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ORIGINAL ARTICLE

Translation and cross-cultural adaptation of the performance-based test – Evaluation in Ayres Sensory Integration®

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ABSTRACT

Background: *The Evaluation in Ayres Sensory Integration®* (EASI) is a performance-based assessment tool, aiming to assess sensory perception, sensory reactivity, postural/ocular/bilateral integration, and praxis in children aged 3–12 years. These types of tests are currently not available in Swedish. A structured, multistep process of translation is crucial for maintaining equivalence between the source and target version of a test.

Objective: Develop a culturally adapted Swedish research version of the EASI for use in the forthcoming international normative data collection.

Method: The translation process followed the first four stages in recommended guidelines for cross-cultural adaptation. Each subtest was translated by two occupational therapists and merged into one Swedish version. That version was reviewed by clinical paediatric occupational therapists in focus groups. The meetings were recorded, transcribed and a content analysis was conducted. One subtest was then subjected to a back-translation process.

Result: Some discrepancies regarding semantic equivalence were found and adapted through all stages. No discrepancies regarding idiomatic or conceptual equivalence were found. Revisions due to the translation process have been incorporated into the final research version of the EASI.

Conclusion: A first, culturally adapted research version of the EASI is ready for the Swedish normative data collection.

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Assessment tool; children; cultural adaptation; instrument; occupational therapy; sensory integration

Introduction

Sensory integration is a neurological process that organizes sensations from the body and environment in order to respond in a meaningful way to a specific situation [1,2]. This process has persistently proven essential for participation in everyday life, play and academia [3–5]. For example, the vestibular and proprioceptive senses affect the development of posture, balance, muscle tone and eye movements. These, in turn, interact with the tactile sense to provide a foundation for adequate body awareness, coordination of the two body sides and praxis. Together, these functions lay the ground for eye-hand coordination, visual-perceptual skills and engagement in purposeful activity and academic learning [2,6].

When the brain is not processing sensory information smoothly or correctly, it will likely lead to sensory integration difficulties [1,2,6,7]. Jean Ayres [1,7] described as early as the 1970s that these types of difficulties can generate a variety of problems in everyday life and others have thereafter confirmed it [3,5,8,9]. Roberts et al. [5] reported a strong relationship between body awareness, balance and touch, and the child's pretend play abilities. A recent study by Ricon et al. [8] found an association between sensory integration difficulties and children's daily routines by comparing children with high functioning autism with typically developed children.

No information has been found about the prevalence of sensory integration difficulties in Swedish children. Moreover, no official number of occupational therapists with postgraduate training in sensory integration theory, now referred to as *Ayres Sensory Integration®* (ASI) [2,6,10], has been found. Estimations made by the authors together with the Swedish Association of Ayres Sensory Integration showed that no more than 10 actively working therapists have undergone qualified training. Even fewer therapists apply the method fully in their practice.

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This can be compared with the USA, where 95% of all paediatric occupational therapists are using principles of ASI in their practice [11]. There has, however, been an increasing interest in recent years for the theory, evaluation and intervention, and many occupational therapists in Sweden have had the opportunity to participate in one-, two- or three-day seminars about ASI theory, evaluation and intervention. The increased interest derives probably partly from the latest version of the American Diagnostic and Statistical Manual for Mental Disorders [12] (DSM). The criteria in DSM-5 concerning Autism Spectrum Disorder (ASD) were changed in 2013, and 'atypical reactions to, or increased interest in sensory input' was added. This was probably due to the fact that reports had indicated that up to 95% of children with ASD showed probable or definite sensory integration difficulties [13,14]. However, it is important to remember that apart from the children with ASD, there are many with and without diagnoses who struggle in school and with everyday life due to problems in sensory integration [7,15–17]. It has been estimated in the USA that 5–16% of children have difficulties processing and integrating sensations that affect their everyday life [16,17]. Another reason for increased interest in ASI might be that working in schools are a new and developing field for Swedish occupational therapists [18] and the awareness of the impact sensory integration function has on children's participation in school activities is growing with them.

In order to provide appropriate support and treatment for these children, and to determine 'best practice' intervention and a person-centred care [19], the occupational therapist has to administer a thorough evaluation to identify whether and how the child's sensory integration function influences his or her occupational performance [9].

A number of different assessment tools are used by practitioners [20], where the *Sensory Integration and Praxis Test* (SIPT) is considered to be the 'Gold standard' of tests. It has been standardized on almost 2000 children in the ages 4–9 years [21] and has demonstrated strong validity and reliability. However, the SIPT has disadvantages. It has not been revised since its creation in 1989, the normative data, although extensive, is limited to North America, and both the training and the test itself are costly. Furthermore, despite the comprehensive nature of the normative data, all of it was collected in North America more than 30 years ago, which thus limits its application on current populations [20,22].

There are currently no performance-based assessment tools measuring sensory integrative functions available in Swedish, but only questionnaires [23–25] and two of those cover different ages, children versus adolescents/adults. Although questionnaires are important for gathering a sensory history and should always be a part of an evaluation, they do not suffice. A standardized assessment tool specifically developed to evaluate sensory integration functions is important for identifying patterns of dysfunction in sensory integration as well as the extent or severity of the dysfunction in order to plan an individualized intervention [26]. There is thus a great need of a more objective assessment tool measuring sensory integration function in Swedish children to complement the questionnaires.

The Evaluation in Ayres Sensory Integration® (EASI) is developed by Mailloux and colleagues [22]. The EASI is modelled according to the constructs established within the theory of ASI and aims to assess sensory perception, sensory reactivity, postural/ocular/bilateral integration, and praxis in children, ages 3–12 years. It is still under development and is, as of now, undergoing rigorous validity and reliability testing, mainly in the USA, and became ready for translation and international field-testing in 2018. The purpose of developing the EASI was to provide a valid and reliable tool for assessing key sensory integration functions that underlie learning, behaviour, and participation and to make it inexpensive, electronically accessible and practical for clinical use [22,27].

When using a test developed for application in one country and culture in another, it is important not only for the translation to be correct linguistically, but to retain the meaning and intent of the original test while also be aware of differences in culture and make due adaptations. That can only be reached through a systematic, multistep translation process [28,29]. The EASI is developed to measure sensory integration functions '… in a manner that minimizes the influences of culture, language comprehension and prior experience' [27,p.4], in order to facilitate a worldwide distribution of the test. A large international project with the purpose of translating and adapting the EASI in order to collect normative data from more than 100 countries started almost coextensively with the development of the test. Apart from Sweden, all the Scandinavian countries, as well as other countries in e.g. Europe, Asia, North America and South America are involved. This study is the very first step in the development of a Swedish

Table 1. Description of the procedure and participants of the translation process.

Stage	Procedure	Participants	Inclusion criteria	Primary focus
1. Forward translation	Individual translation from English to Swedish.	Four translators, including first author	OT, Postgraduate training in ASI. Living in USA for a minimum of four months.	Semantic and idiomatic equivalence
2. Translation synthesis	A merging of individually translated tests. Discussion of wording, sentences and meaning.	Translators 1–4 and an independent translator	OT, Postgraduate training in ASI. Living in USA for a minimum of four months. Experience of using the SIPT.	Semantic and idiomatic equivalence
3. Focus groups and content analysis	Discussion about wording and cultural adequacy. Content analysis	Seven OT's mainly working in paediatrics. First author and second author.	OT, minimum of one-day seminar about ASI, experience working with children in Sweden.	Semantic, idiomatic, experiential and conceptional equivalence
4. Back translation	Back translation of Swedish version 2. Comparison with original EASI.	Back translator First author Original developer	Back translator: English-born, fluently speaking Swedish.	Semantic equivalence

research version of the EASI, where the main point is performing a valid translation and cultural adaptation in order to participate in the international normative data collection.

Aim

The aim of this study was to develop a culturally adapted Swedish research version of the EASI for use in the forthcoming international normative data collection.

Materials and methods

Study design

This study comprises a methodological and descriptive research of the translation and cross-cultural adaptation of an instrument. To attain content equivalence between the original source and the target version of a test it is necessary to follow specific procedures and to strive for equivalence regarding semantics, idiomatic expressions, experience and concept. The translation process in this study followed the first four steps of the guidelines regarding translation and cross-cultural adaptation recommended by Beaton et al. [28] and started during summer 2018 with the engagement of participants suitable for the project.

Both the forward translators and the expert panel in this study were occupational therapists with different levels of knowledge in ASI, and experience of working with, and assessing children (Table 1). Due to the limited number of Swedish occupational therapists with postgraduate training in ASI, a choice was made to use the ones with postgraduate training as translators and those with an interest in sensory

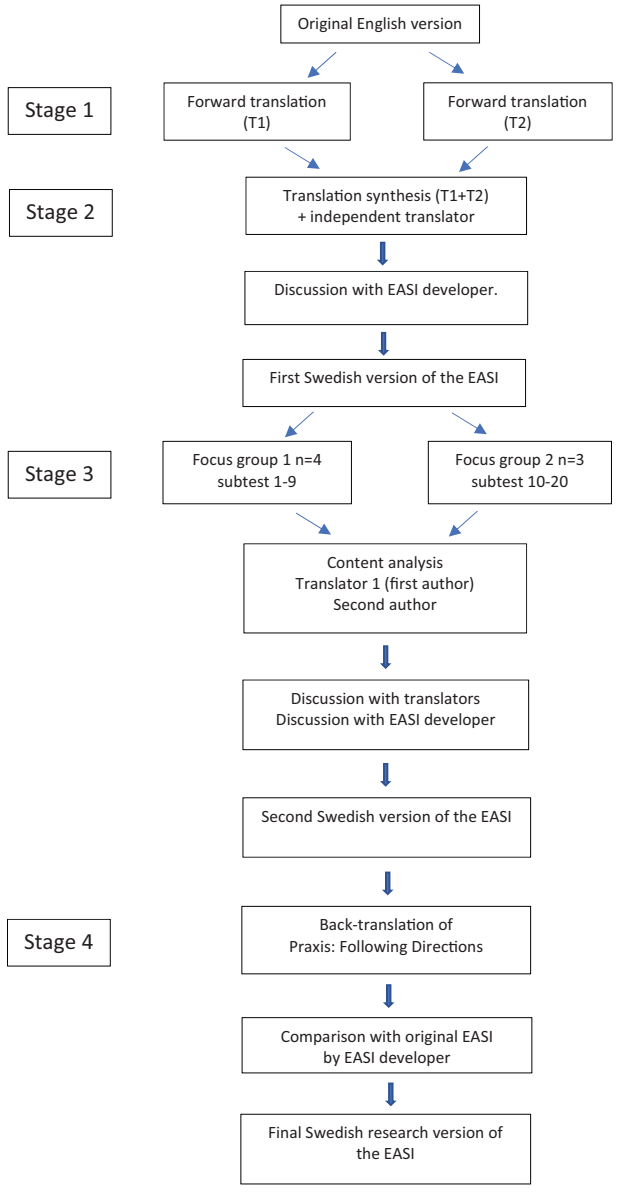

Figure 1. Translation process of the EASI for use in the Swedish normative data collection.

integration in the expert panel. The latter were instead considered experts in clinical practice with long experience preforming varied evaluations on children (Table 1).

Four therapists, one of them the first author, performed the forward translation in stage 1 (Figure 1), two translators for each subtest. A fifth therapist was engaged for the synthesis as an independent third translator [29] regarding ambiguities and discrepancies of words, sentences and meanings during stage 2 and, after discussions with an EASI developer, a first Swedish version was established. Seven new occupational therapists were then engaged for stage 3 and divided into two groups for the third part of the process; the focus group interviews. A content analysis following Graneheim and Lundman [30] was performed after transcribing the audio recording of the discussions during the interviews [31,32]. Focus group interviews can be used when people from the target group discuss different aspects of a topic, especially when the topic is new or complex [31]. Assessments on sensory integration functions are still considered new and complex in Sweden. Content analysis is used to detect patterns in the experience and perception of a certain subject and enables the author to systematically identify information, which in this study provided data for analysing possible problems arising from differences in cultures. A directed content analysis implies predetermined categories when starting the analysis, but at the same time, it promotes an openness to anticipate new categories in order to enhance the possibility for new insights in the area of research [33]. A manifest analysis refers to the description of the text on a more literal level of interpretation and sort the content into categories according to the visible and obvious components, but no deeper interpretation is made and no themes are developed [30]. Finally, in stage 4, one subtest was back translated by a bilingual translator and reviewed by the developers of the original test.

The last stage of Beaton's guidelines [28], pretesting of the translated version, was not included in this study but is planned as part of the normative data collection. Following that, a back translation of the whole test will be completed.

Instrument

The American assessment tool EASI is still under development and therefore neither the test nor the manual [27] has yet been published [22]. The EASI has undergone feasibility and pilot testing in the USA as well as assessment of usability regarding logistics and administration of scoring. It currently consists of 20 performance-based subtests measuring different aspects of sensory integration function. The subtests are divided into four domains as can be seen in Table 2 and are scored in different ways: a) the child is scored 2, 1 or 0, b) the child is scored only with 1 or 0 and c) where they are timed during an activity.

The EASI includes a manual, questionnaire, test sheets for each subtest, test forms and response cards for some of the subtests. The manual contains thorough instructions on material and administration. The test sheets are for the testers, with information about materials needed in each subtest, and instructions about the scoring in the specific subtests. Each test sheet also contains instructions about the administration of the subtest and verbal instructions to be given to the child. These verbal instructions are not meant to be memorized or stated word-for-word, but

Table 2. Domains and subtests of the EASI and who translated it.

Domain	Tests	Translator
Sensory perception tests	Tactile Perception-Localization (TP:L)	Translator 1, Translator 3
	Tactile Perception-Designs (TP:D)	Translator 1, Translator 3
	Tactile Perception-Shapes (TP:S)	Translator 1, Translator 3
	Tactile Perception-Oral (TP:O)	Translator 1, Translator 3
	Proprioception-Joint Position (Prop:JP)	Translator 1, Translator 2
	Proprioception-Force (Prop:F)	Translator 1, Translator 2
	Vestibular-Nystagmus (V:N)	Translator 1, Translator 2
	Visual Perception-Designs (VP:D)	Translator 1, Translator 4
	Visual Perception-Search (VP:S)	Translator 1, Translator 4
	Auditory Perception-Localization (A:L)	Translator 1, Translator 3
Postural-ocular-bilateral tests	Postural Control (PC)	Translator 1, Translator 2
	Balance (Bal)	Translator 1, Translator 2
	Ocular-Motor and Praxis (O:M & Pr)	Translator 1, Translator 2
	Bilateral Integration (BI)	Translator 1, Translator 2
Praxis tests	Praxis: Ideation (Pr:I)	Translator 1, Translator 2
	Praxis: Positions (Pr:P)	Translator 1, Translator 2
	Praxis: Sequences (Pr:S)	Translator 1, Translator 2
	Praxis: Following Directions (Pr:FD)	Translator 1, Translator 2
	Visual Praxis – Construction (VP:C)	Translator 1, Translator 4
Sensory reactivity test	Sensory reactivity (SR)	Translator 1, Translator 4

are rather suggestions that can be altered in order to help the therapist illustrate the idea of the test to the child [27]. *Praxis: Following Directions* is the only subtest where the instructions to the child are not suggestions, it is instead in this case vital to be exact in the instructions to the child, in order to be able to evaluate the child's performance. The test forms are for the child, for example the forms for *Visual Praxis: Designs*, where the child makes the drawings. The response cards are for example cards with geometric forms used during *Tactile Perception: Shapes*.

The translation into Swedish was performed for the test sheets and, when needed, the test forms but not the entire EASI manual at this stage.

Translation process

The collaboration with the EASI developers began in 2017, when they reached out to Sensory Integration therapists around the world, asking for someone in each country to take the lead on working with the development of a worldwide assessment tool for children with sensory integration issues. The first author became the *country lead* for Sweden, which entails responsibility for coordinating the translation and normative data collection of the EASI in Sweden. The developers sent selected parts of the test to all the country leads, asking about possible difficulties in understanding or words that could cause offence after translation. This was done to reduce problems when the actual translation process began.

Stage 1 forward translation

The first author translated all 20 subtests from English to Swedish (Figure 1). The same subtests were concurrently divided between three occupational therapists for a separate translation (Table 2). All of the chosen translators were members of the *Swedish Association of Ayres Sensory Integration* and have had advanced level training in ASI and assessment tools measuring sensory integration function. All had Swedish as their native language and had lived in the USA for a minimum period of four months, studying ASI. They thus had a good command of the American-English language, the specific terms used in ASI theory and an understanding of both the Swedish and the American culture, which is an advantage in the translation process [28,29,34]. All the therapists translated their assigned subtests separately generating two Swedish versions (T1 and T2) for each subtest.

Stage 2. Translation synthesis

T1 and T2 were compared and merged into one target-version in Swedish through a thorough discussion between the translators and a third, *Expert OT*, who was also a member of the *Swedish Association of Ayres Sensory Integration*, but not involved in the previous translation process. The expert OT has more than 25 years of experience of working within the Swedish school system and child psychiatry using ASI theory and the Sensory Integration and Praxis Test [21]. Her main purpose was to consider possible ambiguities and discrepancies of words, sentences and meaning that occurred between the two translated versions. This stage generated a Swedish EASI research version 1.

Stage 3. Expert panel focus group interviews

A purposive sampling of participants was made for the focus groups through a social network of occupational therapists interested in ASI. All the participants

Table 3. Participants in expert panel focus groups, their clinical experience and experience in sensory integration.

	Clinical experience	Sensory integration experience	Kind of meeting	Subtests reviewed
Focus group 1	2 OTs from child psychiatry with 4 & 17 years of work experience with children. 1 paediatric OT from Habilitation, with 16 years of work experience with children 1 OT working mostly with young adults for 3 years.	All 3 paediatric OTs had attended a 3-day course in SPM (Sensory Processing Measure) and a workshop in Sensory Integration clinical observations and online Alert Program. OT working with adults had attended a 1-day seminar about Sensory Integration.	Physical meeting	Subtest 1–9
Focus group 2	1 OT from child psychiatry, with 19 years of work experience with children. 2 paediatric OT's from the School system, with 3 & 6 years of work experience with children.	Two of the OTs had attended a 3-day course in SPM. One had also attended a workshop in SI clinical observations and online Alert Program. One had attended a 1-day seminar about ASI.	*via* Skype for business	Subtest 10–20

had completed a minimum of a one-day seminar about ASI (Table 3) and had extensive expertise in clinical settings, mostly with children. All of the participants received information about the study both verbally and in writing from the first author, and they signed a consent form. The expert panel was divided into two focus groups [31,32], reviewing different parts of the EASI, as can be seen in Table 3. They had not been involved in the previous translation process nor did they have any prior knowledge of the EASI.

In order for the expert panel to familiarize themselves with the topic of discussion, the first author sent them both the Swedish EASI version 1, the original English research version and instructions in order to focus their attention on the comprehension of the language and cultural adequacy.

The focus groups were conducted as semi-structured interviews, led by the first author, and the subtests were reviewed one by one and difficult terms, phrases and formulations were identified and discussed as well as cultural adequacy. Both meetings, which lasted about 90 min, were audio recorded, transcribed and a content analysis was conducted [30–33].

The first focus group took place in a comfortable room for talking at the workplace of one of the OTs. The second focus group was performed *via* Skype due to geographical and logistical difficulties and each OT participated from their own office during the session. The first author acted as the moderator during both focus group sessions and welcomed the participants. The moderator also clarified that the participants were the experts and that the discussion would be between them while the role of the moderator was not to be active in the discussion, but to guide it and encourage all participants to contribute with their thoughts and perceptions of the test concerning comprehension and cultural aspects.

The discussions from both focus groups were recorded and the data transcribed in order to conduct a directed, descriptive, manifest content analysis [30,33]. Beaton et al. [28] emphasize the importance of equivalence between the original and the translated test in four areas; semantic, idiomatic, experiential and conceptual (Table 4). This is for attaining content equivalence and at the same time making necessary cultural adaptations.

These four concepts were used as the predetermined categories in the analysis. The first author listened to the recordings and read the transcribed text several times and then highlighted all text that appeared to describe any discrepancies concerning comprehension of the test or cultural aspects. All highlighted text was then coded using the predetermined categories wherever possible. Text that did not relate to the translation or cultural aspects were excluded. After coding, the data for each category was examined to determine whether a subcategory was needed or not. The content was then identified through meaning units [30,33]. The two authors discussed the coding in relation to the categories and subcategories thoroughly until consensus was reached in order to attain greater trustworthiness.

The cultural differences and difficulties with comprehension that emerged within the different categories, as well as the suggested alternatives, were discussed within the group of translators after the focus group interviews and the analysis of their content. Some issues were easily corrected, while some of the problems were summarized and sent to one of the developers of the original EASI for clarifications before deciding on any alterations.

Stage 4 back translation

EASI subtest *Praxis: Following Directions* was back translated into English, by a bilingual translator with English as the native language, but living and working in Sweden and speaking Swedish fluently. The translator was not an Occupational Therapist, had not taken any part in the previous translation process and had no previous knowledge of the EASI. The back-translated version was sent to the developers for review and the discrepancies were discussed by the first author and one of the developers and altered where necessary.

Results

The results are presented in three parts following the stages of the translation process. First, there is a

Table 4. Description of four types of equivalence.

Equivalence	Description [32]
Semantic	The meaning of the words is the same in both languages. Are there multiple meanings for any items? Are there grammatical difficulties in the translation?
Idiomatic	Statements that are symbolic, for example 'It's raining cats and dogs' which actually means it is raining a lot.
Experiential	Relates to people having the same sort of experiences in the different cultures. For example, in one culture people are used to wearing gloves, but in another it is warm all year around and the people there do not have the experience of wearing gloves.
Conceptual	A concept must exist, and mean the same thing in both cultures, or be adapted. For example, the word 'family' can have different meanings in different cultures.

presentation of the results from Stages 1 and 2, the forward translation and synthesis. Second, the information gathered from the focus groups are described by presenting categories, subcategories and extracted, specifically defining, citations by the participants. Examples of how the discussions resulted in alterations in the Swedish version of the EASI are also presented. Third, there is a presentation of the results from the Back translation performed on *Praxis: Following Directions*.

Forward translation and synthesis

The EASI was thoroughly translated individually by each translator with extra concern regarding semantic equivalence. It became apparent, during the comparisons and discussions in stage 2, the synthesis, that sentences and wordings in the majority of the items matched or were very similar. Differences such as the use of 'object' vs 'thing' and 'scent' vs 'smell' in a sentence emerged in several items and depending on whether the instruction was for the occupational therapist testing the child, or for the child itself, the choice differed. The words 'thing' and 'smell' are something one uses with children while the words 'object' and 'scent' are more correct and will be used in instructions to the occupational therapist. The word 'Head lag' in subtest *Postural control,* item 15 turned out to be a real challenge and several of the translators became involved in finding the best translation. No exact translation could be found and finally it was adapted to 'head control'.

The sentence 'Now, show me how many different things you can do with your body until I tell you to stop.' in *Praxis: ideation,* proved difficult to translate. It did not lend itself to a direct translation, and was instead altered to 'Now, show me how many different ways you can move, until I say stop. Use your whole body'.

The Expert OT participated as an independent translator at this stage, and contributed to the best possible merging of the translations.

Some concerns regarding experiential equivalence were raised at this stage. The *Tactile Perception: Oral* was mentioned specifically and a discussion arose about 'who does what'. There is no tradition of occupational therapists in Sweden working with oral motor difficulties in children, which is a field where speech therapists are prominent. This was not a serious concern, merely an observation.

No conceptual or idiomatic discrepancies were found during the forward translation or synthesis and the Swedish EASI version 1 was developed and sent to the expert panel in preparation for the focus groups.

Focus group interviews

The following four categories were predetermined: semantic, idiomatic, experiential and conceptual equivalence. Issues concerning idiomatic and conceptual equivalence were discussed in both focus groups, but no discrepancies were found. One further category emerged in the content analysis, it had been discussed in both focus groups as an important aspect in the translated version: the standardization of instructions.

Semantic equivalence

The subcategories being **wording**, **concept** and **sentence structure**.

Several of the participants found the word 'jogs' difficult, as in when the child jerks or hesitates when drawing.

> *… don't know quite how to translate it … jogs … in English. There is hardly a good word for it (in Swedish) …*

> *… flow in the motion … ?A tug or jerk, maybe that is ok …*

The final decision was made to retain the Swedish word for 'jerk'.

One discussion concerned how we talk to children in Sweden compared with how this is done in the USA. For example, in test item 3–4 in *Proprioception: Force*, the English instruction states: 'Now we'll do another'.

The discussion was if we say 'we' when we mean the child as in the example in the original test or should it be 'Now *you* will do another' in Swedish?

> *Should we say we or you? With the children, maybe we should say you.*

> *Even if I'm showing something, I should direct myself to the child*

All of the participants in the focus group agreed on changing it to you.

Experiential equivalence

No subcategory was necessary.

One of the occupational therapists expressed concern about the *Ocular motor praxis test*, since that is

something that Swedish occupational therapists do not usually evaluate.

> *….this is something I'm not at all used to evaluating, so this will be difficult for me… I had to think several times about what I read…*

This concern originated from inexperience and a lack of greater knowledge of ASI, and will not be an issue for testers thoroughly trained in the EASI.

Standardization of instructions

This category was not predetermined but emerged during the content analysis of the focus groups. The subcategories are **missing information** and **need of clarifications**. The participants had difficulty understanding how some of the items should be performed, due to a lack of information, such as in *Tactile Perception: Designs*:

> *Should… should you draw with your finger…? It says, to draw with your*
>
> *finger in the beginning of the trial… the question is whether it should be in the*
>
> *instructions, somewhere, just for the tester.*

And in *Auditory: Localisation* (A:L):

> *a bit difficult to grasp what… how to make the sounds…*
>
> *I had to search in the text, how to make the sounds, and then I thought*
>
> *I should knock, but I'm not sure…*

This resulted in minor additions to the instructions in the Swedish version, taken from the manual, translated and inserted into the respective test sheets.

Back translation

The back translation focuses mainly on semantic and conceptual equivalence, and the subtest *Praxis: Following Directions* was back translated and compared to the original version by one of the developers. This resulted in only one significant discrepancy involving three items in the subtest (Table 5).

The English word 'put' was at first translated with the word 'Stretch', which does not have the same meaning in English. After a discussion with the second translator of the subtest and the independent third translator, a change was made to replace the word stretch with the Swedish word for 'hold', which is closer to the word 'put'. This was again discussed with the developer and approved.

All changes due to the translation and cultural adaptation process has been incorporated into the final research version of the EASI that will be used for the Swedish normative data collection.

Discussion

The aim of this study was to develop a culturally adapted Swedish version of the EASI for use in further research and a normative data collection.

The EASI was originally developed with the intention to be translated and adapted worldwide, in order to identify and support as many children with special needs as possible. It was thus constructed for optimal use in geographical and culturally diverse locations [22,27]. The availability of materials used in the test, as well as some specific wordings were verified through social media from over 100 countries in the early stages of its development. This work simplified the translation process greatly, especially concerning idiomatic and conceptual equivalence. This is likely one reason why neither translators nor focus group participants found discrepancies in these areas. Another reason could be that the developers also made a great effort to avoid cultural jargon (idioms) in the test and worked hard to only include activities without cultural aspects. Experiential equivalence in a test usually refers to experiences of the target population of the test and the importance of sharing the same experiences across cultures [28]. In this case it should have included the experience of children performing on the EASI tests. But, since this study does not include using the tests with children, experiences analysed were of the participating occupational therapists and issues were raised concerning evaluation of ocular motor control and tactile perception in the mouth. Participants expressed an inexperience in

Table 5. Results of changes in EASI due to back translation.

Praxis: following directions	Original EASI	Back translated version EASI	Final research version Swedish EASI
Item 3	Lift your foot and put it out to the front.	Lift your foot and stretch it out to the front.	Lift your foot and hold it out to the front.
Item 4	Put one hand forward and one foot back.	Stretch one hand forward and one foot back.	Hold one hand forward and one foot back.
Item 5	Put one arm up, one arm down, and one foot back.	Stretch one arm up, one arm down, and one foot back.	Hold one arm up, one arm down, and one foot back.

performing this type of test and a discussion about how the occupational therapy trade differs between Sweden and the USA began. Unfortunately, no studies were found concerning this subject. The semantic equivalence, where the goal is to retain the true meaning of each item [28], was the greatest challenge throughout the translation process. Not so much in the instructions for the children, but in the assurance that the Swedish occupational therapists understand the intention of each test and item. Despite the thorough translation and discussions amongst the translators, some idiosyncrasies, problematic terms and phrases were identified during the focus group interviews. Suggestions for alternatives were given and discussed. Some minor discrepancies were easily altered, for example using the word smell or scent, or paper instead of sheet of paper to make the semantic equivalence stronger. Missing information and a need for clarifying instructions were an issue that the second focus group in particular brought up. Most of these issues could have been avoided if the participants had had access to the manual as well as the test sheets. On the other hand, it provided the participants and the authors with an opportunity to discuss which specific information is important to have easy access to when testing a child. Both focus group interviews generated productive discussions, which need to be continued.

There is so far only one article published [22] about the psychometric properties of the EASI, due to it still being under development, and these results are very promising. Nothing has as yet been published about the translation or adaptation of the instrument to other languages, since this work is in its initial phase. No specific requirements were stated by the developers concerning the translation process with the exception of *Praxis: Following Directions*, which was expected to be back translated prior to the normative data collection. Apart from this, each country lead had a mandate to determine how much of the test needed to be translated and which methods and procedures were to be used. Beaton et al. [28] was chosen for the Swedish translation since these guidelines are very structured, well recommended and commonly used.

Forward translation and synthesis

Semantic and conceptual equivalence are frequently mentioned as being especially important when translating an assessment tool and ensuring appropriate cultural adaptations while still preserving the original version's validity in the target version [28,35,36]. After a thorough discussion between the authors and some experts in translating assessment tools, the decision was made to use occupational therapists with advanced training in ASI for the translations. This was based on the EASI being a performance-based test with instructions for occupational therapists, and not a questionnaire to be completed by parents or teachers. In order to ensure a more conceptual rather than a literal translation, all the consulted translators were well versed in both the English language and in American culture.

There is no agreement among researchers as to how many translators should be involved in the first step of translating the original source test to the new target language. The decision to use two independent translators for each subtest was based on the recommendation by Beaton et al. [28]. The WHO [36] states that only one translator is needed, as long as that translator is familiar with the terminology of the area. Sousa and Rojjaasrirat [29] advocate the use of two teams of translators, if resources are available, to minimize the risk of idiosyncrasies. This study did not have resources to use whole teams but deciding on two translators for each subtest was an attempt to reduce that risk. The first author translated the whole test, while the second translation was dispensed to three different translators. This turned out to be an extra validation since many of the subtests contained several terms and phrases that were the same. Discussions concerning the most correct translation thus generally involved more than the two translators and the third independent translator, and it could be said to have been a team of translators as suggested by Sousa and Rojjaasrirat [29]. Both translators were in agreement regarding the translation of the majority of the items and sometimes they only differed in terms of the sentence structure. Having a third, independent source during the translation synthesis is recommended by Sousa and Rojjaarirat, and proved to be beneficial and strengthened the result. The first author had the overall responsibility to ensure that all the terms and phrases were expressed in the same way throughout the test.

Focus groups with an expert panel

Most research concerning the translation and adaptation of an assessment tool recommend using an expert panel where all the participants are in consensus regarding all the translated items [28,37,38]. This is a very time-consuming procedure and, as

previously referred to, the EASI is extensive with 20 different subtests and many items and instructions. This was thus not possible to achieve during this study. Instead a panel of experts in paediatric clinical experience was assembled and divided into two groups and occasions, and focus group interviews were conducted instead of trying to reach a consensus. Focus group interviews are recommended when people from the target group discuss different aspects of a topic, especially when the topic is new or complex [31]. The paediatric OT's using the EASI were the target group in this study, and comprehension of the assessment tool and its cultural aspects was the topic. Since both ASI theory and assessments of sensory integration functions are relatively new in Sweden, and definitely complex, focus group interviews were considered a suitable method to investigate the participants' interpretation and perceptions of the translated EASI. The authors (both with postgraduate training in ASI) were able to benefit from the dynamics and interactions created in the focus groups and gain a better understanding of the participants' view and comprehension of the test.

The content analysis following the interviews aimed at detecting patterns of cultural difficulties between the translated version of the EASI and the original. Focus group interviews have been used in the earlier stages of the process in other translation studies [36,38–40], and content analysis was conducted in two of them [36,40]. The participants for the expert panel focus groups were chosen mainly for their clinical experience with the EASI target population (children 3–12 years) but also for their interest in ASI. One participant had mostly clinical experience with young adults, and it was thus considered suitable to gain an alternative insight to the test. It would have been preferable, if they had greater experience of the ASI theory, but due to the lack of Swedish therapists with advanced training, this was not possible. It was more important not to use the same therapists as in the first stages. In order to keep objectivity, none of the participants had any previous knowledge of the EASI and no involvement in the first stages of the translation.

Back translation

In order to meet the time limit for the international normative data collection, set by the developers, the decision was made to only let one subtest go through the back-translation process at this point, the subtest *Praxis: Following Directions*, as it was requested by the original developers. This was due to the specific language requirements where the goal is to see how the child is able to follow auditory instructions only.

Back translation is the standard recommendation in almost all literature [28,29,36,37], but it differs in which phase of the translation process it is performed. Beaton et al. [28] recommend that it is performed prior to the pilot testing, while other researchers choose to do it after testing it on a target population [36]. In all the subtests, except for *Praxis: Following Directions*, the items are developed so that only *suggestions* for instructions to the child are given [27]. The tester can thus adjust as needed in order to help the child to understand the task, and a back translation is thus not vital for the preservation of psychometrics. It was thus considered important to have the EASI tested on a target population prior to the whole test being back translated but that is not included in this study. The most important goal, at this stage, was to ensure that the occupational therapists using the EASI in the normative data collection understand the meaning and intention of the tests.

The recommendations in the guidelines by both Beaton et al. [28] and WHO [37] are to perform a back translation even prior to engaging the expert panel. However, it was determined in this study to do it the other way around, which Lund et al. [38] had previously done. The aim was to capture as many problematic areas as possible before exposing it to the back-translation process. This, in combination with the ongoing collaboration with the original developers, turned out to be beneficial, since the comparison of the back translated subtest *Praxis: Following Directions* only found one word in need of retranslation, the word 'put'.

There is always a risk of losing important meaning content in an assessment tool during a translation process [41,42]. At the same time, there are no general rules of transferability of constructs and measures or specifics of *how* accurate an equivalence should be, and thus each one must be assessed case by case [41,42]. It can be assured that the quality of the test has been retained in the final Swedish research version as systematic procedures have been followed [28], with multiple stages and continuous feedback from one of the original developers throughout the procedure.

To minimize the risk of preconceptions during the study, due to the authors' knowledge of both the assessment tool and the theory behind it, several countermeasures were taken. Firstly, the choice to have more than one translator and to engage a third part, independent from the first translations during the synthesis. Secondly, the decision to use the

openness of focus group interviews, in order to strengthen the trustworthiness of a directed content analysis.

Limitations and recommendations for future research

There were limitations in this study. Purposive sampling, where the researcher and the participants are acquainted constitutes a risk for bias, which was taken into consideration. It became apparent to the authors during the study that there was a need for advanced knowledge in ASI in order to really understand the EASI, and furthermore, that there was not a sufficient number of occupational therapists in Sweden who had that experience. It would have been beneficial if the participants in the focus groups had been trained in both ASI and the EASI, and had access to the complete manual.

Future psychometric research of the translated Swedish version of the EASI involving occupational therapists who have been trained in, and have used the EASI for some time is strongly recommended and planned for, i.e. a Test-retest study.

Conclusion

Semantic, idiomatic, experiential and conceptual equivalence in the Swedish translation of EASI was explored in this study, and a preliminary equivalence was achieved through a multistage translation process. Cultural adequacy was ensured and the goal of translating and make a first Swedish, culturally adapted version of the EASI, was accomplished. There is still research that needs to be completed before the translated EASI can be used in a Swedish clinical setting, but the Swedish EASI is ready to proceed to the next level of testing: the Swedish normative data collection.

The availability of an appropriately translated and culturally adapted set of tests, such as the EASI, will impact practice, as well as research possibilities in Sweden. The work on implementing ASI theory and practice among occupational therapists in Sweden will be facilitated when a more extensive assessment tool of sensory integration function such as the EASI is available and this study is an important first step in providing that.

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Disclosure statement

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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