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English summary

Abstract

This study was a research into the development of a voice assessment profile (VOIAS). Already a preliminary literature search showed that no such profile within music therapy existed, and only very sparse research within music therapy focusing on and involving the human voice. The development of VOIAS is based on vocal parameters extracted from the literature review and my clinical approach “Psychodynamic Voice Therapy”. The parameters’ relevance is based on clinical practice and the focus of population in this study, clients suffering from depression.

The following summarises the findings of the investigation of two main questions and five sub-questions of this study:

Main research questions:

1. What constitutes a valid and reliable voice assessment tool for clinical music therapy practice?

A valid and reliable voice assessment tool is composed of a manual with clear definitions of the different vocal parameters, and clear guidelines for how each parameter should be assessed. The use of a Likert-scale in the assessment of the different vocal parameters ensures a structured and controlled way of assessing subjective scorings. Selected vocal parameters analysed from a psychoacoustic perspective, VOIAS-2, also provide a valid and reliable way of analysing voice data.

2. Can this voice assessment tool be used to evaluate change over time?

Both VOIAS-1 and VOIAS-2 can be applied in order to evaluate change over time reliably. VOIAS-2 furthermore has the potential to capture small movements and changes even before it is experienced consciously by the client herself/himself or the staff involved.

Sub-questions:

1. How can relevant vocal parameters for a voice assessment tool be identified and operationally defined?

The clinical applicable vocal interventions have to direct the selection of the vocal parameters for constructing the VOIAS profile. Furthermore a proper theoretical as well as practical approach has to inform the voice assessment profile. A study of the pattern of the process of the vocal parameters across the vocal exercises will validate and reveal the reliability of these to provide relevant information for clinical practice and the interdisciplinary team. Each single parameter has to be seen in connection with the rest, and then related to the client’s story. Relevant vocal parameters for a voice assessment tool are identified by asking persistently if each selected parameter gives information relevant for clinical practice.

2. Can inter-rater / assessor agreement be obtained to ascertain consistent outcomes in application?

The statistic calculation demonstrates a very high interrater / assessor agreement for VOIAS-1 as a whole (Correlation is significant at the 0.01 level). However, looking more closely into the parameter body, a significant negative correlation between Rater 3 and the researcher is found. Therefore this parameter needs some adjustments if interrater / assessor agreement is to be obtained.

3. What guidelines are necessary for assessors to undertake a systematic and consistent evaluation?

The guidelines should be clear and complete, keeping the information and definition level at an absolute minimum, and aimed at simplicity.

In order to establish shared scoring conventions and ensure interrater reliability in clinical trials it is important to apply training facilities. Furthermore, the performance of the interpretation calls for more intense training, where the trainee rates audio samples in a class with others.

4. What are the potentials and limitations of a vocal assessment tool?

The most valid and reliable voice assessment profile is based on three core vocal exercises, the Glissando, the CoreTone and the Vocal Improvisation, all free from semantics and linguistics, being close to universal and primary vocal sounds. Only one music therapy session is required for assessing. The voice assessment protocol, consisting of the three vocal exercises can be applied by other clinicians, even with very little training and instruction.

VOIAS-1 and VOIAS-2 are complementary and consist of clinical relevant vocal parameters, which can evaluate change over time. With some training VOIAS-1 will be easy to handle. VOIAS-2 has potential to capture small movements and changes as well as to provide a broader description of the person being assessed, which is important information to be reported to the interdisciplinary team. However, the software PRAAT and the MIRtoolbox used in VOIAS-2 are not developed for singing. A simple version of a software needs to be developed focusing on the needs of music therapy in assessing the human singing voice.

The vocal parameter “body” needs further development and requires self-experience to support the understanding of the approach. In the statistical analysis a significant negative correlation was found between two raters, Rater 4 (the researcher) and Rater 3. The findings indicate that Rater 3 approached the evaluation as a whole differently from the researcher, Rater 1 and Rater 2, and it is indicated that much may be caught up with by some training.

A limitation is that the performance of the interpretation calls for more intense training, where the trainee should rate and discuss audio samples in a class with others.

5. Will the assessment / voice assessment analysis provide valid and reliable data when applied in clinical practice?

The three cores vocal exercises have the potential to capture even small movements and changes as well as broadening the description of the person being assessed. It provides essential information relevant to report to the interdisciplinary team. A triangulation indicated that VOIAS as a whole can be a valid tool providing clinically relevant information about the therapeutic process and the client’s state of being. This confirms the relevance of going further with the development of the voice assessment tool and bringing it closer to standardization. This was also viewed from the perspective of clinical practice.

Summary

This study was a research into the development of a voice assessment profile (VOIAS), which is able to document change over time according to the principles of evidence-based practice in a valid and reliable way (Wigram et al. 2002), as well as provide relevant information for clinical music therapy practice and the interdisciplinary teams. Already a preliminary literature search showed that no such profile within music therapy existed, and only very sparse research within music therapy focusing on and involving the human voice. The impact of this discovery was that I had to construct such a voice assessment profile as well as the procedures around it myself. Therefore the literature review was focused on gathering

information about possible vocal parameters, and selecting and defining these in order to build a quantitative profile for evaluating the human voice in music therapy. Furthermore, I have found it important also to look into clinical literature focusing on the human voice as a primary instrument within music therapy, as well as reviewing very focused studies of the voice in other fields and professions outside music therapy. This review focused on extracting vocal parameters according to the descriptions of focus for listening to the human voice.

The literature review revealed a significant lack of attention towards the human voice within music therapy and at the same time the voice as a possible source for information about effects and emotional states of a client.

The study is an investigation of the following research questions, divided into two main questions and five sub-questions:

Main research questions:

1. What constitutes a valid and reliable voice assessment tool for clinical music therapy practice?

2. Can this voice assessment tool be used to evaluate change over time?

Sub-questions:

1. How can relevant vocal parameters for a voice assessment tool be identified and operationally defined?

2. Can inter-rater / assessor agreement be obtained to ascertain consistent outcomes in application?

3. What guidelines are necessary for assessors to undertake a systematic and consistent evaluation?

4. What are the potentials and limitations of a vocal assessment tool?

5. Will the assessment / voice assessment analysis provide valid and reliable data when applied in clinical practice?

Design and method

In order to answer the research questions this study employed mixed methods including both qualitative and quantitative research methods, and including both fixed and flexible designs (Robson 2002, Creswell and Clark 2011).

A multiple case study is part of evaluating the VOIAS performed to evaluate a voice assessment profile. The focus of population in this study is clients suffering from depression. In this research project the case study utilises an approach of developing a method to observe and collect data and examine the possible evaluation of the human voice as the particular phenomenon in clinical practice. Since the VOIAS is something intended to be useful in clinical practice, it is highly relevant for the empirical basis of the research project to be able to observe how it functions.

As a whole the design of this study can be described as an Emergent sequential exploratory mixed methods design with emphasis placed on the second, quantitative phase. In other words, according to Hanson et al. (2005), an unequal priority of the qualitative and quantitative analysis.

The initial qualitative phase concerns gathering information about possible vocal parameters, and selecting and defining these in order to build a quantitative profile for evaluating the human voice - VOIAS. The second quantitative phase follows two different mixed methods designs. In both cases the use of mixed methods arose from issues that developed during the process of conducting the research. These were an examination of the potentials and limitations of VOIAS, the psychological interpretation of the measurements outcome and the trustworthiness and relevance of the information for clinical practice as a result of the interpretation (Chapter 9). Therefore a qualitative method was added in both cases because the use of only one method was found to be inadequate in that phase of the study.

The mixed method design examining the first tryout of VOIAS can be described as an

Explorative sequential design with unequal priority given to the quantitative and qualitative analysis. This part of the research is a two-phase mixed methods design. In phase one quantitative data was collected from three independent music therapists evaluating 87 different sound files using VOIAS, and then analysed quantitatively (statistics). This was done in order to examine the inter-rater reliability and to clarify the pattern of the music therapy treatment process over time. This was followed up by phase two, a qualitative phase, containing an interview protocol to collect qualitative data addressing the three music therapists experiences in using the designed profile and manual to evaluate its potentials and limitations. These data underwent a phenomenological based meaning condensation of three follow-up interviews.

The mixed method design examining a psychoacoustic analysis and a psychological interpretation can be described as a sequential transformative design with unequal priority given to the quantitative and qualitative analysis. This mixed methods design utilized a theoretical-based framework - a transformative worldview - to make a psychological interpretation (Phase 2) of the quantitative analysis of data collected in Phase 1.

Finally a concurrent triangulation design was carried out. The triangulation design is a one-phase design where both quantitative and qualitative methods are implemented during the same frame and with equal weight. It involves the concurrent but separate collection and analysis of data, merging the different sets of data during interpretation of results.

Studying the human voice from five different perspectives

By thoroughly reviewing my own working method and daily practice of "Psychodynamic Voice Therapy" and taking into consideration that most often the human voice within the field of music therapy is used for singing song, the following five interventions were selected:

1. An open sounding glissando movement

including an ascending and descending glissando movement in one motion.

2. Sounding one note; - the CoreTone

3. Sounding a crescendo and decrescendo on one note; - the CoreToneVolume,

4. A song; - Happy Birthday

5. A vocal improvisation.

These five vocal interventions were composed into a voice assessment protocol applied in the first, seventh and last sessions of a music therapy treatment running over 12 sessions in order to collect clinical voice samples/data from two men and two women suffering from depression. Additionally voice samples from one non-clinical woman and one non-clinical man were collected by carrying out one assessment. All in all 57 clinical voice samples and 10 non-clinical voice samples were collected.

The design and construction of a voice assessment profile - VOIAS

The design and construction of VOIAS was based on the different vocal parameters identified by looking into existing literature and my own approach and working method. The aim was to construct a general model of a voice assessment profile (VOIAS) focusing on the human voice within music therapy, and not fixed to a certain working method. In the selection of the different parameters it was taken into consideration that research reviewed concluded that only a limited number of acoustic cues have been studied. Additionally it was concluded that it was necessary for researchers to reach beyond single measures of the most common voice cues.

The five vocal interventions chosen in order to cover how the human voice generally is employed within music therapy directed the selection of the vocal parameters for constructing the VOIAS profile as a whole. Some parameters were possible to assess and evaluate both subjectively and objectively, whereas others were only possible to approach either subjectively or objectively (psychoacoustically). The VOIAS profile as a whole

therefore consists of both a subjective approach of assessing/evaluating vocal sound samples/vocal data collected, VOIAS-1, and an objective approach, VOIAS-2, a developed manual of how to employ either VOIAS-1 or VOIAS-2.

In the following it will in each single vocal intervention be clarified and summed up which parameters were selected for the subjective approach for assessment and evaluation (VOIAS-1) and which were selected for the psychoacoustic analysis carried out in chapter 8 (VOIAS-2).

Vocal parameters selected for the assessment of the open sounding glissando movement

In summary, the vocal parameters included in VOIAS-1 therefore were as follows:

pitch range, ending pitch of the ascending glissando movement and fluency.

In summary, the following four parameters were included in the psychoacoustic analysis undertaken in chapter 8:

- calculating the pitch range
- calculating and comparing maximum pitch reached in the ascending glissando with maximum pitch reached when starting the descending glissando
- the ending of the ascending glissando
- time based analysis of the open sounding glissando movement as a whole, including the duration of sounding and breathing.

Vocal parameters selected for the assessment of the CoreTone and CoreToneVolume

In summary, the vocal parameters included in VOIAS-1 were as follows:

pitch (fundamental frequency), loudness, richness, tension versus breathy, fluctuation and quality (timbre) in relation to a spatial body sensation, either horizontal or vertical.

In summary, the vocal parameters included in the psychoacoustic analysis undertaken in chapter 8 were the following six parameters:

- fundamental frequency/Hz (pitch)

- spectrum
- spectrum centroid
- formant contours
- intensity - loudness
- duration of the sounding.

Vocal parameters selected for the assessment of the Song

In summary, the vocal parameters included in VOIAS-1 were as follows:

loudness, richness, tension versus breathy, fluctuation and quality (timbre) in relation to a spatial body sensation, either horizontal or vertical.

In summary, the vocal parameters included in the psychoacoustic analysis undertaken in chapter 8 were the following four parameters:

- measuring the starting pitch / mean frequency of the first tone in the song
- spectral centroid
- the intensity - loudness of the song
- the formant contours of the song

Vocal parameters selected for the assessment of the Vocal improvisation

In summary, the vocal parameters included in VOIAS-1 were as follows:

pitch range, mean loudness, mean richness, mean tension versus breathy, flexibility in form and structure, dynamics, fluency and quality (timbre) in relation to a spatial body sensation, either horizontal or vertical.

In summary, the vocal parameters included in the psychoacoustic analysis undertaken in chapter 8 were the following six parameters:

- measuring the fundamental frequency of the first tone in the voice improvisation
- calculating the pitch range in the improvisation
- a time based analysis of the free voice improvisation
- the sounding and breathing durations in the improvisation

- *studying the pitch contour of the improvisation*
- *studying the formant contours of the improvisation*

Results from the first tryout of VOIAS-1

Three independent music therapists tried out VOIAS-1 for the first time. They were only provided with a manual and the specific assessment sheets of VOIAS-1 to evaluate the sound samples. Quantitative data were collected from the three independent music therapists using VOIAS-1 in a first tryout for assessing the 87 sound samples collected from two men and two women suffering from depression, and from one non-clinical man and one non-clinical woman. The sound samples from the non-clinical man and non-clinical woman were added three times. An examination of the interrater / assessor agreement, as well as the possibility of VOIAS-1 to evaluate change over time was carried out. In doing so the scorings of the three music therapists and myself were subject to a statistical analysis. In order to evaluate and examine the function of VOIAS-1, as well as its potentials and limitations, a follow up interview was carried out, and a phenomenological based meaning condensation of the three follow-up interviews was carried out.

Results from the statistical examination of VOIAS-1

All data were entered into SPSS for each client at each time-point (first assessment, second assessment, and last assessment) with each individual rater's scores. The Pearson's correlation used to measure inter-rater reliability showed that the inter-rater reliability of VOIAS-1 was significant (Correlation was significant at the 0.01 level). This is a promising result. It supports and validates that the next possible step is to carry out a wider test of VOIAS-1 with a larger sample size for a further validation study of VOIAS-1.

A Spearman's Correlation was run in order to examine the parameter Body closer on the total scores by rater. Spearman's rank order correlation calculation found a significant negative correlation between Rater 4 (the researcher) and Rater 3. A significant negative

correlation between two raters is unusual. It says that the higher one rater scored, the lower the other rater scored it. It could be discussed as to why there was a significant negative correlation, and what this means as a part of this assessment profile.

Each sound samples collected from one non-clinical man and woman added three times. This meant that the assessors evaluated the same sound sample three times without knowing it. When studying each assessor's own inter reliability towards the same sound sample it turned out that Rater 3 presented the lowest inter reliability evaluating 46 % of the sound samples equally. Rater 3 was also the only rater who evaluated the same sound sample totally differently each time (6 %). This shows a tendency for Rater 3 to approach the evaluation as a whole differently from the researcher, Rater 1 and Rater 2. This could be the explanation as to why there was a significant negative correlation between the researcher and Rater 3.

Finally a Repeated Measures ANOVA was completed using all of the raters' scores at each of the three time points and between the first and third time points. Bonferoni's post hoc analysis was completed to determine where any significant changes might have occurred. The analysis of the overall score of all four clients looking into the possibility of VOIAS-1 to evaluate change over time showed that VOIAS-1 has the potential of being able to document significant changes over time. This is also a promising result supporting and validating that VOIAS-1 has the potential to document and validate change over time in the therapeutic process.

Results from an evaluation of the VOIAS-profile: Three qualitative follow-up interviews

All in all VOIAS-1, consisting of a manual and five different assessment sheets was experienced as quite clear and complete, yet to the complex side and time consuming, but not too complex to apply in clinical practice. The results of the follow-up interviews documented a need for minor corrections and adjustments of the VOIAS-1 in order to make the guidelines clear, precise and complete.

The follow-up interviews revealed that one vocal parameter, which addressed a spatial body sensation and the quality of the voice, was the most complicated parameter to approach. The follow-up interviews however also revealed that this parameter, the “body” parameter, employed an approach and listening attitude easy to adapt to when modeled and described.

The inter-reliability of VOIAS-1 can be ensured by implementing carefully planned training in the method. The importance of self-experience to the vocal parameters is supported by the outcome of the follow-up interviews. This will further support and relative to the understanding and approach of VOIAS-1.

Another limitation is that VOIAS-1 is too quantitative and in need of possibly adding subjective descriptions.

VOIAS-1 is basically experienced as a tool for the music therapist. There is agreement among the interviewees that VOIAS-1 will only be relevant for certain client groups; clients with the ability to reflect, adults looking for personal development or out-patients.

It is experienced that VOIAS-1 has potentials for providing data that make change over time evident and visible, as well as providing essential clinical descriptions about the client’s state of being, which have value to the interdisciplinary team, the interdisciplinary collaboration about the treatment and in order to set the diagnosis.

It is furthermore experienced that VOIAS-1 has potentials for being applied as a tool for structuring the therapeutic work, as well as encouraging and supporting the client to understand herself/himself better.

Results from a psychoacoustic analysis and a psychological interpretation

The quantitative possibilities of assessment were examined and choices made in selection of psychoacoustic methods. Musical data of two men and two women suffering from depression performing five different vocal exercises were analysed psychoacoustically, with attention to different vocal parameters extracted and identified by employing either

PRAAT or the MIRtoolbox. A theoretical-based framework, a transformative worldview, was utilized to make a psychological interpretation of the psychoacoustic analysis; the psychological interpretation was related to the clinical process of each client. This was done in order to examine the validity and relevance of the vocal exercises and the selected vocal parameters.

In order to evaluate and examine the function and reliability of VOIAS-2 as a whole, the assessment of the therapeutic process was examined across the exercises for each participant.

It was revealed that the most reliable vocal assessment consists of three core exercises, the Glissando, The CoreTone and the Improvisation. A vocal assessment consisting of these three vocal exercises has the potential to capture even small movements and changes as well as broadening the description of the person being assessed. In other words, it can provide relevant and essential information relevant to report to the interdisciplinary team.

There were indications that the CoreTone only captured mood changes. Therefore it can be concluded that it is essential for a vocal assessment to include more than one single exercise, and that the clinical conclusion cannot be based solely on one single vocal exercise. This revealed concrete elements of potentials and limitations of VOIAS-2, which should be considered for further investigation.

Finally, in each case the results of the overall assessment of the therapeutic process were compared with the statistical results of how three independent music therapists and I evaluated the therapeutic process employing VOIAS-1. It was found that the assessment of the overall therapeutic process by employing VOIAS-1 is congruent with the overall conclusion of the assessment of the therapeutic process employing VOIAS-2, the psychoacoustic analysis.

This is a promising result indicating that the implementation of VOIAS-1 can be valid and reliable in describing the clinical process and the client’s state of being. Furthermore it was

Vocal parameters	Depression	A decrease of depression
Glissando	↘	↗
Pitch range	↘	↗
Maximum ascending pitch vs. maximum descending pitch	↘	↗
Ending pitch	↘	↗
Sounding duration	↘	↗
Breathing duration	↘	↗
CoreTone	↘	↗
Fundamental frequency	↘	↗
Spectrum	↘	↗
Spectral centroid	↘	↗
Formant contours	↘	↗
Intensity	↘	↗
Duration of CoreTone	↘	↗
Improvisation	↘	↗
Pitch range	↘	↗
Time bases analysis of Improvisation in total	↘	↗
Sounding duration	↘	↗
Breathing duration	↘	↗
Formant contours	↘	↗

Table 1: Summary of the vocal parameters selected and identified as being relevant for further research within the population of depression.

found that VOIAS-1 and VOIAS-2 are complementary.

Additionally it was found that training is required for a person to carry out a psychoacoustic analysis.

Results from looking into tendencies according the voice and depression

The case study design engenders the possibility of considering what may be generalized from a number of cases within the same clinical population as a consequence of evaluation over time by looking into eventual tendencies in this group according to the

phenomenon in its context ; the human voice and depression. In this research study two men and two women suffering from depression were recruited. The diagnosis of both the men however changed during the treatment. This left two women suffering from depression. The results from the analysis both with VOIAS-1 and VOIAS-2, as well as the clinical report pointed out that the depression decreased over time in both cases.

According to the results above the most reliable vocal assessment consists of three core exercises, the Glissando, The CoreTone and the Improvisation (see table 1). When

looking into these three core vocal exercises, and relating and comparing the pattern of progress over time within the vocal parameters, they in general follow the same tendencies for the two women. The tendencies confirm my clinical experience. It is however not a result with validity. In order to provide validity to the result the sample size is far too small. However, the result indicates that it is worthwhile looking more into the following parameters connected to the three core vocal exercises by recruiting a larger sample of women and men. This is in order to examine if the same tendencies appear in both men and women and to examine if the vocal parameters follow the same tendencies within each gender.

Results from exploring the pattern of the music therapy process across assessments - a triangulation

One single case study was then selected in order to carry out a triangulation. The triangulation was carried out in order to validate the VOIAS profile as a whole, and the relevance of taking the development of a voice assessment tool further is also viewed from the perspective of clinical practice. Data and patterns describing the therapeutic process were examined from different perspectives: 1) The clinical description of

the music therapy process, 2) AB's self-experience as illustrated by quotes and drawings and 3) by AB's evaluation of her Visual Analogue Scale, 4) AB's scores on the HAM-D scale, and finally 5) by the statistical analysis indicating how three independent music therapists and I measured AB's therapeutic process in the employment of VOIAS-1.

The description and illustration of the patterns of the therapeutic process are congruent, and this is a promising result indicating that VOIAS can be a valid tool, providing clinically relevant information about the therapeutic process and the client's state of being. One case triangulation is however not enough to validate the method, but it provides a promising starting point for further research.

The present version of VOIAS enables evaluation and structured observations of the human voice performing three core vocal exercises free from semantics and linguistics. Furthermore the results of the research indicated that the voice assessment protocol is possible to administer in a consistent and stable manner with standard procedures and solid psychometric properties. This moves VOIAS one step closer to standardization.