WAIS (W_BLOCK), Picture Completion WAIS (W_PICTURE), Picture Arrangement WAIS (W_ARRANG), Pseudosigns (PSEUDO), Social Introversion MMPI (SOC_INTR), Dominance MMPI (DOMINAN), Social Responsibility MMPI (RESPON) and Academic

background (A_BACK). These factors were used to predict two measures: ratings for LSE (LSESUBJ) and for SLI (INTSUBJ) provided by an expert trainer.

Results

Before performing the regression analyses, we standardized test scores and calculated correlations between pairs of variables. We observed multiple high correlations between the independent variables. A high degree of multicollinearity may occur in many-variables studies and, in fact, produce unacceptable uncertainty in the regression results. In other words, if two or more independent variables are highly correlated, it can be difficult to estimate their separate effects through regression analysis. Therefore, to accommodate the multicollinearity problem, we selected a group of predictor variables to be entered into the regression model and omitted those showing very high correlations. Within the group of verbal WAIS subtests, we excluded the Information subtest because it showed high correlations with the other verbal scales, especially with Vocabulary (see Appendix 2), which seemed important for interpreting performance, and tapped to a significant extent the same skills measured by Vocabulary: knowledge of topic areas, rich vocabulary and fluent oral expression. Among the performance scales of WAIS, we excluded Digit Symbol Coding and Object Assembly. While both of these scales tapped visual-motor coordination, which could be important to SLI performance, this skill was also evaluated by the Block Design subtest. Besides, Digit Symbol Coding showed high correlations with Picture Completion and Block Design, and Object Assembly had a very high correlation with Block Design as well.

Within the personality variables, only three were entered in the regression analysis: *Social Introversion, Dominance* and *Social Responsibility.* Selection was done on the basis of scales tapping different normal-range personality traits as well as on the basis of the existing correlations between pairs of variables. The Social Introversion scale tests a person's tendency to withdraw from social contact and responsibilities. High scores on this scale indicate shyness, insecurity, apathy, poor decision-making, strong inhibition, low confidence in self-capacities and frustrated interpersonal skills. Low scores indicate that the individual is extroverted, active, sociable, intelligent and talkative. High scores on the Dominance scale indicate that a person is assertive, resourceful, likely to hold positions of responsibility or leadership, realistic and task-oriented, tenacious and optimistic. Low scores point to an individual who is pessimistic, lacks self-confidence, is rigid in problem-solving approaches, has low tolerance for frustration, and is unrealistic and unreliable. The Social Responsibility scale provides a measure of a person's social participation. High scores correspond to an individual who is self-confident, has

a sense of duty, strong standards, confidence in others, a strong sense of justice and ethical concerns. Low scores show that an individual is unwilling to accept responsibility for his/her own behaviour, unreliable, and not likely to assume responsibility within a group.

We excluded *Dependence* and *Self-Strength. Dependence* measures the same aspects as *Dominance* but in the opposite direction, and correlated with three normal scales (see Appendix 2). *Self-Strength* indicates the capacity to face external pressure and emotional stress, which might be a relevant factor for sign interpreting performance, but these were being partially covered by *Dominance* and showed a high positive correlation with this scale as well.

Mean group scores of participants in the WAIS subtests and MMPI scales that were entered in the analyses and in the test of pseudosigns are shown in Tables 5, 6 and 7.

For the regression analyses, we used the forward stepwise method,[1] with tolerance = 0'0001; F to enter = 1'00 and F to remove = 0'00. A first analysis was run on LSE rating and a second on SLI rating. In a final analysis, LSE rating was also included as a predictor of SLI rating.

Variables predicting LSE rating

Variables appearing in the regression model for the LSE rating were the following: Pseudosigns, Dominance MMPI, Similarities WAIS, Digit Span WAIS and Academic background. While the regression model approached significance in the prediction of the LSE rating (Adjusted $R^2 = 0.58806730$; $F_{5,20} = 8.1379$; $p < 0.0002$), the only statistically significant variable is Pseudosigns (see Table 5).

Table 5. Regression model for SL rating

N=26	BETA	p-level
Intercpt		.233428
PSEUDOSI	.519305	.001422
DOMINAN	.246010	.114239
W_SIM	.252954	.095351
W_DIGIT	.202698	.178524
A_BACK	.183998	.220923

Variables predicting SLI rating

The regression model for SLI rating is similar to the one obtained for LSE rating and allows for a significant prediction of the criterion variable (Adjusted $R^2 = 0.68288386$; $F_{7,18} = 8.6908$; $p < 0.0001$). The factors making a significant

contribution to the prediction of SLI rating are Pseudosigns, Similarities WAIS, Dominance MMPI and Digit Span WAIS (see Table 6).

Table 6. Regression model for SLI rating

N=26	BETA	p-level
Intercpt		.081381
PSEUDOSI	.514416	.001103
W_SIM	.372470	.019925
DOMINANC	.328988	.032161
W_DIGIT	.314645	.030811
W_COMP	−.119140	.546703
A_BACK	.265057	.075023
W_PICTURE	−.219230	.222541

Criterion variable LSE rating as predictor of SLI proficiency

We observed that the variable having the highest positive correlation with SLI rating was the LSE rating ($r = .92$). We subsequently decided to include the LSE rating in the group of predicting — independent — variables and carry out a regression analysis again in order to see if any other variable was making an independent contribution to the prediction of SLI rating. The regression model shows that the LSE rating is the strongest predicting variable, followed by the WAIS Picture Arrangement subtest. The Similarities WAIS shows a marginal value ($p < 0.06$). The statistical significance of the regression is very high (Adjusted $R^2 = 0.88672267$; $F_{7,18} = 28.957$, $p < 0.0000$) (see Table 7).

Table 7. Regression model for SLI rating including the SL rating as predictor

N=26	BETA	p-level
Intercpt		.194754
LSESUBJ	.683334	.000018
W_SIM	.157865	.068214
W_PICTURE	−.220633	.018328
W_DIGIT	.161798	.071923
A_BACK	.120517	.185733
DOMINANC	.125586	.178818
PSEUDOSI	.130795	.188583

Discussion

Predictors of LSE proficiency

Analyses of the results indicate that motor coordination, visual discrimination and visual immediate memory, evaluated by the test of pseudosigns, are predictors of success in learning LSE and, thus, very important abilities for learning a signed language. The fewer the visual and motor difficulties, the easier and faster it is to acquire signing skills. Although other variables also appear in the prediction model for LSE rating (see Table 8), none of them reaches significance. Surprisingly, none of the performance subtests of the WAIS are good predictors of LSE proficiency. These subtests measure spatial processing, attentiveness to detail and visual motor integration. Considering the high correlation ($r = .40$; see Appendix 2) between the test of pseudosigns and the Block Design scale of the WAIS, we can infer some overlapping regarding what is being measured by these two tests. Thus, evidence that perceptual-motor coordination skills measured by the test of pseudosigns underlie successful acquisition of LSE would be also supported by the high correlation existing between the Block Design scale and the LSE rating ($r = .50$), and the predictive power of the test of pseudosigns appears to be much higher than that of the Block Design scale of WAIS. Having identified skills that predict good results in the acquisition of LSE, we are better able to evaluate students who enter an SLI training programme without any knowledge of LSE.

Predictors of SLI proficiency

We have seen that the best predictor of LSE proficiency is perceptual-motor coordination, which — together with the cognitive verbal skills evaluated by the WAIS Similarities and Digit Span subtests, and the personality traits tapped by the MMPI Dominance scale — will help predict SLI proficiency in students beginning their training without previous knowledge of LSE.

Some of the intellectual abilities required in interpreters are to a certain extent evaluated by the WAIS cognitive subtests that were significant in the analysis. The verbal Similarities task measures abstract verbal reasoning and analogical thinking, and is strongly associated with academic success. This result appears to be in line with recent evidence revealing that sign language interpreters are superior to the general population in abstract reasoning skills (Seal 2004). Another verbal task, Digit Span, evaluates auditory short-term working memory and concentration. The statistical significance of this variable confirms previous evidence that memory skills are important in evaluating incoming candidates (Lambert 1991).

Similarly to the prediction model for LSE proficiency, the best predictor of SLI proficiency is Pseudosigns ($p < 0.001$), which is to be expected, since the two variables — LSE rating and SLI rating — have a very high positive correlation ($r = .92$).

We hypothesized that an academic background may be a significant predictor of SLI proficiency because cultural background and academic training are considered necessary requirements in candidates for interpreter training. It has been claimed that cultural background is provided by education to a great extent (Zimmerman & Woo-Sam 1997). However, results do not support our hypothesis, indicating that this factor is not a prerequisite for interpreter training.

Given the high positive correlation between LSE and SLI ratings ($r = .92$), we tried to isolate factors predicting only SLI proficiency from those that also predict LSE proficiency by including the LSE rating in the group of predicting variables. Analysis indicated that the LSE rating is the best predictor of SLI proficiency, followed by the perceptual skill assessed by the WAIS Picture Arrangement subtest. This result indicates that signed language skills are the key factor predicting success in interpreter training, thus confirming the basic principle assumed in interpreter training that B-language skills must precede such training (Bowen & Bowen 1989: 109). Results indicate that the intellectual abilities evaluated by the Picture Arrangement WAIS are also necessary for the acquisition of SLI skills. This nonverbal subtest evaluates the capacity to understand cause–effect relationships and the ability to process visual information quickly. It requires visual and spatial accuracy and use of logical and sequential thinking to recover an underlying story. Perhaps these cognitive skills are related to the processing of connected discourse, which is assumed to be a "crucial feature of the interpreter's task" (Gerver et al. 1989: 725).

However, it is important to emphasize that the use of the predictive model including LSE rating and Picture Arrangement can only be applied in selection processes where the LSE level of candidates is known.

Since LSE proficiency is the best predictor of SLI performance and perceptual motor coordination the best predictor of LSE proficiency in students admitted to training without any prior knowledge of LSE, the test of pseudosigns will serve as a significant predictor of successful acquisition of both signing and interpreting skills. If a candidate to an SLI programme presents good perceptual-motor coordination and visual discrimination skills, as revealed by the pseudosign test, s/he is likely to become a proficient signer and thus to develop SLI skills. By the same token, if visual and motor skills are poor, the candidate may not become as proficient in signing as is needed for interpreting students learning LSE from scratch before or concurrently with interpreting training. Our research supports the premise that language skills are fundamental to interpreter training, which is a basic assumption among trainers and professionals in the field of spoken- and signed-language interpreting, but is not actually implemented within SLI training programmes in Spain.

Personality traits

Personality factors are much less important than cognitive skills in the prediction of LSE and SLI levels. We hypothesized that some personality traits related to extroversion could be important in learning a signed language, but our results do not support this hypothesis. We did, however, find that the personality traits measured by the Dominance scale are relevant to success in the achievement of SLI skills. Some of the personal qualities considered desirable in spoken- and signed-language interpreters or studied as predictors of success — e.g. flexibility, stress resistance and self-confidence — are evaluated to a certain extent on the basis of Dominance. A person obtaining a high score in Dominance feels prepared to assume responsibilities and cope with trouble, is not easily intimidated, feels strong when facing different situations, and is tenacious, assertive and self-confident.

Project constraints

Considering these results, several points should also be discussed for the purpose of designing further research into the acquisition of SLI proficiency. First, more research is necessary to confirm the important role of the cognitive skills isolated in this study of SLI performance. It is also necessary to evaluate other possibly important cognitive abilities for the acquisition of SLI skills. For example, auditory or visual working memory skills, which are essential to the interpreter's task, have not been directly assessed in this study. Second, as present results suggest, no personality traits seem to be important for successful acquisition of a signed language, and only a few personality traits have been found important for acquiring SLI skills. Further exploration of personality factors is also needed; the MMPI may not be the most suitable personality assessment test for our purpose, as it contains many clinical scales and few scales evaluating normal personality traits. Also, there are probably skills comprising the so-called "attitude" of a sign language interpreter, which need to be investigated in further studies. Finally, future research should make recourse to more homogeneous samples and such samples should hopefully be of greater size to yield increased statistical significance.

Conclusions

Are there any psychological dimensions underlying successful acquisition of SLI skills? The results presented here suggest two main conclusions. First, there is certainly a group of factors that are important for the acquisition of signing and interpreting skills to a proficient level. Second, perceptual-motor and cognitive

abilities are more important than personality traits in predicting success. The set of relevant abilities isolated in the present study may be used to guide the design of a psychometric instrument aimed at evaluating candidates' potential for SLI training programmes. If candidates have no prior knowledge of a signed language, the battery of tests would include the following tasks: Pseudosigns, Similarities WAIS, Digit Span WAIS and Dominance MMPI. If candidates already have some command of a signed language, the battery would comprise a test to evaluate signed-language proficiency and the Picture Arrangement subtest of the WAIS.

Moreover, a candidate's good performance on the WAIS verbal subtests of Similarities and Digit Span and high scores on the MMPI Dominance scale will provide an additional guarantee of cognitive and personal potential for successful outcomes at the end of an SLI training period.

Even if linguistic and interpreting-related skills are not set as entry requirements to SLI programmes, evaluation of entering students' potential based on the set of abilities isolated in the present study would still be useful to improve the quality of education and contribute to the acknowledgement of the profession. Administration of these tests to evaluate students before they start training would allow for projections about their future achievements, distinguishing prospective interpreters from those who have less of a chance of obtaining good results during training.

Finally, these preliminary findings point to the need for more research on abilities underlying successful acquisition of signing and interpreting skills. Further insight into these factors will contribute to creating a frame of reference for curricula of SLI courses.

Note

1. *Stepwise* is a more useful procedure in regression to help the researcher develop its forecasting model than the ordinary multiple regression analysis. The stepwise option lets you either begin with no variables in the model and proceed *forward* (adding one variable at a time), or start with *all* potential variables in the model and proceed *backward* (removing one variable at a time). In forward stepwise, the first predictor selected is the one that contributes the greatest amount to the model. Then at a second step, from the remaining predictors, a second predictor is selected using the same criteria, and so on. Stepwise finishes when there are no more predictors that make a significant contribution to the model.

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Appendix 1. Samples from the test of pseudosigns (to be read from left to right)

1.

2.

Appendix 2. Correlation scores of criterion and predictor variables of the study

	INF	COM	ARI	SIM	DIG	VOC	LET	PIC	BLO	ARR	OBJ	SOC	SEL	DEP	DOM	RES	PSE	ACA	LSE	INT
W_INF	1.00	.62	.060	.67	.02	.84	–.12	.27	.17	.44	.12	–.18	.14	–.05	.55	–.07	–.02	.34	.17	.24
W_COMP	.62	1.00	.18	.56	.17	.59	.33	.47	.34	.63	.30	–.41	.34	–.28	.47	.02	.35	.28	.45	.42
W_ARIT	.06	.18	1.00	.14	.41	–.11	.21	–.10	–.11	.13	.24	–.08	–.01	.02	–.03	–.22	.03	.13	.11	16
W_SEM	.67	.56	.14	1.00	.14	.64	.01	.34	.11	.18	–.05	–.13	.23	–.20	.38	.00	.23	.12	.52	.59
W_DIGIT	.02	.17	.41	.14	1.00	–.00	.36	.27	35	.12	.05	.04	–.13	.08	–.10	–.29	.33	–.31	.33	.37
W_VOCAB	.84	.59	–.11	.64	–.00	1.00	–.06	.29	.11	.41	.10	–.29	.32	–.17	.62	–.15	–.10	.22	.23	.29
W_SYMBOL	–.11	.33	.21	.02	.36	–.06	1.00	.59	.59	.24	.49	–.22	.21	–.15	.10	–.20	.33	–.29	.29	.25
W_PICTURE	.27	.47	–.11	.34	.27	.29	.59	1.00	.50	.36	.25	–.16	.14	–.30	.29	.13	.29	–.19	.33	.33
W_BLOCK	.17	.33	.27	.26	.36	.11	.59	.50	1.00	.60	.73	–.11	.29	–.17	.47	.07	.41	.12	.50	.41
W_ARRANG	.45	.63	.13	.18	.12	.41	.24	.36	.60	1.00	.36	–.39	.26	–.32	.45	.16	.07	.44	.24	.11
W_OBJ	.12	.30	.24	–.05	.06	.10	.49	.25	.73	.36	1.00	–.01	.43	.62	.58	–.13	.30	.07	.25	.24
SOC_INTR	–.18	–.41	–.07	–.12	.04	–.29	–.22	–.16	–.11	–.39	–.01	1.00	–.30	.52	–.28	–.21	.84	–.25	–.14	–.06
SELF_S	.13	.33	–.01	.23	–.13	.32	.21	.13	.28	.26	.43	–.30	1.00	–.80	.64	–.01	.59	.15	.22	.13
DEPENDEN	–.04	–.28	.01	–.20	.07	–.17	–.17	–.14	–.30	–.17	–.31	.60	–.80	1.00	–.55	–.32	–.11	–.20	–.39	–.24
DOMINAN	.55	.47	–.03	.37	–.10	.61	.10	.29	.46	.45	.58	–.28	.64	–.55	1.00	.01	.64	.36	.23	.37
RESPON	–.07	.02	–.22	.01	–.29	–.15	–.20	.12	.07	.16	–.13	–.21	–.01	–.32	.02	1.00	–.00	.39	–.30	.18
PSEUDO	–.02	.35	.02	.23	.33	–.10	.33	.28	.41	.07	.29	.07	.09	–.28	–.02	.41	1.00	.03	.64	.64
A_BACK	.34	.28	.13	.12	–.31	.22	–.29	–.19	.12	.43	.07	–.25	.16	–20	.36	.39	.02	1.00	.26	.22
LSESUBJ	.17	.45	.11	.52	.33	.23	.29	.33	.50	.24	.25	–.14	.22	–.39	.38	.23	.64	.26	1.00	.93
INTSUBJ	.24	.42	.16	.59	.37	.29	.25	.33	.40	.11	.24	–.06	.13	–.24	.37	.18	.64	.22	.93	1.00