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A short form of the Speech, Spatial and Qualities of Hearing scale suitable for clinical use: The SSQ12

William Noble[1], **Niels Søgaard Jensen**[2], **Graham Naylor**[2], **Navjot Bhullar**[1], and **Michael A. Akeroyd**[3]

[1]School of Behavioural, Cognitive and Social Sciences, University of New England, Australia

[2]Eriksholm Research Centre, Oticon A/S, Denmark

[3]MRC Institute of Hearing Research (Scottish Section), Queen Elizabeth Building, Glasgow Royal Infirmary, 16 Alexandra Parade, Glasgow G31 2ER, United Kingdom

Abstract

Objective—To develop and evaluate a 12-item version of the Speech, Spatial and Qualities of Hearing Scale for use in clinical research and rehabilitation settings, and provide a formula for converting scores between the full (SSQ49) and abbreviated (SSQ12) versions.

Design—Items were selected independently at the three centres (Eriksholm, MRC Institute of Hearing Research, University of New England) to be representative of the complete scale. A consensus was achieved after discussion.

Study Sample—The data set (n=1220) used for a factor analysis (Akeroyd et al., submitted) was re-analysed to compare original SSQ scores (SSQ49) with scores on the short version (SSQ12).

Results—A scatter-plot of SSQ12 scores against SSQ49 scores showed that SSQ12 score was about 0.6 of a scale point lower than the SSQ49 (0-10 scale) in the re-analysis of the Akeroyd et al. data. SSQ12 scores lay on a slightly steeper slope than scores on the SSQ49.

Conclusions—The SSQ12 provides similar results to SSQ49 in a large clinical research sample. The slightly lower average SSQ12 score and the slightly steeper slope reflect the composition of this short form relative to the SSQ49.

Keywords

Speech; Spatial and Qualities of Hearing scale; short version; clinical use; SSQ

Introduction

The Speech, Spatial and Qualities of Hearing scale (SSQ) (Gatehouse & Noble, 2004) is designed for use typically as a complement to behavioural or experimental measures of hearing ability. It has been applied across a range of clinical and clinical research-related contexts: for example, Beijen et al. (2007) used the version of the scale adapted for parents

Corresponding Author: Dr Navjot Bhullar, School of Behavioural, Cognitive and Social Sciences, University of New England, Armidale NSW 2351, Australia. navjot.bhullar@une.edu.au.

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(Galvin, Mok & Dowell, 2007) to compare ratings of children fitted with one versus two cochlear implants; the standard SSQ featured in a study by Laske et al. (2009) who compared performance and self-assessed outcomes following provision of a second cochlear implant; Banh, Singh and Pichora-Fuller (2012) compared SSQ responses of older adults whose hearing was audiometrically "normal" with those of a younger sample; Fuller et al. (2012) included the scale in a study comparing performance and self-ratings of cochlear implant users with and without a history of musical training; Hua et al. (2012) used the SSQ to assess CI versus CI plus contralateral linear frequency transposing hearing aid fitting; and in a study by Olsen, Hernvig and Nielsen (2012) the SSQ was used to assess abilities of people with unilateral hearing loss.

The SSQ is in the public domain and the definitive version (#5.6, 49 items) is downloadable from http://www.ihr.mrc.ac.uk/products/display/ssq. A "Benefit" version has been developed, for use in appraisal of abilities prior to and following an intervention, and a "Comparison" version allows observation of self-assessed contrasts between different fitting strategies (Jensen et al., 2009). Although the complete 49-item scale (referred to here as SSQ49) is serviceable as it stands, an abbreviated form would have value for swift or routine assessments, for example, prior to and following clinical treatment to manage hearing disabilities. Here we report the development of a 12-item version — the SSQ12 — suitable for such a purpose.

There are other short forms of the SSQ already available. Demeester et al. (2012) have recently published the SSQ5, which they see as providing a valuable population screening tool as it was derived by statistical analyses to achieve optimum sensitivity and specificity. Kiessling et al. (2011) have developed a 15-item short form of the SSQ intended for epidemiological settings and as complementary to their laboratory investigations of binaural hearing function. Our aim in devising the SSQ12 was not to go in the same direction as either of these other short forms but rather to compile a set of items that represent the scale as a whole, offering the clinician or researcher an efficient scaled-down version.

The choice of a size of 12 items in the present study was partly influenced by the 12-item "hearing handicap scale" (HHQ; Gatehouse & Noble, 2004) that might serve as a size-matched companion measure in clinical settings. It is also comparable to the number of pragmatic subscales (ten) devised by Gatehouse & Akeroyd (2006), whereby SSQ items having similar meaning and reference were grouped in sets; it was judged that attention could usefully be given to representing these subscales in a short form. These pragmatic subscales are labelled: *Speech in Quiet*, *Speech in Noise*, *Speech in Speech Contexts*, *Multiple Speech Stream Listening*, *Localization*, *Distance and Movement*, *Segregation*, *Identification of Sound*, *Quality and Naturalness*, and *Listening Effort*.

An additional feature helping to inform the present project was a factor analysis conducted on a substantial set of SSQ data (n=1220) accumulated at the MRC Institute of Hearing Research Scottish Section over a 10-year period (Akeroyd et al., 2011). This analysis provides factor loadings for each item, expressing the "representativeness" of each one with regard to the factor in question. An initial analysis of this data suggested four factors, able to be identified as *speech hearing*, *spatial hearing*, *qualities of hearing*, and *listening effort*. A

subsequent, more detailed analysis (Akeroyd et al., submitted), split the cases into those who were unaided, unilaterally aided, and bilaterally aided. This analysis identified three evident factors across all three groups that essentially, though not perfectly, reflected the three sections of the SSQ, with the possibility of a fourth factor — listening effort. This data set was used to compare the final form of the SSQ12 with the complete scale (SSQ49).

Method

Initial item selection

At a face-to-face conference involving representatives of the three centres engaged in this project (Eriksholm, MRC IHR, UNE) the decision was made that each centre would independently nominate twelve items judged to be of value in a clinical context given their experiences in use of the SSQ. In providing their nominations each centre narrated the features they took account of in making their selections. These narratives are summarised below.

Eriksholm—Attention was given to avoiding items that had attracted significant numbers of "not applicable" responses, and favouring items that had featured in previous more ad hoc abbreviated forms of the SSQ used for product testing. Items were also favoured that produced wider rather than narrower ranges of scores. A balanced distribution across the 10 pragmatic subscales (Gatehouse & Akeroyd, 2006) and the four factors from the original factor analysis (Akeroyd et al., 2011) was also used as a guiding principle.

MRC Institute of Hearing Research Scottish Section—Items were identified that had strong weightings on the three factors evident in the more recent analysis (Akeroyd et al., submitted), but with attention to simplicity of wording. Three Speech items were selected that feature speech heard against other sounds, and in which the contexts are easy for respondents to visualise. Three Space items were selected that feature distance, lateral movement and movement to and from the listener of a non-speech object (bus, truck). Three Qualities items were chosen that reflect key nodes of this domain, namely clarity, segregation, and identification. Three further items were chosen that lay outside the factor structure yet seem to address important points, namely telephone conversation, externalisation, and listening effort.

University of New England (UNE)—Items were selected that featured strongly in the original (four-factor) analysis, but with the addition of items specifically addressing multi-stream speech perception and directional location, both judged as critical functions. Attention was given to the likely applicability of items across different communities, in terms of the contexts described, and the range of sensitivity of items to unilateral and bilateral amplification, as shown in the SSQ49 data reported by Noble and Gatehouse (2006).

Subsequent item selection

Items constituting the SSQ12 were tagged using the numbering in version 5.6 of the SSQ49, where the three sections are taken as Parts 1, 2 and 3. There were ten items in common

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across at least two centres. There was agreement to retain two of the three items that had been nominated by all three centres (#1.11, conversing while many others are speaking; #2.9, distance of a vehicle). It was decided that an “effort” item nominated by UNE (#3.14, referring to “concentration”) was more general in its reference while covering the same point as the third common one (#3.15, referring directly to “effort”).

There was agreement that items nominated by two of the three centres would also be retained: listening to one talker in a complex background (#1.1), switching from one person to another (#1.12), spatial location (#2.6), motion (#2.13), and sound segregation (#3.2.) One exception was an item on “clarity of music” (#3.8). After considerable discussion it was agreed that an item on “making out which instruments are playing” (#3.7) be used instead of the one about “clarity of music” because #3.7 includes reference to separating simultaneous events.

It was seen that one or two of the items uniquely in the MRC IHR list (telephone #1.14, internalisation of sound #2.14) were somewhat removed from the set being converged upon through discussion, but that an item about attending to simultaneous speech streams (#1.10) covered usefully different ground from an item on rapid switching of conversational speech, and should be added. It was agreed that an item about group conversation in which everyone could be seen (#1.4) was more straightforward than one referring to the same context but without everyone able to be seen. Other uniquely nominated items, about spatial hearing, were already represented by items selected by at least two of the centres.

Table 1 lists the items constituting the SSQ12. Nine of the ten pragmatic subscales are represented as are the three broader SSQ subscales (and hence major factors).

Results

The large data set that has been used in a recent factor analysis (Akeroyd et al., submitted) was seen as an appropriate resource to allow comparison of the SSQ12 with the original SSQ (SSQ49). The most parsimonious way to present this is by plotting individual SSQ12 scores against SSQ49 scores and a power-function curve linking the two. Figure 1 shows the result. There was close agreement between the two versions of the scale, with the SSQ12 exhibiting a modestly lower average score than the SSQ49 (note that the points mostly fall below the 1:1 line). A feature of the difference was the slightly steeper slope of SSQ12 values relative to SSQ49 values, indicating a greater contrast between lower and higher self-ratings on the short version compared with the complete version. We found that a power function gave a good fit to the data as a whole, fairly representing the steeper-than-1 slope: a second reason for using a power function was that it ensures that SSQ49 scores of 0 and 10 transform to SSQ12 scores of 0 and 10. The power function defined the transformation linking SSQ49 scores to SSQ12 scores and *vice-versa*. The equations are reported on the figure. Transformations for the three sub-groups in the present dataset (unaided, unilaterally aided, bilaterally aided) exhibited only negligible differences from the transformation for the pooled dataset shown in Figure 1.

Discussion and conclusion

The SSQ12 was derived from experiences in use of the complete scale, informed by the salience of various items in providing insights into components of hearing function. The data reported here show that the SSQ12 closely concurs in its average performance with the SSQ49, while exhibiting a greater sensitivity to differences in hearing status, as shown by the steeper slope of scores relative to the complete scale. This finding was expected given that no items in the SSQ12 represent the pragmatic subscale labelled *Speech in Quiet*, which most people, even if otherwise identified as hearing impaired, self-rate quite highly. It can also be said that more challenging contexts are given prominence in the SSQ12 relative to the complete inventory, which would lead to greater differentiation of abilities, as expected from data reported by Gatehouse and Noble (2004).

We see the SSQ12 playing a role in clinical settings especially when accompanied by the 12-item HHQ (Gatehouse & Noble, 2004). At a practical level, both scales could be provided to clients as a paper-and-pencil inquiry, in advance of initial appointment, with the request to complete both and bring that to the first appointment. This would give the clinician or researcher immediate knowledge of pre-intervention levels of *disability* and *handicap* (WHO, 1980). Although the complete SSQ performed best, in terms of test-retest reliability, when given as an interview both times (Singh & Pichora-Fuller, 2010), test-retest performance using a mailed version followed by an interview was observed in that study to provide the next most stable results.

There are items in common between the SSQ12 and both of the existing short forms (Demeester et al., 2012; Kiessling et al., 2011). It may be expected that the different short forms provide similar overall assessments.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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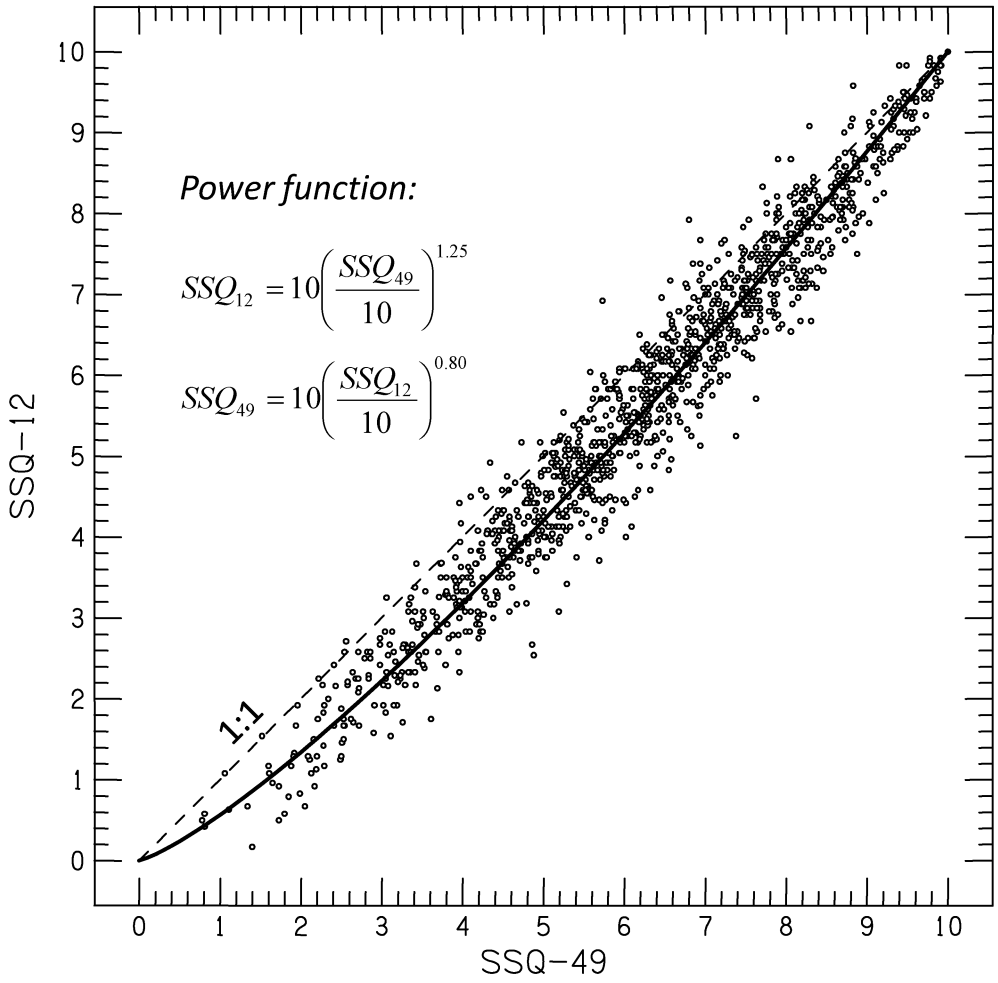

Figure 1. Scatter-plot of average SSQ12 scores against average SSQ49 scores for 1220 cases, comprising 386 unaided, 627 unilaterally aided and 207 bilaterally aided.

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Table 1

SSQ49 index	SSQ12 index	item	pragmatic subscale
1.1	1	You are talking with one other person and there is a TV on in the same room. Without turning the TV down, can you follow what the person you're talking to says?	Speech in noise
1.10	2	You are listening to someone talking to you, while at the same time trying to follow the news on TV. Can you follow what both people are saying?	Multiple speech streams
1.11	3	You are in conversation with one person in a room where there are many other people talking. Can you follow what the person you are talking to is saying?	Speech in speech
1.4	4	You are in a group of about five people in a busy restaurant. You can see everyone else in the group. Can you follow the conversation?	Speech in noise
1.12	5	You are with a group and the conversation switches from one person to another. Can you easily follow the conversation without missing the start of what each new speaker is saying?	Multiple speech streams
2.6	6	You are outside. A dog barks loudly. Can you tell immediately where it is, without having to look?	Localization
2.9	7	Can you tell how far away a bus or a truck is, from the sound	Distance and movement
2.13	8	Can you tell from the sound whether a bus or truck is coming towards you or going away?	Distance and movement
3.2	9	When you hear more than one sound at a time, do you have the impression that it seems like a single jumbled sound?	Segregation
3.7	10	When you listen to music, can you make out which instruments are playing?	Identification of sound
3.9	11	Do everyday sounds that you can hear easily seem clear to you (not blurred)?	Quality & naturalness
3.14	12	Do you have to concentrate very much when listening to someone or something?	Listening effort