City Research Online

City, University of London Institutional Repository

This is the accepted version of the paper.

This version of the publication may differ from the final published version.

Adaptation of the British Sign Language Receptive Skills Test into Polish Sign Language

Justyna Kotowicz[1], Bencie Woll[2] and Rosalind Herman[3]

[1]Pedagogical University of Cracow, Poland; [2]University College London, UK;

[3]City, University of London, UK

Abstract

The evaluation of sign language proficiency needs to be based on measures with well-established psychometric proprieties. To date, no valid and reliable test is available to assess Polish Sign Language (*Polski Język Migowy*, PJM) skills in deaf children. Hence, our aim with this study was to adapt the British Sign Language Receptive Skills Test, the first standardized test to determine sign language proficiency in children, into PJM, a less researched sign language. In this paper we present the first steps in the adaptation process and highlight linguistic and cultural similarities and differences between the BSL Receptive Skills Test and the PJM adaptation. We collected data from 20 deaf children who were native signers (age range: 6;1 to 12;11) and 30 deaf children who were late learners of PJM (age range: 6;7 to 13;8). Preliminary analyses showed that the PJM Receptive Skills Test has

acceptable psychometric characteristics (item analysis, validity, reliability and sensitivity to age). Our long term goal with this work was to standardize the PJM Receptive Skills Tests and to include younger children (from 3;0 to 6;0 years old) so that it can be used in educational settings and in scientific research.

Keywords: sign language assessment, sign language test adaptation, sign language development, sign language acquisition, Polish Sign Language, deaf children's language

Adaptation of the British Sign Language Receptive Skills Test into Polish Sign Language

Sign language, the primary form of human language used by Deaf communities, is, like spoken language, transferred from one generation to another (Klima & Bellugi, 1979). Sign language is fully accessible and learnable for all deaf children to communicate and discover the world (Humphries et al., 2014). Deaf children typically acquire or learn visual-spatial language in different contexts, *inter alia*, in the family setting (Bellugi, 1988) or in educational settings (Rinaldi, Caselli, Onofrio, & Volterra, 2014). Children exposed to sign language from infancy go through similar stages of development as children acquiring spoken language (Bellugi, 1988; Mayberry & Squires, 2006; Morgan, 2014; Petitto et al., 2001). Age-appropriate sign language acquisition prevents deaf children from language deprivation and cognitive disorders associated with a lack of spoken language acquisition, as experienced by many (Humphries et al., 2014). However, the process of sign language acquisition can be at risk of delay or disruption (Quinto-Pozos, 2014). This is because although the natural sign language learning environment for a deaf child is the deaf family with deaf signing parents, only a limited percentage of deaf children have early access to sign language and acquire sign language as a first language in the familial milieu. Approximately 5% of deaf children are born to deaf parents and, consequently, are exposed to sign language from birth (Mitchell & Karchmer, 2004). To be raised by deaf signing parents does not guarantee native norms for sign language development in all children (Baker, van den Bogaerde, & Woll, 2005) for a number of reasons. Firstly, despite early and rich sign language input, some native signers exhibit sign language and communication disorders similar to the speech and spoken

language disorders found in hearing children; for example, there can be a developmental language disorder in sign language (Mason et al., 2010; Morgan, Herman, & Woll, 2007). Secondly, some deaf parents can themselves be late learners of sign language, which can influence their sign language competence (Morford & Carlson, 2011). Deaf children who are offered impoverished and inconsistent sign language input by non-native signing deaf parents may differ in sign language production skills from deaf children with deaf native signing parents (Ross & Newport, 1996). Thirdly, deaf children of deaf parents (DCDP) may have interactions with a limited number of signing interlocutors (adults and children) compared to the number of spoken language conversational partners for hearing children, and as a consequence, deaf children can have a reduced amount of input and more limited variability in sign language input compared to hearing children in spoken language environments. Fourthly, some deaf parents do not use sign language at home with their children, and their family communication is based on spoken language, gestures, and home signs (Baker et al., 2005).

Unlike the minority of deaf children who are native signers, most deaf children are raised by hearing parents who usually do not initially know sign language (Humphries et al., 2014); they usually only start to learn sign language as a second language after the birth of their deaf child. Some hearing parents decide to use sign language in daily communication with their deaf child. However, some have problems accessing appropriate sign language tuition and others struggle with poor language learning abilities, and their skills in sign language can therefore be limited. Consequently, hearing parents of deaf children can struggle to provide rich and well-structured input in sign language (Knoors & Marschark, 2012). Therefore, it is unsurprising that deaf children of hearing parents have been found to

generally have lower sign language skills than aged-matched native signers (Herman & Roy, 2006).

Deaf children of hearing parents (DCHP) generally learn sign language at schools that offer bilingual education, either in special schools for deaf children or in integrated settings. However, pupils who have not had rich access to sign language before entering school and whose sign language acquisition is based mainly on school interaction can show atypical language development (Mayberry & Lock, 2003).

Summarizing the evidence, sign language acquisition may be delayed or disordered in a considerable proportion of deaf children. For this reason, the process of a child's sign language acquisition should be monitored and supported by schools and habilitation centres. In order to measure the development of sign language, and indirectly to assure an adequate language environment, an assessment tool is needed. The first standardized measure for sign language development in the world was the British Sign Language (BSL) Receptive Skills Test (RST) (Herman, Holmes, & Woll, 1999). Currently, in Poland there is a need for a sign language assessment tool, because there are no tests that can be used to monitor the acquisition of Polish Sign Language (*Polski Język Migowy*, PJM). In kindergarten, primary schools, and habilitation centres, sign language assessment—if it occurs at all—is based on informal procedures similar to those used in other countries without developmental sign language tests (Haug, 2011a, b;Herman, 1998). The lack of an appropriate assessment inspired us to start working on the adaptation of the Receptive Skills Test (RST) from BSL to PJM with respect to the test adaptation guidelines recommended by the authors of the BSL-RST and others (Haug & Mann, 2008). This paper describes the first eight steps in the adaptation of the BSL RST into PJM, with the future goal of developing the first standardized assessment of PJM.

The British Sign Language Receptive Skills Test and its adaptations

The BSL RST (Herman et al., 1999) was developed to measure BSL receptive morphosyntactic skills in children from 3 to 11 years of age. The test is normally administered face-to-face with paper booklets, with the administrator conducting the scoring and helping the child with the administration of the video-based online content. The test now has a fully online version (see www.dcalportal.org). The test contains: (1) a vocabulary check and (2) a video-based Receptive Skills Test. In the vocabulary check, the child is asked to produce signs used in the main RST using a picture-based elicitation task. The goal of the vocabulary check is to ensure that the child is familiar with the signs utilized in the RST and to verify which version of the test should be used (in the original test, there were two versions of the BSL test, a Northern UK and Southern UK versions, each with different regionally varying signs, although there is only a single version in the new online format: again, see www.dcalportal.org). If the child does not produce the elicited signs correctly, the test administrator checks to see if the child recognises the signs. Based on the vocabulary check scores, the assessor decides if the child knows (can produce or at least recognise) the vocabulary included in the RST, and therefore whether or not to proceed with the test. In the main part of the RST, the child sees signed utterances of increasing difficulty, and is required to select one picture from a choice of four, that corresponds to the presented phrase. The child is asked to point to the correct picture. Scoring is automatic in the online version; in the paper-based version, the child points to the correct picture in the test booklet and the test administrator notes the child's responses on the RST score sheet. This part of the test contains 3 practice items and 40 test items.

The objective of the RST is to evaluate the knowledge of six grammatical structures in BSL: (1) negation, (2) number and distribution (plurals), (3) verb morphology, (4) noun-verb distinction, (5) size and shape specifiers, and (6) handling classifiers (Herman et al., 1999). Examples of each structure are presented in Table 1, and they are explained below. (Table 1 contains PJM equivalents that will be described in Step 3 of the RST adaptation process from BSL into PJM, and this description is in the online supplement that can be found with the online version of this article).

Insert Table 1

In BSL, negation can be expressed by manual negators (signs) and non-manual elements (e.g. headshake) (Sutton-Spence & Woll, 2007). In spoken languages, speakers can optionally add non-manual negation (e.g. headshake) to their speech, while in BSL, non-manual negation is obligatory and manual negators are optional in some constructions. Hence, manual negation must be combined in varying ways with non-manual elements (Atkinson, Campbell, Marshall, Thacker, & Woll, 2004). For example, in the BSL RST, item 3 (ICE CREAM NOTHING, English "no ice-cream") includes both the manual negator NOTHING and the non-manual negator of down-turned lips, headshake and narrowed eyes.

The grammatical structures for number and distribution are more complex in BSL than the plural in English. Plurals in BSL can be expressed by: repeating the sign (each repetition placed in a slightly different location representing distribution of referents in space); adding a quantifier (usually before the noun); or using a classifier construction, a predicate expressing *inter alia* the number and distribution (Sutton-Spence & Woll, 2007). In the BSL RST, item 6 (ONE TEDDY, English "one teddy") contains a classifier construction (all fingers extended, spread and loosely curved) and a single location, showing that there is just one teddy.

Three groups of verbs can be identified in BSL: plain verbs, agreement verbs, and space verbs (Schembri, Fenlon, & Cormier, 2018). In BSL, verb agreement is expressed by using syntactic space: the subject and the object are indicated by the location of the beginning and end points of signing. For example, in the BSL RST, in item 18 (BOOK-GIVE-TO-CHILD, English "a book is given to the child") the verb GIVE moves from the initial location where BOOK is signed, to the location where CHILD is signed.

A noun-verb distinction exists in BSL. When both noun and verb are derivationally related, the verb and noun have different movements (a longer movement in the verb compared to the shorter and more abrupt movement in the noun) (Herman et al., 1999). In the BSL RST, item 8 (DRIVE, English "drive") is a verb because the sign has a long movement with a gradual ending.

In BSL, size and shape specifiers are a type of classifier that describes the shape, patterning or size of a noun (Morgan & Woll, 2007). In the BSL RST, item 22 (WIDE-STRIPES-DOWN-TROUSERS, English "thick, vertical stripes on trousers") includes a size and shape specifier comparable to a modifier in spoken languages.

Handling classifiers indicate how an object can be manipulated by an animated being (Morgan & Woll, 2007). In the BSL RST, item 37 (EAT-THIN-SANDWICH, English "eating a thin sandwich") assess the handling classifier for SANDWICH. This sentence differs from the sentence EAT-THICK-SANDWICH as the handshape in the verb EAT is different according to the thickness of the object handled.

The psychometric parameters of the BSL RST confirm its value as an assessment measuring sign language skills in deaf children, with evidence available for the reliability (Herman et al., 1999) and the validity (Herman & Roy, 2006) of the test. To measure reliability, test-retest reliability (reported correlation r = 0.87) and split-half reliability

analyses (reported correlation r = 0.9) were conducted. To measure validity, the BSL RST scores were correlated with two non-verbal subtests from the Snijders-Oomen Test (Herman et al., 1999), with reading abilities in English, and with BSL skills rated by testers (Herman & Roy, 2006). The BSL RST significantly correlated with the Snijders-Oomen Categories sub-test scores. According to Herman et al. (1999), the non-verbal subtest indirectly requires verbal processing and hence, the Categories subtest may correlate with language skills assessments (such as the BSL RST). The BSL RST did not correlate with the second non-verbal Snijders-Oomen subtest (Mosaic), but the Mosaic is a pure measure of visual-spatial skills (Herman et al., 1999). The BSL RST scores were significantly correlated with Edinburgh Reading Test scores (reported correlation r = 0.70) and with tester ratings of children's BSL skills (exact correlation not reported) (Herman & Roy, 2006).

The BSL RST has a standardised procedure for conducting the assessment, and its norms are based on empirical data (Herman et al., 1999). The norming sample included 135 participants: 118 deaf children and 20 hearing children of deaf parents, whose first language was BSL. All of the deaf children had had extensive exposure to BSL: the deaf participants included deaf children of deaf parents (DCDP) and deaf children of hearing parents (DCHP) who had been in educational settings with BSL as the language of communication.

The BSL-RST has been adapted to a number of other sign languages, including: LSF (French Sign Language (Courtin, Limousin, & Morgenstern, 2010)), DSL (Danish Sign Language (Seiler & Larsen, 2005)), LIS (Italian Sign Language (Surian & Tedoldi, 2005)), DGS (German Sign Language (Haug, 2011a, b)), Auslan (Australian Sign Language (Johnston, 2004)), LSE (Spanish Sign Language (Valmaseda, Pérez, Herman, & Ramírez, 2013)) and ASL (American Sign Language ((Enns & Herman, 2011)). Adaptations of the BSL RST into other sign languages has opened discussions (e.g. Haug & Mann, 2008) on the

adaptation of sign language tests more generally, emphasising that adaptations are not simply

translations from the source language to the target language. Oakland and Lane (2004)

emphasized the distinction between translation, interpreted as a transfer from one language to

another one without linguistic and cultural changes in the test construction, and adaptation,

which should be managed within a framework recognising similarities and differences

between languages and cultures. "Sign language test adaptation is not a 'quick and dirty'

approach to designing a test: the result can produce a valid and reliable instrument to be used

in schools." (Haug, 2011b, p.357).

Based on the computerized adaptation of the BSL RST into DGS, Haug (2011a)

described procedures for the adaptation of sign language tests that have since become

established and accepted in sign language research methodology. The preparation of the PJM

RST was influenced by the procedures outlined by Haug (2011a), who described the

necessary steps in the adaptation of sign language testes and proposed a model of sign

language adaptation that provided guidelines for the present research. The DGS RST was an

inspiration for the PJM RST: the layout of the PJM RST was based on that of the computer-

based DGS RST, because the interface used in the DGS RST was described as child friendly

and easy to navigate (Haug, 2011a). Figure 1 presents the PJM RST layout. A computer-

based format was also chosen because this format helps to minimise the possibility of

mistakes made by human raters.

Insert figure 1

The process of test adaptation may involve significant changes in test construction

and, therefore, it is good practice for the authors of the source assessment tool to be involved

in order to oversee any linguistic and cultural modifications. In the current study, the authors

of the BSL RST closely monitored and guided each step taken in the adaptation of the BSL

RST into PJM. A similar process of co-operation between researchers took place during the ASL adaptation and was identified by that team as a necessary factor in the process of sign language test adaptation, which in turn may lead to a better understanding of visual-spatial language acquisition in deaf children (Enns & Herman, 2011).

Adapted Polish Sign Language Receptive Skills Test

PJM is used by more than 50,000 deaf signers in Poland, a country with a population of 38.5 million people (signers constitutes more than 0.1% of the whole number of inhabitants); the PJM community is one of the largest language minority groups in Poland (Świdziński, 2014). Despite the size of the community, PJM has not yet been recognised as an official state language, although the use of PJM is regulated by the Sign Language and Other Communication Mode law that was established on 19th of August 2011 (Rutkowski & Mostowski, 2017) which ensures the right to use different modes of communication, *inter alia* PJM. In 2012 Poland ratified the United Nation's Convention on the Rights of Persons with Disabilities (CRPD); this requires governments within the context of education to promote sign language learning and support to develop the linguistic identity of the deaf community.

In the school year 2018/2019, the number of deaf and hard of hearing children in kindergarten, primary and secondary schools was 12,778 (https://cie.men.gov.pl/, System of Educational Information, 2018) in all types of educational setting including special schools for deaf children and mainstream schools. Polish law does not guarantee the use of PJM in deaf education. However, there is recent legislation supporting the use of PJM in educational settings. In accordance with the CRPD, the Polish Ministry of Education has followed the decree (28th of August 2017) according to which sign language has a place in individual

therapeutic programmes and, hence, deaf and hard of hearing pupils are able to attend sign language lessons (Rutkowski & Mostowski, 2017). Sign language courses are supplementary and PJM is not included in education as a subject.

PJM has also become more available to deaf pupils thanks to PJM adaptations of school books that contain signed versions of texts, following the source content and layout; and PJM school programmes for deaf children who are not native signers (Rutkowski & Mostowski, 2018).

Recently, the need to support PJM development in deaf children has become a subject of discussion; however, specialist educators working with deaf children face different issues such as insufficient measures to monitor the development of PJM skills of children using PJM in educational settings. Widely available developmental measure of PJM with good psychometrics parameters has been lacking in Poland (Tomaszewski, Niedźwiecka, & Majewska, 2018). The development of a new assessment tool in the absence of limited research on PJM acquisition, or on PJM grammar development in deaf children has presented challenges. In this context, the adaptation of the BSL RST, a well-established assessment tool, appeared to be a good solution. This standardised test of BSL, constructed with methodological and theoretical precision, was therefore used as a basis for developing the first PJM test for deaf children.

The adapted PJM RST is designed to be an assessment tool that can be administered not only by deaf educators but also by hearing specialists with the appropriate skills in PJM: the minimum PJM's level recommended is Level A2 according to the Common European Framework of Reference for Languages (CEFR)(to administer the BSL RST a minimum of BSL Level 2 (comparable to A2) is required). As all instructions and test items in the PJM RST are signed on the test video by a deaf person, persons administering the test are not

required to have a high level of PJM skills. However, they need to have sufficient knowledge of PJM to conduct the assessment, especially the Vocabulary Check, where they evaluate if the child's sign vocabulary is adequate to undertake the test, and more generally, to be able to sign with the child if she or he wants to ask additional questions or have a more general conversation during the testing. Also basic knowledge about language testing in needed to conduct the test, e.g. the test administrator should be aware that before starting the test it is necessary to be familiar with the testing procedure including recording responses and providing feedback to the child. The test administrator should also know that his/her behaviour can affect the child's performance, e.g. eye-pointing (i.e. looking at the target item) may influence the child's choice.

Objectives

The aim of the present study was to adapt the BSL RST with special regard given to linguistic, cultural, and methodological issues (Haug, 2011b), and to collect preliminary evidence of its psychometric properties in terms of: 1) Item analysis; 2) Validity; 3) Reliability; and 4) Sensitivity to Age. Due to space limitations this paper, the first seven steps we took to adapt the BSL RST into PJM are described in full in an online supplement that readers can download from the online location of this paper. In Table 2, we summarize all eight steps that were taken, but again, we refer readers to the online supplement for the full prose description of the first seven steps.

Insert Table 2

Main study (Step 8 in Table 2)

Method – Participants

In the main study, which was Step 8 in Table 2, the final version of the PJM RST was administered to 50 prelingually deaf children (gender: ♂= 23, ♀= 37), 20 with deaf parents (native signers, DCDP) (*Mean* age (years; months) = 9;11, *SD* age = 2;0, *Min* age = 6;1, *Max* age = 12;11), and 30 with hearing parents (late learners of sign language, DCHP) (*Mean* age (years; months) = 10;5, *SD* age = 1;10; *Min* age = 6;7, *Max* age = 13;8). All the DCDP were rated by teachers as having native PJM skills (for 16 DCDP the evaluation was made by teachers who were deaf signers; for the remaining four, hearing signing teachers made the evaluation). DCDP's PJM skills were evaluated by a questionnaire in which teachers were asked to assess receptive and production skills on a scale from 1 (no skills) to 7 (excellent skills). The inclusion criterion was above 6 on the 7 point scale. Deaf parents also reported in the questionnaire that PJM was the first and dominant language of all DCDP and they did not declare any sign language impairment in their children's PJM development. The majority of the DCHP started to communicate in sign language at the age when Polish children enter the school education system (*Mean* age of PJM acquisition (years; months) = 6;2, *SD* age = 2;2). Table 3 shows the characteristics of the sample. Children came from 5 schools for deaf children, all with a Total Communication approach, with all using sign language on a daily basis. Only Total Communication schools ensure PJM access, because none of the Polish schools for deaf children has a bilingual approach with high levels of immersion in Polish and PJM as two different languages. None of the children had additional disabilities or below-average IQ (measured by Raven's Progressive Matrices).

Insert Table 3 here.

It was not possible to include younger children as the present study was part of a larger project investigating language and cognitive skills in deaf school-aged children.

Materials

The final version of the PJM RST assesses knowledge of five morphosyntactic areas: (1) negation, (2) number and distribution, (3) spatial verb morphology, (4) size and shape specifiers, and (5) handling classifiers. The computer-based PJM RST contains two parts: a vocabulary check (27 signs elicited from pictures) and a video-based RST (3 practice items and 47 test sentences: 38 items from the BSL-RST and 9 newly developed items). All pre-recorded instructions and test items are signed by a deaf person experienced in preparing educational materials. In the first part, the assessor evaluates whether the child knows the vocabulary used in the PJM RST. This part is managed on the computer by the assessor. The child is asked to name in PJM the pictures that are presented on the computer screen. The assessor judges the appropriateness of the child's answer: if the child uses the same signs that are in the PJM RST, the child is ready to continue with the PJM RST. If the child produces a different variant of the target sign or a gesture, a short training session is provided in order to familiarize the child with the target sign. In the training session the tester presents video clips of the sign(s) and encourages the child to repeat them. If the child is able to recognize the sign following training, measured by a recognition task (choosing one picture from a choice of four to depict the target sign), then the test can be continued. In the second part of the test, all procedures are managed by the child on the computer with the assistance of the assessor: for each item, after watching a short utterance signed in PJM, the child is asked to choose the most appropriate picture from a choice of three or four on the screen using the computer mouse.

The PJM RST is an attractive assessment approach for children. All instructions and items are included in the computer version, which ensures that all children receive the same instructions and stimuli. The scores are automatically saved.

Procedure

Prior to the study, written parental consent, verbal (spoken/ signed) consent from the deaf children and verbal (spoken/signed) consent of the children's teachers and school head teachers were obtained. All participants were tested individually in a quiet setting in their school. The test was administered in parallel sessions by two hearing signers of PJM (an educational researcher and a PJM interpreter).

Data analysis

All DCDP were native signers, exposed from birth to sign language. For this reason, their scores were taken as a basis for all statistical analyses except for test validity. All DCHP were late learners of sign language (*Mean* age of PJM acquisition (years; months) = 6;2, *SD* age = 2;2) and therefore their results were not incorporated in the calculation of psychometric parameters of the test. DCHP results were only analysed to test validity, defined as the inter group difference between DCDP and DCHP. Data were analysed with SPSS, version 24 (Statistical Package for the Social Sciences).

Results

Item analysis. One approach to item analysis is to measure the difficulty index (*p* value). The item difficulty index is the proportion of participants who answer an item correctly out of the number of all participants multiplied by 100%. The item difficulty index ranges from 0 to 100%. In other words, a high item difficulty index means that an item is easy and everyone gets it right (Green, 2013). The item difficulty index was calculated for all items of the adapted PJM RST. Five items (number: 27, 31, 37, 42) with a difficulty index lower than 25% (meaning that scores were below chance on a multiple-choice task with four

options) were removed from the subsequent analysis (Haug, 2011b). These items may be

considered too difficult for this age group. As the children included in the study were from

the older age range of the original BSL RST (which was normed on children aged 3-11), we

did not exclude 9 items that had a high difficulty index (in other words, easy items), because

they might be sensitive to differentiate PJM skills in younger children in future studies on the

PJM RST.

A test should have an average item difficulty index equal to 50% when a choice of

answers is not provided. In a multiple choice test, the probability of guessing has to be taken

into consideration. To maximize item discrimination, a certain difficulty level is desirable

depending on the number of given options. In the PJM RST, 33 items have 3 distractor

pictures (4 pictures per item) with a mean difficulty index equal to 85%. For three-response

multiple choice items (2 distractors + target), the item difficulty index is 89%. Lord (1952)

suggested that a desirable item difficulty percentage for four-response multiple choice

questions is 74% and for three-response multiple choice questions, 77%. On this basis, the

PJM RST is relatively easy for the deaf children tested. However, this may be because the

children were all in the older part of the age range for the test. Taking into account that the

RST was designed for children from the age of 3, a limitation of the main study is that the

youngest child in the sample was 6;1 years. We anticipate that the PJM RST will be more

appropriately challenging for participants younger than 6;1 (age range: 3-6 years).

The item discrimination index shows how success on an item corresponds to success

on the whole test (Green, 2013). In order to compute the item discrimination index two

groups are derived from the sample: the best scoring participants (masters' group) and the

lowest scoring participants (no-masters group). The item discrimination index ranges from -1

to +1 where the score +1 means that all of the best scoring participants got an item correct,

while all the lowest scoring participants got it wrong (Green, 2013). Although the

discrimination index was calculated, it should be interpreted with caution, because the sample

had relatively high scores with low variability (as mentioned above, all were from the older

age range for the RST). Only one item was below 0: this item had already been detected by

the difficulty index as an outlier (item 37, HOUSE-TOP-RIGHT, English "the house is on the

top right left side (of the street)"). This item was answered correctly more often by the lower

scoring group than by the higher scoring group.

Validity. One method for testing validity is the analysis of group differences when

two groups are expected to have different levels of the measured construct (Bachman, 2004).

The test should reflect this difference in the scores. We hypothesized that native signers

(DCDP), immersed in sign language from birth, would have better scores in the PJM RST

than late learners of PJM (DCHP). The Shapiro-Wilk Test demonstrated that the data in both

groups were normally distributed (Table 4) and Levene's Test confirmed the homogeneity of

variance ($F = 5.372$, $p > .05$). According to the t-test, the difference between DCDP and

DCHP was statistically significant ($t(46) = 5.81$, $p < .001$, Cohen's $d = 0.158$) (Figure2). This

shows that native signers (DCDP) obtained significantly higher scores than deaf children with

more limited and later access to sign language (DCHP), and confirms the validity of the PJM

RST. The small effect size (Cohen, 1992) may be the result of the small sample size.

Insert Table 4

Insert Figure2

Another way to test validity is to verify the correlation between two tests that

are supposed to measure the same construct (Hornowska, 2007). In Poland, there are no other

developmental assessments to measure PJM. Therefore, it was not possible to use a

comparable test to verify the validity of the PJM RST. We therefore tested validity indirectly,

ADAPTATION OF THE BRITISH SIGN LANGUAGE RECEPTIVE SKILLS TEST

by looking for a lack of correlation between the PJM RST and a test (Raven's Progressive Matrices) designed to measure another construct (abstract reasoning, fluid intelligence) (Hornowska, 2007). The raw scores in Raven's Progressive Matrices were translated into ten scores with a mean of 5.5, a standard deviation (SD) of 2 and maximum of 10. DCDP scores ranged between 5 and 10, and, none of the children scored below 1 SD ($M = 7$, $SD = 2$). The Shapiro-Wilk test shows that the scores on Raven's Progressive Matrices do not have a normal distribution ($W(20) = 0.867$, $p < .05$), therefore, the nonparametric Spearman's rho correlation was used. The PJM RST results do not correlate with scores on Ravens Progressive Matrices ($rho = -0.283$, $p > .05$) in the DCDP group, suggesting indirectly the validity of the PJM RST as a measure of language ability, although of course this needs further investigation.

Reliability. Internal consistency was measured by the Kuder-Richardson formula (KR-20 = 0.737). A Kuder-Richardson formula between 0.7 - 0.8 is commonly described as acceptable reliability for a test (Hornowska, 2007). This score is thus a demonstration of the reliability of the PJM RST.

Sensitivity to age. Sign language acquisition is a developmental process and, in consequence, we can hypothesize that the scores of the PJM RST should correlate with chronological age. Two variables, the PJM RST scores ($W(20) = 0,953$, $p > .05$) and age ($W(20) = 0.949$, $p > .05$) have a normal distribution according to the Shapiro-Wilk Test. For this reason, the parametric Pearson correlation was administered. A strong correlation between the PJM RST scores and age (a large effect size according to Cohen, 1992; $r = 0.63$, $p < .01$) (Figure 3) provided further support for the validity of the test.

Insert Figure 3

Discussion

The adaptation of the BSL RST into PJM is a long-term process demanding methodological, linguistic, and cultural analyses which cannot be limited to simply translating from one language to another. To adapt a test from one sign language to another one requires knowledge about differences and similarities in sign languages which must begin with cooperation between researchers. Therefore, the first seven steps in the adaptation of the BSL RST into PJM were undertaken in collaboration with the authors of the BSL RST, who shared their experience of sign language acquisition research and test development and also assisted with the revision of the items for the PJM version. Readers are encouraged to read the online supplement for a detailed description of the seven first steps in the eight-step process.

In the online supplement, pilot tests 1, 2, and 3 are described in detail as parts of the first seven steps. Based on the three pilot studies, changes were made and 10 new items developed (7 included in the final analysis) for the PJM RST. Five linguistic features were assessed in the PJM RST: 1) negation; 2) number and distribution; 3) spatial verb morphology; 4) size and shape specifiers; and 5) handling classifiers, based on comparative analyses of BSL and PJM.

The first linguistic feature from the BSL RST, negation, is present in PJM and is comparable to BSL. Like the BSL version, he PJM RST contains several linguistic negation markers: manual negators, only non-manual negation, and signs with negative incorporation (Kuder, Filipczak, Mostowski, Rutkowski, & Johnston, 2018). However, not all available negation manual signs in PJM were assessed. A similar situation has been described for the BSL RST adaptation into LIS: LIS signers report a greater variety of negation markers than BSL users (Surian & Tedoldi, 2005). The LSF RST's authors (Courtin et al., 2010) also faced

problems with the linguistic category of negation: LSF seems to contain fewer negation

structures than BSL. Courtin et al. (2010) highlighted that in the BSL RST, negation features

are assessed in 10 items out of 40 (25%). As negation is quite complex in PJM, a large

number of items relating to negation is justified for the PJM RST (10 items out of 43

analysed items, 23%), whereas this may not be the case in other sign languages, such as LSF.

The category of number and distribution was comparable in PJM and in BSL, so the

items from this category were adapted from the BSL RST into PJM without major changes,

although with some small adaptations in relation to the classifier handshapes expressing

number and distribution. Similar changes were required for the ASL RST version (Enns &

Herman, 2011), for example where the classifier handshape for vehicles (e.g. CAR) is

different from BSL. Another difference was the position of the quantifier "a lot of:" in BSL

this usually occurs pronominally, while in PJM it appears more often post-nominally. In both

the DGS RST (Haug, 2011a) and PJM-RST, items have post-nominal quantifiers, although

this change from the original BSL RST was explicitly planned and discussed by the expert

panel for the PJM adaptation, while in the DGS-RST, the change was made spontaneously

during the filming, and only subsequently accepted by other specialists (Haug, 2011a).

The category of spatial verb morphology is also present in both BSL and PJM: items

in this category were adapted into PJM without major changes. As far as is known, for the

first time complex AB constructions were identified in PJM and confirmed by the expert

panel and corpus data.

Size and shape specifiers, as well as handling classifiers, are found in both BSL and

PJM; the items from the BSL RST were adapted into the PJM RST, with some small changes

e.g. in handshape of the size and shape specifier for item 16 (CURLY HAIR): in PJM the

handshape is "all fingers extended, spread and loosely curved," whereas for BSL, "the index

finger is extended and loosely curved from the fist." Haug (2011a) has highlighted that the similarity in the categories of size and shape specifiers and handling classifiers in many sign languages explains why the RST may be adapted to other languages, including languages which are less well documented and less-researched, such as PJM.

Only one structure from the BSL RST was removed: the verb-noun movement distinction that has not been reported in the PJM literature or observed in the corpus data. The same situation has been described for the DGS RST (Haug, 2011a): the movement difference between noun and verb derivationally related pairs does not exist in DGS. Even if the structure is present in a sign language, it may of course be found in different noun-verb pairs, e.g. the verb-noun distinction exists in AUSLAN (Johnston, 2004) and LSE (Valmaseda et al., 2013); however, the pair WRITE and PENCIL from the BSL RST did not occur either in Auslan or LSE, since in both Auslan and LSE the sign WRITE is not derivationally related to the sign PENCIL. For the Auslan RST, item 26 (PENCIL) was removed because Johnston (2004) did not want to change any of the test pictures and also wanted to use the norms for the BSL RST, justified by the close historical relationship between BSL and Auslan. For LSE (Valmaseda et al., 2013), the item was changed twice (firstly to the pair CHAIR-SIT and then to the pair CLOTHES-DRESS UP).

Based on statistical analyses of the findings from the main study (Step 8 in Table 2), using scores from 20 deaf children who were native signers aged from 6;1 to 12;11 and from 30 deaf children who were late learners of PJM aged from 6;7 to 13;8, the PJM RST was found to be an assessment tool with acceptable psychometrical validity and reliability properties.

In the analysis of the PJM RST, we compared DCDP and DCHP scores. It is highly likely that even if being raised by deaf parents does not guarantee native-like sign language

acquisition, there is a much greater probability that deaf parents provide a good sign language environment for deaf children. The specific characteristics of deaf families that are crucial for deaf children's sign language development are still under debate (Haug, 2011a): whether what is most important is parents' sign language skills or whether other factors may play an important role in the child's sign language development such as age of first exposure to sign language, or the number of signers in the child's family. Even if the reasons that make deaf parents potentially providers of a good linguistic environment are not very well researched, DCDP are usually reported to have better sign language skills than DCHP (Herman & Roy, 2006). DCDP outperformed DCHP on the original BSL RST (Herman & Roy, 2006) as well on the DGS (Haug, 2011a) and Auslan (Johnston, 2004) adaptations.

Another question that still needs to be addressed is which type of education support native-like development of sign language in deaf children and which specific characteristics of hearing parents' communication. When DCHP met criteria for inclusion: a high degree of exposure to BSL before the age of 5 years (as some hearing parents are able to assure a good sign language environment) and participation in a bilingual education system that may support native-like sign language proficiency in DCHP, they were also included in the normalization sample of the BSL RST (Herman et al., 1999). The BSL RST adaptation into LSE (Valmaseda et al., 2013) was used to investigate the importance of bilingual education for sign language receptive skills in deaf children. When DCHP were immersed in bilingual education before the age of 4 years, the two groups DCDP and DCHP did not differ (Valmaseda et al., 2013). In the present study, inclusion of DCHP immersed early in bilingual education was not possible because there is no Polish educational setting with a strong and early bilingual policy. In their study on the ASL RST, Allen & Enns (2013) found that regular use of sign language at home might be also an important contributor to high RST

scores: in their study, DCDP did not differ from DCHP whose parents reported

communicating in ASL on a daily basis with their deaf children. Significantly lower scores

on the ASL RST were found in DCHP who did not use ASL at home (compared to both

DCDP and DCHP with ASL at home). At the time of the Polish data collection, the inclusion

of DCHP with regular use of sign language was problematic, because support for hearing

parents to learn and use sign language was limited and in need of modification. Hence, a very

limited number of hearing parents had started to learn PJM and mostly communicated with

their deaf children using spoken language with some isolated signs and fingerspelling.

Investigations of test concurrent validity may aim to correlate the test under

development with other measures assessing the same skills (Bachman, 2004). However, no

measure to assess deaf children's knowledge of PJM is available. Analysing RST validity,

Johnston (2004) and Courtin et al. (2010) suggested that it is possible that the RST does not

measure sign language skills but instead, more general visuo-spatial skills, since there are a

large number of items testing sign language features with high iconicity (Courtin et al.,

2010). Hence, in the present study, scores on the PJM RST were compared to an assessment

tool that measures non-verbal abilities in logical reasoning, in order to check if the PJM RST

measures the logical reasoning ability rather than PJM skills. The PJM RST scores did not

correlate with Raven's Progressive Matrices, a measure of non-verbal intelligence (abstract

reasoning). Hence, the present data showed that scores on the PJM RST are not correlated

with visual non-verbal measures. A similar analysis of validity was undertaken during the

standardization of the BSL RST, with BSL RST scores compared to two non-verbal subtests

of the Snijders-Oomen Test: one that was supposed to be connected with language skills

(Mosaic) and another that was a pure non-verbal measure (Categories subtest) (Herman et al.,

1999). The BSL RST scores correlated with the Mosaic subtest and not with the category

subtest, indicating that the BSL RST correlates with other language measures, but not with non-verbal intelligence generally.

The developmental sensitivity of the test was explored and the PJM RST scores correlated with the age of participants. Other RST adaptation have also reported to be sensitive to age: DGS (Haug, 2011a); ASL (Enns, 2013); and LSE (Valmaseda et al., 2013). Haug (2011a) stressed that DCDP scores started to approach ceiling values at 6-7 years, with average scores of 44/49, and DCHP approached ceiling values at 7-8 years, indicating that the DGS RST is not sensitive enough for children older than this. The same issue was captured in other adaptations processes (Enns & Herman, 2011; Valmaseda et al., 2013). This highlights the need to test younger deaf children in order to validate the use of the PJM RST. Additionally, it may also suggest that the BSL RST, originally developed 20 years ago (Herman et al., 1999), needs to be revisited and that more difficult items would make the BSL RST more sensitive to assess older children's understanding of BSL grammar.

The item analyses revealed that for the age group tested, the PJM RST is a relatively easy test. This may be due to the fact that 3-6 year old children were not tested. However, Haug (2011a) reported that the DGS RST also contained many easy items, even though he tested children aged 3;9-10;10.

Limitations of this study include small sample size and age range restricted to older children (native signers: age range: 6;1 to 12;11 and late learners of PJM: age range: 6;7 to 13;8). The small number of deaf children of deaf parents is explained by the limited number of them in the deaf children population (Qi & Mitchell, 2012). Recruitment in the present study was via schools and this determined the age of children because in Poland children enter school at the age of 6 years. As kindergarten is not obligatory in Poland, the recruitment of younger children is more time and resource consuming and is planned as a

next step in the adaptation process. The biggest issue that was encountered during the present study was the lack of developmental research on PJM acquisition to provide a strong basis for the PJM RST adaptation. For this reason, different expert panels were included in the research.

In conclusion, the PJM RST, the first assessment tool to measure PJM skills in children, is a pioneering work in Poland that needs to be further developed. To confirm the reliability and validity of the PJM RST, younger deaf children need to participate in future studies, with the final goal to standardize the test on a larger and more representative sample.

References

Allen, T. E., & Enns, C. (2013). A psychometric study of the ASL Receptive Skills Test when administered to deaf 3-, 4-, and 5-year-old children. *Sign Language Studies*, *14*(1), 58–79. https://doi.org/10.1353/sls.2013.0027

Atkinson, J., Campbell, R., Marshall, J., Thacker, A., & Woll, B. (2004). Understanding "not": neuropsychological dissociations between hand and head markers of negation in BSL. *Neuropsychologia*, *42*(2), 214–229. https://doi.org/10.1016/S0028-3932(03)00186-6

Bachman, L. (2004). *Statistical analyses for language assessment*. Cambridge University Press. https://doi.org/https://doi.org/10.1017/CBO9780511667350

Baker, A., van den Bogaerde, B., & Woll, B. (2005). Methods and procedures in sign language acquisition studies. *Sign Language & Linguistics*, *8*(1–2), 7–59. https://doi.org/10.1075/sll.8.1.03bak

Bellugi, U. (1988). The acquisition of a spatial language. In F. Kessel (Ed.), *The development of language and language researchers: Essays in honor of Roger Brown*. Hillsdale, New

York, NY: Lawrence Erlbaum Associates.

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155–159.

https://doi.org/10.1037/0033-2909.112.1.155

Courtin, C., Limousin, F., & Morgenstern, A. (2010). Évaluer les compétences linguistiques

des enfants en langue des signes française: Une expérience pionnière. *Language,*

Interaction and Acquisition, *1*(1), 129–158. https://doi.org/10.1075/lia.1.1.08cou

Enns, C. J., & Herman, R. (2011). Adapting the Assessing British Sign Language

Development: Receptive Skills Test into American Sign Language. *Journal of Deaf*

Studies and Deaf Education, *16*(3), 362–374. https://doi.org/10.1093/deafed/enr004

Green, R. (2013). *Statistical analyses for language testing*. Basingstoke, UK: Palgrave

Macmillian.

Haug, T. (2011a). *Adaptation and evaluation of a German Sign Language Test. A computer*

based receptive skills test for deaf children ages 4–8 years old. *Main*. Hamburg:

Hamburg University Press.

Haug, T. (2011b). Approaching sign language test construction: adaptation of the German

Sign Language Receptive Skills Test. *Journal of Deaf Studies and Deaf Education*,

16(3), 343–361. https://doi.org/10.1093/deafed/enq062

Haug, T., & Mann, W. (2008). Adapting tests of sign language assessment for other sign

languages-a review of linguistic, cultural, and psychometric problems. *Journal of Deaf*

Studies and Deaf Education, *13*(1), 138–147. https://doi.org/10.1093/deafed/enm027

Herman, R. (1998). Issues in designing an assessment of British Sign Language development.

International Journal of Language & Communication Disorders, *33*(S1), 332–337.

Herman, R., Holmes, S., & Woll, B. (1999). *Assessing BSL Development - Receptive Skills*

Test. Gloucestershire, UK: Forest Bookshop.

Herman, R., & Roy, P. (2006). Evidence from the wider use of the BSL Receptive Skills

Test. *Deafness and Education International*, *8*(1), 33–47. https://doi.org/10.1002/dei.33

Hornowska, E. (2007). *Testy psychologiczne. Teoria i praktyka*. Warszawa, Poland:

Wydawnictwo Naukowe Scholar.

Humphries, T., Kushalnagar, P., Mathur, G., Napoli, D. J., Padden, C., & Rathmann, C.

(2014). Ensuring language acquisition for deaf children: what linguists can do.

Language, *90*(2), 31–52. https://doi.org/10.1353/lan.2014.0036

Johnston, T. (2004). The assessment and achievement of proficiency in a native sign

language within a sign bilingual program: The pilot Auslan Receptive Skills Test.

Deafness & Education International, *6*(2), 57–81.

https://doi.org/10.1179/146431504790560582

Klima, E., & Bellugi, U. (1979). *Signs of language*. Cambridge, MA.

Knoors, H., & Marschark, M. (2012). Language planning for the 21st century: revisiting

bilingual language policy for deaf children. *Journal of Deaf Studies and Deaf Education*,

17(3), 291–305. https://doi.org/10.1093/deafed/ens018

Kuder, A., Filipczak, J., Mostowski, P., Rutkowski, P., & Johnston, T. (2018). What corpus-

based research on negation in Auslan and PJM tells us about building and using sign

language corpora. In M. Bono, E. Efthimiou, S.-E. Fotinea, T. Hanke, J. Hochgesang, J.

Jette Kristoffersen, … Y. Osugi (Eds.), *Workshop Proceedings. 8th Workshop on the

Representation and Processing of Sign Languages: Involving the Language Community.

Language Resources and Evaluation Conference (LREC)* (pp. 101–106). Miyazaki,

Japan: ELRA.

Lord, F. M. (1952). The relation of the reliability of multiple-choice tests to the distribution

of item difficulties. *Psychometrica*, *17*(2), 181–194. https://doi.org/doi:

10.10007/BF02288781

Mason, K., Rowley, K., Marshall, C. R., Atkinson, J., Herman, R., Woll, B., & Morgan, G. (2010). Identifying specific language impairment in deaf children acquiring British Sign Language. *British Journal of Developmental Psychology*, 33–49. https://doi.org/doi: 10.1348/026151009x484190

Mayberry, R. I., & Lock, E. (2003). Age constraints on first versus second language acquisition: Evidence for linguistic plasticity and epigenesis. *Brain and Language*, *87*(3), 369–384. https://doi.org/10.1016/S0093-934X(03)00137-8

Mayberry, R. I., & Squires, B. (2006). Sin language acquisition. In K. Brown (Ed.), *Encyclopedia of Language and Linguistics* (2nd Editio, pp. 291–296). Oxford: Elsevier.

Mitchell, R. E., & Karchmer, M. A. (2004). Chasing the mythical ten percent: parental hearing status of deaf and hard of hearing students in the united states. *Sign Language Studies*, *4*(2), 138–163. https://doi.org/10.1353/sls.2004.0005

Morford, J. P., & Carlson, M. L. (2011). Sign perception and recognition in non-native signers of ASL. *Language Learning and Development*, *7*(2), 149–168. https://doi.org/10.1080/15475441.2011.543393

Morgan, G. (2014). On language acquisition in speech and sign: Development drives combinatorial structure in both modalities. *Frontiers in Psychology*, *5*, 1217. https://doi.org/10.3389/fpsyg.2014.01217

Morgan, G., Herman, R., & Woll, B. (2007). Language impairments in sign language: breakthroughs and puzzles. *International Journal of Communication Disorders*, *42*(1), 97–105. https://doi.org/10.1080/13682820600783178

Morgan, G., & Woll, B. (2007). Understanding sign language classifiers through a polycomponential approach. *Lingua*, *117*(7), 1159–1168.

https://doi.org/10.1016/j.lingua.2006.01.006

Oakland, T., & Lane, H. B. (2004). Language, reading, and readability formulas: implications for developing and adapting tests. *International Journal of Testing*, *4*(3), 239–252. https://doi.org/10.1207/s15327574ijt0403_3

Petitto, L. A., Katerelos, M., Levy, B. G., Gauna, K., Tétreault, K., & Ferraro, V. (2001). Bilingual signed and spoken language acquisition from birth: implications for the mechanisms underlying early bilingual language acquisition. *Journal of Child Language*, *28*(2), 453–496. https://doi.org/10.1017/S0305000901004718

Qi, S., & Mitchell, R. E. (2012). Large-scale academic achievement testing of deaf and hard-of-hearing students: Past, present, and future. *Journal of Deaf Studies and Deaf Education*, *17*(1), 1–18. https://doi.org/10.1093/deafed/enr028

Quinto-Pozos, D. (2014). *Multilingual aspects of signed language communication and disorder*. Bristol: Multilingual Matters.

Ross, D. S., & Newport, E. L. (1996). The development of language from non-native linguistic input. In A. Stringfellow, D. Cahana-Amitay, E. Hughs, & A. Zukowski (Eds.), *Proceedings of the 20th Annual Boston University Conference on Language Development* (Vol. 2, pp. 634–645). Boston: Cascadilla Press. Retrieved from http://wearables.cc.gatech.edu/paper_of_week/Ross_and_Newport_1996.pdf

Rutkowski, P., & Mostowski, P. (2017). Polski język migowy narzędziem przeciwdziałania wykluczeniu. *Trendy. Internetowe Czasopismo Edukacyjne.*, *1*, 18–22.

Rutkowski, P., & Mostowski, P. (2018). Multimedialne adaptacje podręczników z serii Nasz elementarz i Nasza szkoła jako pomoc w nauczaniu polskiego języka migowego (PJM). *Forum Oświatowe*, *30*(2), 245–266.

Schembri, A., Fenlon, J., & Cormier, K. (2018). Indicating verbs as typologically unique

constructions: reconsidering verb 'agreement' in sign languages. *Glossa: A Journal of General Linguistics*, *3*(1), 89. https://doi.org/10.5334/gjgl.468

Seiler, A., & Larsen, T. (2005). *Vurdering af børns tilegnelse af dansk tegnsprog. Forsta˚elsestest*. Aalborg, Denmark: Døveskolernes Materialecenter.

Surian, L., & Tedoldi, M. (2005). *Adaptation of BSL Receptive Skills Test to Italian Sign Language (LIS)*. Triest, Italy: Unpublished manuscript, University of Trieste.

Sutton-Spence, R., & Woll, B. (2007). *The linguistics of British Sign Language*. Cambridge, UK: Cambridge University Press. https://doi.org/10.1017/cbo9781139167048

Świdziński, M. (2014). Wprowadzenie. In M. Świdziński (Ed.), *Sytuacja osób głuchych w Polsce. Raport zespołu ds. g/Głuchych przy Rezczniku Praw Obywatelskich* (pp. 8–12). Wraszawa, Poland: Biuro Rzecznika Praw Obywatelskich.

Tomaszewski, P., Niedźwiecka, A., & Majewska, M. (2018). Kompetencje dzieci głuchych w posługiwaniu się językiem migowym – metody oceny i jej kliniczne znaczenie. *Edukacja*, *4*(147), 136–148. https://doi.org/10.24131/3724.180410

Valmaseda, M., Pérez, M., Herman, R., & Ramírez, N. (2013). Evaluación de la competencia gramatical en LSE: proceso de adaptación del BSL-Receptive Skill Test (Test de Habilidades Receptivas). In *Actas del Congreso CNLSE sobre Investigación de la Lengua de Signos Española* (pp. 209–224). Madrid, Spain: Real Patronato sobre Discapacidad.

Table 1. Linguistic features of BSL included in the Receptive Skills Test with item examples

Linguistic feature	Example with BSL gloss and English translation	Equivalent in PJM gloss and Polish translation
Negation	ICE-CREAM NOTHING No ice-cream.	LODY NIE-MIEĆ Nie ma lodów.
Number and distribution	ONE TEDDY One teddy.	JEDEN MIŚ Jeden miś.
Verb morphology	BOOK-GIVE-TO-CHILD A book is given to the child.	KSIĄŻKA-DAĆ-DZIECKO. Książka jest dawana dziecku.
Noun-verb distinction	DRIVE Driving.	Not applicable.
Size and shape specifiers	WIDE-STRIPES-DOWN-TROUSERS Wide, vertical stripes on trousers.	CIENKI-PASKI-WZDŁUŻ-SPODNIE Cienkie, pionowe paski na spodniach.
Handling classifiers	EAT-THIN-SANDWICH Eating a thin sandwich.	JEŚĆ-CIENKI-KANAPKA. Je cienką kanapkę.

Table 2. Steps in the adaptation of the BSL RST into PJM (based on Enns & Herman, 2011

and Haug, 2011b)

Step number	Adaptation activities	Procedures
Step 1	Review and cultural adaptation of materials	1. Consultations with deaf and hearing specialists 2. Redrawing of pictures (targets and distractors)
Step 2	Selection of vocabulary	1. Conducting Pilot 1: Vocabulary check (vocabulary elicitation task) with deaf adults (N = 4) 2. Consultations with deaf and hearing specialists based on Pilot 2 results
Step 3	Item adaptation	1. Comparison of six grammatical structures in BSL and PJM based on literature 2. Consultations and working meetings with deaf and hearing specialists
Step 4	Technical realization	1. Deaf signer video-recorded presenting test sentences 2. Programming and interface made by deaf and hearing IT team in order to obtain a computerised version of RST developed based on the DGS-RST
Step 5	Pilot 2 and modification	1. Conducting Pilot 2 with DCDP and DCHP (N=12) 2. Analysing Pilot 2 data 3. Modifications after Pilot 2: 3.1. Changes to vocabulary 3.2. Verification of distractors 3.3. Redrawing and retouching of pictures 3.4. Re-filming sentences
Step 6	Development of new items	1. Identification of PJM grammatical structures not included in the original BSL test 2. Consultation with deaf and hearing linguists 3. Construction of 10 new items (target and distractors) 4. Filming of new items
Step 7	Pilot 3 and modifications	1. Conducting Pilot 3 with DCDP and DCHP (N=12) (Testing and re-testing) 2. Analysing Pilot 3 data 3. Modification after Pilot 3: Exclusion of ineffective items
Step 8	Main study	1. Conducting main study of DCDP (N=20) and DCHP (N= 30) 2. Statistical analysis of the PJM RST: item analysis, validity, reliability and sensitivity to age

Table 3. Demographic information about Main Study sample

Variable	Characteristics	Number of children		
		Pilot 2	Main study	
			DCDP	DCHP
Gender	Male	8	16	7
	Female	4	4	33
Parental hearing status	Deaf parents	5	20	
	Hearing parents	7		30
Hearing loss	Severe	4	7	7
	Profound	8	13	33
Cochlear implants	Yes	3	0	19
	No	9	20	11
Hearing aids	Yes	9	18	13
	No	3	2	17
Additional disabilities	Yes	0	0	0
	No	12	20	30

Note. For Pilot 2: All participants $N = 12$; *Mean* age = 10;10; *SD* age = 1;7; *Min* age = 8;0; *Max* age = 12;6
For main study: All participants: $N = 50$: DCDP – deaf children of deaf parents: ($N = 20$), *Mean* age = 9;11, *SD* age = 2;0, *Min* age = 6;1, *Max* age = 12;11 and DCHP – deaf children of hearing parents deaf children of deaf parents (N=30), *Mean* age = 10;5, *SD* age = 1;10; *Min* age = 6;7, *Max* age = 13;8.

Table 4. Descriptive statistics for performance on the PJM RST for DCDP and DCHP

	Number of participants	Mean score	SD	95% confidence interval		Shapiro-Wilk Test	
				Lower bound	Upper bound	Statistic	Significance
DCDP	20	35	3.00	33.30	36.10	0.949	.352
DCHP	30	28	5.64	25.46	29.67	0.977	.745

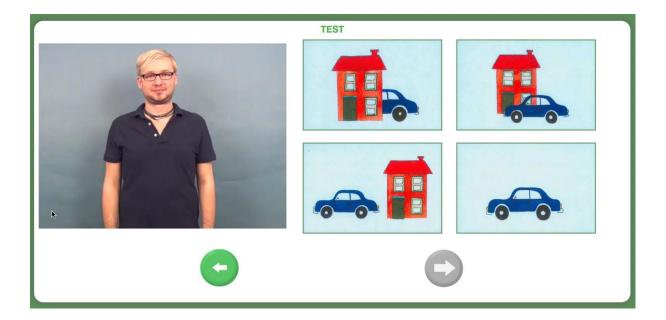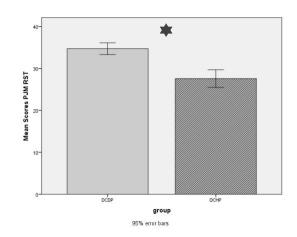Figure 1. The PJM RST screen layout, item number 15 (CAR BEHIND).

Figure 2. Mean scores on the PJM RST for deaf children of deaf parents (DCDP) and deaf children of hearing parents (DCHP).
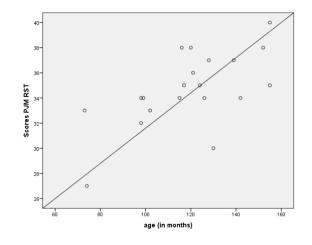
Figure 3. Scores on the PJM RST by age (in months) for deaf children of deaf parents

Steps in the adaptation of the BSL RST into PJM

In this online supplement, we reproduce Table 2 from our main publication in *Language Testing* to overview the eight steps undertaken for the adaptation of the BSL RST into PJM. The initial seven steps are described in full in this supplement, with step eight described in the main publication.

Copy of Table 2 from the main publication.
Steps in the adaptation of the BSL RST into PJM (Enns & Herman, 2011; Haug, 2011)

Step number	Adaptation activities	Procedures
Step 1	**Review and cultural adaptation of materials**	3. Consultations with deaf and hearing specialists Redrawing of pictures (targets and distractors)
Step 2	**Selection of vocabulary**	3. Conducting Pilot 1: Vocabulary check (vocabulary elicitation task) with deaf adults (N=5) 4. Consultations with deaf and hearing specialists based on Pilot 2 results
Step 3	**Item adaptation**	3. Comparison of six grammatical structures in BSL and PJM based on literature 4. Consultations and working meetings with deaf and hearing specialists
Step 4	**Technical realization**	2. Deaf signer video-recorded presenting test sentences 3. Programming and interface made by deaf and hearing IT team in order to obtain a computerised version of RST developed based on the DGS-RST

Step 5	**Pilot 2 and modification**	4. Conducting Pilot 2 with DCDP and DCHP (N=12)
		5. Analysing Pilot 2 data
		6. Modifications after Pilot 2:
		    6.1. Changes to vocabulary
		    6.2. Verification of distractors
		    6.3. Redrawing and retouching of pictures
		    6.4. Re-filming sentences

Step 6	**Development of new items**	5. Identification of PJM grammatical structures not included in the original BSL test 6. Consultation with deaf and hearing linguists 7. Construction of 10 new items (target and distractors) 8. Filming of new items
Step 7	**Pilot 3 and modifications**	4. Conducting Pilot 3 with DCDP and DCHP (N=12) (Testing and re-testing) 5. Analysing Pilot 3 data 6. Modification after Pilot 3: Exclusion of ineffective items
Step 8	**Main study**	3. Conducting main study of DCDP (N=20) and DCHP (N= 30) 4. Statistical analysis of the PJM RST: item analysis, validity, reliability and sensitivity to age

Step 1. The adaptation process was initiated by **a review and cultural modification of the materials**. The goal of this step was to identify changes required to ensure test stimuli

were better suited to the Polish cultural context. The materials were examined by Expert Panel 1, which comprised deaf experts (a teacher in a school for deaf children and a graphic designer) and hearing experts (a developmental psychologist, a PJM interpreter, and an educational researcher). They recommended modifications to pictures for 8 items (1 of the 3 practice items of the BSL RST, and 7 of the 40 items of the BSL RST). To achieve these changes, 4 pictures of target items and 10 pictures of distractors were redrawn. For example, in the British pictures of a car, the steering wheel was on the right, whereas in the Polish version it should be on the left. The illustrations of cups were replaced by mugs, because in Poland, not all children are familiar with cups or the sign CUP. The picture of a bus stop was felt to be a culturally inappropriate example of a place to queue, because in Poland, passengers waiting for public transport usually do not form a queue. For this reason, a new illustration with a queue at a ticket office was proposed by the panel.

  Step 2. Selection of vocabulary. In Pilot 1**,** the vocabulary check was administered to deaf adults ($N = 4$, gender: $N♀ = 4$, *Mean* age (years; months) = 25;4; *SD* age = 5;2; age range 21;1 -32;7) who were non-native but highly fluent signers immersed in the signing community: 2 were PJM teachers and 2 worked on PJM corpus data analysis. The deaf adults were asked to produce signs for the pictures included in the Vocabulary Check.

  Based on the results of Pilot 1, Expert Panel 2 was assembled, comprising three deaf teachers of PJM from the Section for Sign Linguistics at the University of Warsaw to review the lexical items chosen for the PJM RST. PJM signs that were reported by experts not to show regional sign variation were selected. The PJM lexicon has not yet been investigated for regional variation, which made this phase of adaptation especially demanding. The selected PJM signs were deemed to be well known to children from different parts of Poland. This step was also important where one concept is expressed by two or more PJM signs, e.g. there was considerable discussion about BALL, which has two variants in PJM; both are iconic, but in the first sign the iconicity is connected with the shape of a ball and in the second one with movement of a ball (bouncing ball). Scores from Pilot 1 were split: two participants produced the first sign BALL and the other two participants produced the second sign. According to Expert Panel 2, children should be familiar with both variants of signs and the second sign (ball motion) was chosen as being more attractive to children.

  Step 3. **BSL RST items were adapted into PJM**. This required a review of the literature on sign language acquisition and multiple consultations with Expert Panel 3, as although different sign languages may share some similar structures, there are cross-linguistic differences (Zeshan, 2004). Expert Panel 3 included the three deaf teachers of PJM who had also been members of Expert Panel 2, and in addition, three hearing members (a sign language linguist, an educational researcher, and a sign language interpreter; two of these were from Expert Panel 1).

  This phase included a review of the literature (e.g. Filipczak, 2009; Rutkowski & Łozińska, 2011b; Świdziński & Gałkowski, 2003; Tomaszewski, 2015), consultations with Expert Panel 3, and access to PJM corpus data[i]. The analysis made by Expert Panel 3 of the content of the BSL RST in relation to the grammar of PJM can be interpreted as providing **content validity** for the PJM RST (Bachman, 2004). A comparison of the six BSL morphosyntactic areas included in the test: (1) negation, (2) number and distribution, (3) spatial verb morphology, (4) noun-verb distinction, (5) size and shape specifiers, and (6) handling classifiers, to similar structures in PJM, demonstrated that PJM and BSL share all of these grammatical structures with the exception of a systematic movement contrast between derivationally related nouns and verbs.

Despite these strong similarities, small differences between the two sign languages were observed, with implications for the selection of the PJM RST items (see Table 1 in the main publication for examples of BSL RST items with PJM equivalents).

Similarly to BSL, negation can be expressed in PJM by a complex system including both manual and non-manual elements, with PJM having a wide variety of negation forms (Kuder, Filipczak, Mostowski, Rutkowski, & Johnston, 2018; Tomaszewski, 2015). In the PJM RST, several negation markers were used: the negators NOT (index finger extended from fist) NOTHING/ NOT-HAVE (flat hand) (item 3 ICE-CREAM NOTHING/ NOT-HAVE, English "no ice-cream"); headshake without an accompanying manual negator (item 23 NOT-SLEEP, English "(he/she is not sleeping"); and verbs with incorporated negation, where a manual negator is affixed to a cognitive or experiential verb (item 4 NOT-LIKE EAT, English "not like to eat").

Based on the corpus data and panel discussion it was indicated that plurals in PJM, as in BSL, may be marked either by repeating the sign, adding a quantifier or using a whole entity classifier construction. The forms of whole entity classifiers for referents vary in different languages (Haug, 2011). Hence in item 6, ONE-TEDDY(English "one teddy"), in BSL and PJM a classifier construction is used; however, in BSL the handshape (all fingers extended, spread and curved) is different from that in PJM (index and middle fingers extended from the fist, spread and curved). This linguistic feature has not yet been fully investigated in PJM, therefore another classifier construction handshape was used in the PJM version and the distractors were kept without any modification. This change was intended to maintain the goal of item 6 which was to measure the ability to understand "number and distribution" despite the difference in form between PJM and BSL.

As in many sign languages (Schembri, Fenlon, & Cormier, 2018), three verb categories have been recognized in PJM: plain verbs, agreement verbs and spatial verbs (Filipczak, 2014). Like BSL, plain verbs, usually body-anchored, do not change location or movement, whereas the initial and final locations of agreement verbs in PJM vary according to the locations assigned to the roles of agent and patient. Spatial verbs are the most complex, incorporating classifiers to represent classes of referents, with movement representing static and changing locations of referents. Verb agreement rules are similar in PJM to those in other sign languages (*inter alia* in BSL) (Filipczak, 2014); however, different sign languages vary with respect to which verbs do or do not mark agreement (Morgan, Barrière, & Woll, 2006). For example, in BSL, SUPERVISE is an agreement verb whose direction of movement changes according to the agent and patient, while in PJM, SUPERVISE is a plain verb which does not undergo agreement. However, all the verbs in the verb morphology category in the BSL RST belonged to the same verb class in PJM (e.g. the agreement verb GIVE in item 29: MOTHER LETTER GIVE, English "mother gives a letter"); therefore no changes were made to these items.

The verb morphology category in the BSL RST also contains complex AB constructions that are used where one person performs an action on another person's body (Morgan, Herman, & Woll, 2002). For example, the BSL RST item 27 ((boy 1) POUR-WATER-BOY WATER-ON-HEAD (of boy 2), English "one boy pours water on the other boy's head") which requires two clauses, one representing the agent's action, and the other representing the consequence to the patient. To our knowledge, complex AB constructions have not been described in PJM; however, the PJM experts all agreed that this structure exists in PJM. This was also confirmed by the corpus data where participants used the complex AB construction in a story telling task. Therefore, similar markers of complex AB constructions were used in the PJM RST item 27 (the agent action and the consequence to the patient).

Hence, the adaptation of the BSL RST into PJM enabled researchers to discover new proprieties of PJM that had not previously been analysed.

Size and shape specifiers describe features of the referent in both BSL and PJM (Rutkowski & Łozińska, 2011). This structure is similar in different sign languages (Haug, 2011) as it is motivated by the size and shape of the referent, e.g. item 22 WIDE-STRIPES-DOWN-TROUSERS, English "wide, vertical stripes on trousers" is very similar in PJM and BSL although there is a slight difference in location: in BSL the classifier is signed in contact with the body and in PJM without contact. Because of this, for item 22 another location of size and shape classifier was used in the PJM RST than in the BSL RST although the distractors were found to be suitable and not changed.

Handling classifiers are present in PJM (Rutkowski & Łozińska, 2011) and as they describe how objects are handled, they are similar in different sign languages (Haug, 2011). Item 37 (EAT-THIN-SANDWICH, English "eating a thin sandwich") uses the same handling classifier in BSL and PJM, therefore the same test item was retained in the PJM version of the test.

Only one grammatical feature used in the BSL RST is absent in PJM: the systematic movement distinction between derivationally related nouns and verbs. Therefore, this grammatical category was removed from the PJM assessment. One of the three items from this category was entirely removed from the PJM RST (item 26, PENCIL, English "pencil"). The remaining two items were kept but modified and used to assess other structures. For example, two new distractors for item 19 (BOY DRINK-FROM-MUG, English "a boy drinks from a mug") were developed to test knowledge about handling classifiers: DOG DRINK-FROM-BOWL, English "a dog drinks from a bowl" and BIRD DRINK-FROM-PUDDLE, English "a bird drinks from a puddle"), as there were only 2 distractors for the item 19 in the BSL RST.

To sum up this phase of the adaptation process, 39 target sentences and 3 practice items were adapted from BSL into a PJM version with 40 items and 3 practice items. As the BSL structures used in the RST were for the most part found to have equivalents in PJM, the majority of items were directly adapted from BSL into PJM without any major modification. However, some items were significantly modified, for example item 12 (PERSON-GO-DOWN-ESCALATOR, Eng. "person descends escalator") was substituted by a sentence judged to be more familiar to children (PERSON-GO-DOWN-STAIRS, English "person goes down stairs") to avoid problems for children living in rural areas of Poland where escalators are rarely seen.

Step 4. **Technical realization**. The PJM target items were then signed by a fluent non-native deaf signer with experience in preparing teaching aids for deaf children. He adjusted his signing style to make it more child-friendly, adapting the speed and clarity of his signing and conveying an enthusiastic attitude to motivate children to complete the task. The test sentences were video-recorded by a deaf cameraman. After the recording session, the videotaped sentences were reviewed by a deaf teacher and a hearing educational researcher (both from Expert Panel 3) who selected the most appropriate recordings.

A team of deaf and hearing programmers then prepared the computerized version of the test, using a child-friendly interface based on the DGS RST developed by Haug (2011a).

Step 5. **Pilot 2** was conducted with prelingually deaf children from both hearing and deaf families ($N = 12$; gender: ♂ $= 8$, ♀ $= 4$; *Mean* age (years; months) = 10;10; *SD* age = 1;7; age range 8;0 to 12;6) (see thecopy of the main manuscript's Table 3 below). All children attended the same school for deaf children which had a Total Communication approach, using both spoken Polish and a variety of forms of signing: PJM, signed Polish (pol. System

językowo-migowy – SJM – a manual communication system based on spoken Polish that is not a distinct language like PJM), fingerspelling and sometimes pidgin signed Polish (a combination of PJM and spoken Polish). Deaf children communicated with their deaf peers mainly in PJM; however, some of them also used spoken language, signed Polish, or pidgin signed Polish, depending on their own communication skills and those of their school mates. No child had additional needs; all had normal nonverbal intelligence as measured by Raven's Progressive Matrices (the raw scores in Raven's Progressive Matrices were translated into sten scores with a mean of 5.5, a standard deviation of 2, and a cut-off of 1 SD, which in sten scores was translated into a score below 3.5 (Jaworowska & Szustrowa, 2000)). The test was administered by a hearing researcher who is a fluent PJM signer, in a quiet room at the children's school. Before testing, written consent was obtained from the children's parents, the school director, and the regional representative of the Ministry of Education. Before conducting the assessment, all children gave their spoken or signed assent to be tested, except for one child who initially agreed to take part in the study but during the session refused to finish the test; his scores were therefore not analysed.

Copy of Table 3 from the main publication.
Demographic information about sample in Main Study (Step 8 in Table 2)

Variable	Characteristics	Number of children		
		Pilot 2	Main study	
			DCDF	DCHP
Gender	Male	8	16	7
	Female	4	4	33
Hearing status of parents	Deaf parents	5	20	0
	Hearing parents	7	0	30
Hearing loss	Severe	4	7	7
	Profound	8	13	33
Cochlear implants	Yes	3	0	19
	No	9	20	11
Hearing aids	Yes	9	18	13
	No	3	2	17
Additional disabilities	Yes	0	0	0
	No	12	20	30

Note. For Pilot 2: All participants $N = 12$; *Mean* age = 10;10; *SD* age = 1;7; *Min* age = 8;0; *Max* age = 12;6
For main study: All participants: $N = 50$: DCDP – deaf children of deaf parents: ($N = 20$), *Mean* age = 9;11, *SD* age = 2;0, *Min* age = 6;1, *Max* age = 12;11 and DCHP – deaf children of hearing parents deaf children of deaf parents (N=30), *Mean* age = 10;5, *SD* age = 1;10; *Min* age = 6;7, *Max* age = 13;8.

Table A shows the results of Pilot 2. Participants were asked to complete the first version of the PJM RST which included 27 items in the Vocabulary Check, 3 practice items and 39 items in the RST. At this stage, no additional Polish items had been developed. The reliability (internal consistency) of the draft version was calculated on the basis of the Kuder-Richardson formula 20 (the equivalent of Cronbach's alpha for dichotomic variables) and was found to be acceptable (*KR20* = 0.713).

Supplement-only Table A.
PJM RST scores in Pilot 2

	Scores obtained	Statistics

Number of participants	Number of items	M	SD	Min	Max	Kuder-Richardson formula,
12	39	28	4.03	23	34	KR20 = 0.713

Pilot 2 demonstrated that the PJM RST interface was easily navigated by all children, and all engaged well with the task. However, it was clear that some aspects of the PJM RST still needed to be improved. Changes required included: 1) changes to the vocabulary; 2) verification of distractors; 3) redrawing and retouching of pictures; and 4) re-filming of test sentences. From the vocabulary check, not all children were familiar with one variant of the sign DOG and it was therefore replaced by another variant which was used by all participants in Pilot 2. The distractors from the original test were verified for appropriateness in PJM as phonological, lexical or morphosyntactic distractors. For example in the BSL RST, item 1 (LOTS APPLE, English "a lot of apples") has a distractor (picture of a boy carrying heavy shopping) that is phonologically connected to the BSL sign LOTS, but in PJM this relationship is absent. For this reason, a new distractor picture of "raindrops falling on apples" was created, which constituted a phonological distractor for the item: the sign "a lot of" and "raindrops falling" share the same handshape and place of articulation; the only difference is the movement made for these two signs. Some pictures needed retouching: for example, the distractor for item 35 (NOT-DROP-CUP, English "(she) is not dropping the cup") shows a girl holding a cup out to a boy and the girl on the picture was carrying the cup with caution so it could be interpreted as the target sentence. Two children asked the tester about this ambiguity. Hence, this distractor was redrawn as "a girl throwing a cup towards a boy".

Step 6. In collaboration with experts (Expert Panel 3), **10 new PJM items were developed**, in order to assess PJM grammatical structures that were not present in the BSL RST. For example, items were added to test for complex syntax (e.g. BOY BROKE LEG/ WHY/ BICYCLE FALL OFF, English " boy broke leg because he fell off the bicycle") and for verbs with a body part classifier (WALK DUCK, Eng. "duck is walking". In this item the B handshape (flat hand) represents the duck's webbed foot). The new PJM items were also served to replace sentences that tested the distinction between the forms of verbs and noun, a grammatical feature not present in PJM. More items were developed than needed in case some proved to be ineffective.

Step 7. The deaf children from Pilot 2 also took part in **Pilot 3** (see Table 3). Testing took place one year after Pilot 2, minimizing any practice effect. Items were presented in the same order during both pilot test phases. In order to calculate test-retest reliability, participants did the PJM RST twice with an interval of one month between tests (Pilot 3a and 3b). The version of the PJM RST used in Pilot 3 included: 27 items in the Vocabulary Check, 3 practice items, 39 items from the original version and 10 newly developed items. It took about approximatively 20 minutes to complete the PJM RST. Two children were excluded from the analysis: one child refused to finish the test (the same child as in Pilot 2) and the second struggled with attention problems during testing.

Scores obtained by the children are presented in Table B. Results were not at either ceiling or floor levels; however, variability was small, which may have been the result of using a small sample with a limited age range. Test-retest reliability was calculated as the correlation between scores from the test and retest ($r = 0.69$, $p < .05$). According to Cohen (Cohen, 1992), the correlation was strong and, thus showed good reliability of this version of the PJM RST.

Supplement-only Table B.

PJM RST scores in Pilot 3a, b

Number of participants	Number of items	Scores obtained				Statistics
		M	*SD*	*Min*	*Max*	Pearson correlation between scores in pilots 3a and 3b
12	47	36	1.83	33	39	*r* = 0.69*
12	47	36	2.47	32	41	

Note. * *p* < .05

      Item analysis **revealed poor functioning of two items**: one from the original test (item 7, DRIVE, English "(a person) drives a car") and one new item (item 43, DOG MOTHER HIS, English "the dog's mother"). Item 7 (DRIVE) did not discriminate between children: all participants answered it correctly, hence, distractor analysis was not possible. This item was originally designed to measure noun/ verb distinctions, a feature absent from PJM, and had been changed during the adaptation process. However, as this modification was not effective, the item was removed after this item analysis. In contrast, item 43 (DOG MOTHER HIS) was found to be very difficult for all children (only two children in Pilot 2 and one in Pilot 3 answered correctly). During the experts' discussion, there was disagreement about item number 43: the structure: a possessive marker in PJM is not well described in the literature, and consequently, the item was removed.

References

Bachman, L. (2004). *Statistical analyses for language assessment*. Cambridge University Press. https://doi.org/https://doi.org/10.1017/CBO9780511667350

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155–159. https://doi.org/10.1037/0033-2909.112.1.155

Enns, C. J., & Herman, R. (2011). Adapting the Assessing British Sign Language Development: Receptive Skills Test into American Sign Language. *Journal of Deaf Studies and Deaf Education*, *16*(3), 362–374. https://doi.org/10.1093/deafed/enr004

Filipczak, J. (2014). Czasownik i przestrzeń. In P. Rutkowski & S. Łozińska (Eds.), *Lingwistyka przestrzeni i ruchu. Komunikacja migowa a metody korpusowe* (pp. 155–168). Warszawa, Poland: Uniwersytet Warszawski.

Haug, T. (2011). *Adaptation and evaluation of a German Sign Language Test. A computer based receptive skills test for deaf children ages 4–8 years old. Main*. Hamburg: Hamburg University Press.

Jaworowska, A., & Szustrowa, T. (2000). *Test Matryc Ravena w Wersji Standard - forma Klasyczna. Podręcznik*. Warszawa, Poland: Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego.

Kuder, A., Filipczak, J., Mostowski, P., Rutkowski, P., & Johnston, T. (2018). What corpus-based research on negation in Auslan and PJM tells us about building and using sign language corpora. In M. Bono, E. Efthimiou, S.-E. Fotinea, T. Hanke, J. Hochgesang, J. Jette Kristoffersen, … Y. Osugi (Eds.), *Workshop Proceedings. 8th Workshop on the Representation and Processing of Sign Languages: Involving the Language Community. Language Resources and Evaluation Conference (LREC)* (pp. 101–106). Miyazaki, Japan: ELRA.

Morgan, G., Barrière, I., & Woll, B. (2006). The influence of typology and modality on the acquisition of verb agreement morphology in British Sign Language. *First Language*, *26*(1), 19–43. https://doi.org/10.1177/0142723706060739

Morgan, G., Herman, R., & Woll, B. (2002). The development of complex verb constructions in British Sign Language. *Journal of Child Language*, *29*(3), 655–675. https://doi.org/10.1017/S0305000902005184

Rutkowski, P., & Łozińska, S. (2011). O niedookreśloności semantycznej migowych predykatów klasyfikatorowych. In M. Bańko & D. Kopcińska (Eds.), *Różne formy, różne treści* (pp. 211–224). Warszawa, Poland: Wydawnictwo Wydziału Polonistyki Uniwersytetu Warszawskiego.

Schembri, A., Fenlon, J., & Cormier, K. (2018). Indicating verbs as typologically unique constructions: reconsidering verb 'agreement' in sign languages. *Glossa: A Journal of General Linguistics*, *3*(1), 89. https://doi.org/10.5334/gjgl.468

Świdziński, M., & Gałkowski, T. (2003). *Studia nad kompetencją językową i komunikacją niesłyszących*. Warszawa, Poland: Uniwersytet Warszawski.

Tomaszewski, P. (2015). Constraints on negative prefixation in Polish sign language. *PLoS ONE*, *10*(11), 1–29. https://doi.org/10.1371/journal.pone.0143574

Zeshan, U. (2004). Hand, head, and face: Negative constructions. *Linguistic Typology*, *8*, 1–58. https://doi.org/1430–0532/2004/008-01

---

[i] Some of the grammatical structures have not yet been described in the research literature. Their presence in PJM was confirmed by an analysis of the biggest PJM corpus dataset collected by the Section for Sign Linguistics which includes approximatively 400 hours of video-taped signing in PJM by approximately100 adult signers from different parts of Poland. The corpus data were accessible thanks to Rutkowski, head of the Section for Sign Linguistics, University of Warsaw.