

## **Development and Standardization of 'Questionnaire on Music Perception Ability'**

**Name of the Authors** - Devi Neelamegarajan, Ajith Kumar Uttappa, ArpithaV, Khyathi G

### **Affiliations:**

#### **Dr. Devi. N, Ph. D (Audiology)**

Lecturer in Audiology, All India Institute of Speech and Hearing  
Manasagangothri, Mysuru-570 006.  
Email: [deviaiish@gmail.com](mailto:deviaiish@gmail.com)

#### **Dr Ajith Kumar U, Ph. D**

Reader in Audiology, All India Institute of Speech and Hearing  
Manasagangothri, Mysuru-570 006  
Email: [ajithkumar18@gmail.com](mailto:ajithkumar18@gmail.com)

#### **Ms. ArpithaV & Ms. Khyathi G.,**

Final year B. Sc Speech and Hearing,  
All India Institute of Speech and hearing  
Manasagangothri, Mysuru-570 006  
Email: [arpithakullal@gmail.com](mailto:arpithakullal@gmail.com) & [khyathijain@gmail.com](mailto:khyathijain@gmail.com)

### **Abstract**

*Music is a part of every human life. Mastering ones skills in music is accompanied by experience, playing an instrument, reading a musical scale and note, passive listening, musical exposure, also depends upon the presence or absence of inborn attributes variously labeled 'talents' or, 'natural aptitudes'. However, an individual might have better perception of musical aspects but still consider themselves as non-musicians. Measuring music perception ability in individuals who are non-musicians but exhibit the musical brain is difficult to categorize. The present study aimed to development, standardize and validate a 'Questionnaire on Music Perception Ability' that can be used as a tool to classify the individuals as with and without musical abilities. The data collected from 174 participants were subjected to cluster analysis to categorize those individuals with and without musical ability based on the cut-off scores. The results of the present study indicates that a person with just a musical ability may also be able to understand and perceive differences in pitch, rhythm, intensity, timbre, harmonies and/or the structures of music.*

**Key words:** musicality, questionnaire, ability, cut-off

## Introduction

Our daily activities are accompanied by music in both social and work locale. In fact, most of the time music is listened or it is heard as background during other activities. However, mastering skills of music perception and performance is accompanied by experience, playing an instrument, reading musical scale or note, passive listening condition, musical exposure, and could also be presence or absence of inborn attributes variously labeled as ‘talents’ or ‘gifts’ or ‘natural aptitudes’ (James, 1947). Vrijnsen (2010) reported that musically well trained individuals show reliable differences in brain structure and function when compared to those who are non-musicians. According to Engineer et al. (2004) the mere exposure to an enriched acoustic environment without training, has reported to have enhanced auditory cortical responses (evoked by the presentation of the auditory stimuli recorded electro physiologically) and sharpen the tuning of auditory neurons, even to non-experienced sounds in both young and old animals. This reveals that expert who doesn’t have any theoretical or technical knowledge of music can still have higher ability for music perception though consider themselves as non-musicians (individuals who had not undergone any formal training of music in any form). This let us to think of the concept ‘musicality in non-musician’. Ability for music perception in non-musicians could be possible if the individual actively engage with music, including the amount of focused listening per day, attachment to music in everyday life, the extent to which an individual responds emotionally to music, and the degree to which an individual takes part in music in informal ways like singing along to tunes, exchanging views on music with others or it could just be an innateness or genetic (Daniel et al., 2014). Zentner and Kagan (1996) reported that musical could be an inherit nature with genetic influence in perception of the music without any formal musical training. Gagne (2004) spans the continuum between genetic and environmental influences, with most of the literature promoting a combination of both elements. Though these studies prove that the musical abilities could an influence of both genetic and environment assessing such a musical ability in an individual’s without any musical training is a challenging task. The assessment of musical abilities and achievements has a relatively long scientific history. Seashore published the initial version of ‘musical talents’ in 1919 since then a number of other tests like Seashore, Lewis, and Saetveit (1960) Seashore measures of musical talent, Wing (1962) Wing standardized tests of musical intelligence, Bentley (1966) Bentley measures of musical abilities, Gordon (1989) Advanced measures of music audiation, Wallentin, Nielsen, Friis-Olivarius, and Vuust (2010) The musical ear test, a new reliable test for measuring musical competence, Law and Zentner (2012) Assessing musical abilities objectively, have been developed to assess musical abilities. Boyle and Radocy (1987) provide a systematic summary of musical aptitude tests published over the course of the 20<sup>th</sup> century and describe how most of them were intentionally designed for specific purposes in (Western) music education. Müllensiefen, Gingras, Stewart, and Musil (2014) developed ‘The Goldsmiths Musical Sophistication Index’ (Gold-MSI), is a new self-report inventory which measures the ability to engage with music in a flexible and effective way. The above pre-existing test for assessing the musical ability have

involved the items of the western music or simple pieces of Western art music and has its own limitation (Lily & Marcel, 2012). These tests require an individual to be involved in a task of listening to the stimuli that was provided as a test item and response for each of its presentation and hence musicality of an individual is objectively measured. There are other self reported questionnaires that are available Music Experience Questionnaire (BMEQ) by Werner et al. (2006), Uses of Music Inventory (Chamorro-Premuzic & Furnham, 2007) Music-Empathizing-systematizing (ME-MS) by (Kreutz, Schubert, & Mitchell, 2008). These tests summarize individual differences in different areas of music use, like emotion, cognitive, psycho-social functioning, how an individual responds to music and also it captures the complete music background and music profile of the individual rather than understanding their perception ability for music like. However, with respect to Indian context, the music that individuals are exposed to is Hindustani or Carnatic music. So the other developed tools which are available, will not be able to exactly measure the musicality of an individual exposed to Indian music and culture. There is also a need to assess an individual's musical skills in terms of self-reported measures by using a questionnaire as the primary data collection tool before measuring objectively. Hence, this provided an insight to develop a simple and basic self reported tool to assess the musical ability of an individual.

Individual with high level of musical achievement also reported to have high level of musical ability. But it is not necessary that individual who have a low level of musical achievement will also have low level of musical ability. Every individual is born with the innate ability of musical ability, the level of musical ability changes in accordance with the quality of music environment (Blacking, 1973). However, measuring the music perception ability in such individuals who are non musicians but exhibit the musical brain is difficult to categorize and identify their musical capabilities. Hence, a measure in a simpler form is required to categorize an individual as with and without musical ability.

### **Aim**

To development, standardize and validate a 'Questionnaire on Music Perception Ability'.

### **Objectives**

To construct, a cut-off score for grouping the participants as those with and without musical abilities. To compare the responses for different questions between the part I and II based on the grouping of the participants. To check if there are any correlation between responses for the questions in part I with that of the questions in part II.

### **Method**

A 'Questionnaire on Music Perception Ability' was developed to classify the individuals as with and without musical abilities (APPENDIX A). This questionnaire includes two parts. Part I: consists of a set of question (demographic data) regarding their age, education, ethnicity, any kind of musical training (vocal, instrument or dance) undergone, musical listening habits, singing ability or ability to play instrument, interest in music (self or parents or siblings), interest

to enjoy and appreciate music. Part II: consists of a self assessment questionnaire related to different parameter of music like pitch awareness, pitch discrimination, timbre identification, and melody recognition and rhythm perception. The items in the questionnaire were prepared by including the suggestions from trained Carnatic musicians (completed senior grade in Carnatic music) and non musicians. Also, some of the musical ability skills and terminologies were reviewed from the existing test for music perception like Music Experience Questionnaire (Werner et al., 2006), Uses of Music Inventory (Chamorro-Premuzic & Furnham, 2007). Then content validity of the developed questionnaire was performed by 20 trained musician and non musician as relevant or non relevant on 5 point rating scale. Those questions which were rated as relevant on 75% criteria were considered to prepare the final questionnaire. Final questionnaire consisted of a total number of 28 questions. The numbers of questions in the questionnaire on each of the sub category are as follows: Pitch awareness (7), pitch discrimination (6), timbre identification (3), melody recognition (6) and rhythm perception (6). The questionnaire was administered on 174 individuals in the age range of 18 - 40 years of age with normal hearing. Purposive sampling procedure was used, in which the participants were selected only if they had not undergone any form of musical training. Those who had even minimal training to music for less than a month were excluded from the study. The tasks of the participants were to answer the questions either as 'Yes' or 'No'. A score of '1' was provided for the answers 'yes' and '0' for the answers 'no'. The raw scores of the collected data were subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS) software version 21 (SPSS Inc. Chicago).

## Results

### *Cluster analysis for obtaining cut-off scores:*

Cluster analysis is a multivariate method which aims to classify a sample of subjects (or objects) on the basis of a set of measured variables into a number of different groups such that similar subjects are placed in the same group (Rosie, 2007). Cluster analysis was applied for the collected data, and cut-off scores were obtained. The participants were categorized into two groups based on the obtained cut-off scores through cluster analysis. Group I with 116 participants was classified as having with musical ability with the cut-off range from 16-28 score (mean: 21.45 SD: 3.95). Group II with 58 participants were classified as having without musical ability with the cut off score ranging from 4-15 (mean: 11.12 SD: 2.6).

### *Comparison and correlation of the responses for different questions in part I and II between the two grouped participants:*

Comparison of the responses for different questions in part I and part II between the two groups classified based on cluster analysis was done to check if there are any significant different between two groups. Table 1 reveals the mean, median and standard deviation of the quantitative

questions in part I and the responses for the questions in part II of the administered questionnaire.

Table 1:

The mean, median and standard deviation of questions in Part I and II of the 'Questionnaire on Music Perception Ability'

Questions		Groups					
		I			II		
		Mean	Median	SD	Mean	Median	SD
Part I	Started listening to music	2.99	1.349	3.00	3.04	1.477	3.00
	No. of hr/day listening to music	2.72	1.052	2.00	2.25	1.049	2.00
Part II	Pitch awareness	5.53	1.270	6.00	3.35	1.356	3.00
	Pitch discrimination	4.50	1.047	5.00	2.39	0.921	2.00
	Timbre identification	2.13	0.933	2.00	0.63	.816	0.00
	Melody recognition	4.72	1.144	5.00	2.51	1.167	3.00
	Rhythm perception	4.40	1.320	5.00	2.23	0.964	2.00

Non-parametric tests were done further to check if there is significant difference between two groups of participants.

Table 2:

Results of Mann-Whitney  $U$  test for the scores of questions in Part I and II between Group I and Group II

Questions		Z	p values
Part I	Started listening to music	-0.015	0.988
	No. of hr/day listening to music	-2.908	0.004
Part II	Pitch awareness	-8.092	0.000
	Pitch discrimination	-9.306	0.000
	Timbre identification	-8.010	0.000
	Melody recognition	-8.881	0.000
	Rhythm perception	-8.493	0.000

The results of Mann-Whitney test in Table 2 reveal that there was no significant difference for the scores of the questions that the age at which they started listening to music. Whereas the number of hours/day of listening to music and the other questions related to pitch awareness, pitch discrimination, timbre identification, melody recognition, rhythm perception and the total scores of the questions in part II are significantly different between the two groups which were grouped based on the cluster analysis. Also, the Pearson correlation was done separately for both the grouping of participants for two questions in part I with that of the overall scores for the questions related to various aspects of music in part II. The questions are 1) Age at which they started listening to music, 2) Number of hours per day of listening to music. The results of the Pearson correlation reveal that there was no significant correlation for the age at which they started listening to music  $r(116) = -.092, p > 0.05$ , and  $r(57) = -.238, p > 0.05$  for those individuals with and without musical abilities respectively. Whereas positive significant correlation was obtained for the question related to the number of hours per day of listening to music  $r(116) = 0.395, p < 0.001$  for those with musical abilities and no significant correlation  $r(57) = 0.192, p > 0.05$  for those individuals without musical abilities.

Further chi-square test was done for three questions in part I which was qualitatively measured. Fisher's exact test was done to analyse the association between the groups formed and the response to the three questions 1) Do you enjoy and appreciate music 2) Do you enjoy dancing? 3) Do any of your family members have learnt music in any form? The results revealed that there was significant difference between the two groups of participants at  $p < 0.05$  between the formed groups. The table 3 shows the crosstab across the two grouped participants with their responses in terms of percentage.

Table 3:

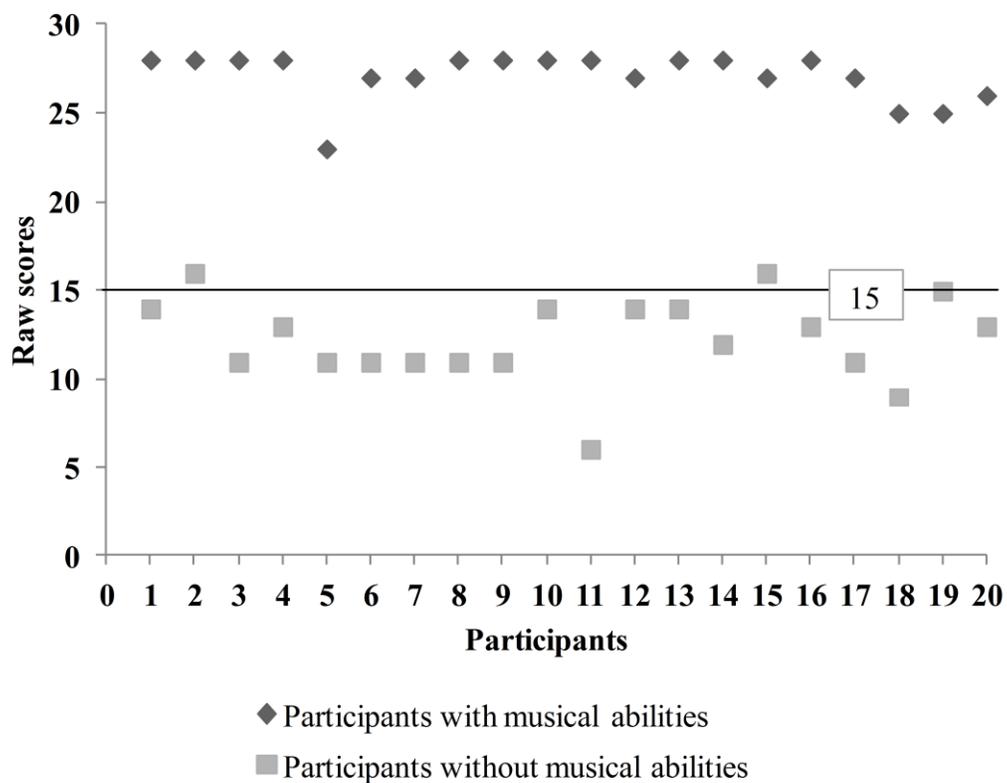
Crosstab report of the responses for three questions in Part I

Grouped participants	Enjoy & appreciate music		Enjoy dance		Family members have learnt music	
	Yes	No	Yes	No	Yes	No
Participants with musical abilities	106 (90.6%)	11 (9.4%)	79 (67.5%)	38 (32.5%)	53 (45.3%)	64 (54.7%)
Participants without musical abilities	43 (75.4%)	14 (24.6%)	20 (35.1%)	37 (64.9%)	6 (10.5%)	51 (89.5%)

The result of the table reveals that there was significant correlation in terms of the responses obtained in terms of percentage of the scores and the participants that were grouped based on the cluster analysis cut-off. Further in order to validate the obtained clusters, questionnaire was re-administered on 20 trained professional musicians and 20 individuals who

had not undergone any musical training and not much interested in music. The scores that were obtained were within the cut-off that was obtained from the cluster analysis. All trained musicians got scores higher than 17 consistent with the classification of Group 1 and all the participants who had not undergone any musical training with least interest towards music got the scores lesser than 16, which is also consistent with the classification of Group II. The Figure 1 represents the distribution of the two new groups of participants along with their criterion line.

Figure 1. The distribution of the two new group of participants along with the criterion line.



The results revealed that the developed ‘Questionnaire on Music Perception Ability’ was highly valid. Thus this reveals that the sensitivity of the questionnaire was 100% to identify those participants as with musical abilities and 90% as without musical abilities.

**Discussion**

Music perception and performance are comprehensive cognitive functions and thus provide an excellent model system for studying human behavior and brain function. The results

of the responses for the questions in part I are well correlated with that of the questions in part II. This reveals that though the individual has not undergone any form of formal musical training might have ability for musical perception which could have its contribution from innateness or the environmental influences. A person with just a musical ability may also be able to understand and perceive differences in pitch, rhythm, intensity, timbre, harmonies and/or the structures of music. This developed questionnaire is a reliable and valid which could reveal musical abilities of the participant who are not trained musicians. This questionnaire can also be used to as an aptitude test for music and may be used to predict the success obtained with musical training. Furthermore, this questionnaire can also be used to select homogeneous participants in research involving auditory processing as most of the auditory capabilities are influenced by musical training.

### **Conclusion**

The musicians are reported to have higher functional abilities in various forms like, language, speech, memory, speech in noise and other cognitive activities (Lee & Hung, 2008). However such superior functional abilities are also reported in non musicians, the underlying cause could be the unrevealed musical ability. Hence, this study was an attempt to exploit the musical abilities of individuals who are non musicians. A questionnaire was developed and validated which could provide information on the musical ability of an individual. This questionnaire can be used as simple, primary and basic tool which could used to assess the musical ability of a person.

### **References**

1. Bentley, A. (1966). *Musical ability in children and its measurement*. London, England: Harrap.
2. Blacking, J. (1973). *How musical is man? (The John Danz Lectures)*. Seattle and London: University of Washington Press, WA.
3. Boyle, J.D. and Radocy, R. E. (1987). *Measurement and evaluation of musical experiences*. New York: Schirmer Books.
4. Chamorro-Premuzic, T. and Furnham, A. (2007). Personality and music: Can traits explain how people use music in everyday life? *British Journal of Psychology*, 98, 175-185.
5. Daniel, M., Gingras, B., Musil, J. and Stewart, L. (2014). The Musicality of Non-Musicians: An Index for Assessing Musical Sophistication in the general population, *PLoS One*, 9, e89642.
6. Engineer, N. D., Percaccio, C.R., Pandya, P.K., Moucha, R., Rathbun, D.L. and Kilgard, M. P. (2004). Environmental enrichment improves response strength, threshold, selectivity, and latency of auditory cortex neurons. *Journal of Neurophysiology*, 92, 73-82.

7. Gagne, F. (2004). Transforming gifts into talents: The DMGT as a developmental theory. *High Ability Studies*, 15, 2, 119-147.
8. Gordon, E. E. (1989). *Manual for the advanced measures of music audition*. Chicago, IL : G.I.A. Publications, Inc.
9. James, M. (1947). The assessment of musical ability. *British Journal of Educational Psychology*. 17(2), pp 83–96.
10. Kagan, J. and Zentner, M. (1996). Early childhood predictors of adult psychopathology. *Harvard Review of Psychiatry*, 3, 341-350.
11. Law, L. and Zentner, M. (2012). Assessing musical abilities objectively: Construction and validation of the Profile of Music Perception Skills. *PLoS ONE* 7, e52508.
12. Lee, C.Y. and Hung, T.H. (2008) Identification of Mandarin tones by English-speaking musicians and non-musicians. *Journal of Acoustic Society of America*, 124: 3235–3248.
13. Lily N. C. Law and Marcel, Z (2012). Assessing Musical Abilities Objectively: Construction and Validation of the Profile of Music Perception Skills. *PLoS One*, 7(12): e52508.
14. Mullensiefen, D., Gingras, B., Stewart, L. and Musil, J. (2014). *The Goldsmiths Musical Sophistication Index (Gold-MSI): Technical Report and Documentation v1.0*. London: Goldsmiths, University of London.
15. Rosie, C. (2007) “Statistics: 3.1 Cluster Analysis.” Mathematics Learning Support Centre. Retrieved from <http://www.statstutor.ac.uk/resources/uploaded/clusteranalysis.pdf>.
16. Seashore, C., Lewis, D. and Saetveit, J.G., (1960). *A second revision of the manual of instructions and interpretations for the Seashore Measures of Musical Talents (1939 revision)*. New York, NY: The Psychological Corporation.
17. Vrijnsen, F. W. (2010). *Brain and Cognitive Differences between Musicians and Non-musicians*, Bachelor thesis, Cognitive Neuroscience. Retrieved from <http://arno.uvt.nl/show.cgi?fid=114170>.
18. Wallentin, M., Nielsen, A.H., Friis-Olivarius, M., Vuust, C. and Vuust, P. (2010). The Musical Ear Test, a new reliable test for measuring musical competence. *Learn and Individual Differences*, 20, 188–196.
19. Werner, P. D., Swope, A. J. and Heide, E.J. (2006). The music experience questionnaire: Development and correlates. *The Journal of psychology*, 140, 329-345.
20. Wing, H.D. (1962). *Wing standardized tests of musical intelligence*. Windsor: National Foundation for Educational Research.

**APPENDIX A**  
**PART I**

Demographic data:

1. Name-
2. Age/gender-
3. Age when you started listening to music -----
4. Number of hours per day of listening to music:-----
5. Do you enjoy and appreciate music?
6. Do you enjoy dancing?
7. Do any of your family members have learnt music in any form?

Others:

1. Family income
  - a. <1000/month
  - b. 1001 – 5000/ month
  - c. 5001- 10,000/month
  - d. >10,000/month
2. Religion and caste
3. Mother tongue
4. Address with phone number:

**PART II**

Note: The below questionnaire has questions related to different parameter of music like pitch awareness, pitch discrimination & identification, timber identification, melody recognition and rhythm perception. The responses are to be elicited in the form of ‘Yes’ or ‘No’.

Pitch awareness:

1. Is your vocal (Voice) range for speech and song the same?
2. Are songs sung in different pitches (shruthi/swarada matta)?
3. Are you aware that different songs have different ragas (tune/variation in swaras) and talas (beats)?
4. Do you feel that different singers sing in different pitches?
5. When we sing sa, ri, ga, ma, pa, ta, ni, sa, is there any change in pitch?
6. Have you heard of scales (swara shreni) in music?
7. Are you aware of saptaswaras or seven notes in music?

Pitch discrimination and identification:

1. Can you discriminate the songs sung by male voice verses female voice?

2. Can you distinguish between high and low pitch (shruthi yalli vyathyasa) when you hear music?
3. Can you exactly find the note/scale (swara) of the music that is played?
4. Can you differentiate the 'frequency modulations' (swara da erilitha) within the notes?
5. Can you differentiate as to whether the singer is still in pitch or has gone out of pitch?
6. Can you differentiate between singers from the song?

Timbre identification:

1. Can you identify the musical instrument (sangeetha vadya) played from a music that you hear?
2. If more than 3 musical instruments are played, can you identify and name all three instruments that are played?
3. When more than one instrument is played and one is out of pitch, can you make out the difference?

Melody recognition:

1. Can you exactly hum the song as you hear? (eg- hnm mmm hmn hn...)
2. Can you identify if there is a change in raga (tune) or modulation with emotion (bhava)?
3. Can you recognize different genres of music, like Carnatic, Hindustani, Western, jazz, Rap etc?
4. Do certain parts of a song remind you of another song?
5. Can you recognize the song when someone hums it?
6. Can you identify the melodies of different emotions (raagada bhavane)?

Rhythm perception:

1. Can you differentiate if the music is slow/relaxing or fast/exciting?
2. Can you exactly count the number of beats (tala) in the song you hear?
3. Can you tap your feet / hand in the same rhythm along with the song's beats?
4. Do you agree that music is unconsciously associated with movements made by our bodies while talking, walking, running, dancing, etc?
5. Can you make out if there is a change in beats within a song? ( taladalli vyathyasa)
6. Can you recognize if someone is singing out of rhythm (tala baddathe)?