

INFLUENCE OF MUSIC EDUCATION ON THE GROUPING OF THE ABA-ABA SEQUENCE SOUNDS IN THE GALLOP RHYTHM

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This article presents the influence of music education on the grouping of sounds into perception streams with the use of the sounds ABA-ABA, which make up the pattern of the “gallop rhythm.” The experiment carried out in both groups confirms that musicians utilize specific skills for an auditory assessment of the sound, which allows them to perceive the “gallop rhythm,” whereas people of no music education cannot follow the “gallop rhythm,” which is present in the samples of the ABA-ABA pattern, in their perception field.

Psychoacoustic analyses are mostly based on the physical assessment of the organ of hearing, ignoring the issue of music education, which may have a significant impact on the interpretation of the results in the group of people mentioned above. It is of particular importance for the performed experiment to note if the respondents have music education, as such information may bring us closer to determining why people with the same physiological hearing condition differ in the way of processing sounds into perception streams.

1.1. JOINING SOUNDS IN TONAL STRUCTURES

Grouping is a process with the main concept involving seeking ranges of auditory scenes, joined with respect to a similar type of integrity (e.g. similarity of colour or pitch). Sounds can be grouped in either of two ways: in sequential grouping, which concerns the melody of a music piece, or in simultaneous grouping, which is responsible for the perception of harmony, if similarities or regularities that favour sound integration are found in both cases [1].

When hearing a piece of music, a listener creates an image in their memory, which corresponds to sounds, regardless of whether the piece was a coherent entity or comprised of multiple different parts. Creating a projection based on the music foundation in one’s mind indicates that both the perceptive image of the whole and of individual parts corresponds to a given piece of music. A piece with a hierarchical structure is created when a sound event consisting of parts is perceived as a whole. A descriptive-formative system must be referred to [2] as an aid in confirming that a (melodic or harmonic) sequence of sounds was performed as a specific perceptive object, i.e. it achieved the mental importance.

1.2. THE ASSUMPTIONS AND OBJECTIVE OF THE EXPERIMENT

The objective of the experiment was to identify the relationship between grouping in perceptive streams and the pitch scale within which the sounds played in the ABA-ABA sequence were distributed. The author’s main assumption in the study was to use sound sequences described in the literature and to compare the results obtained in the two groups under study – musicians and non-musicians. The principal intention of the analysis was to enable referring the experiment results directly to literature data. The study participants were presented with sequences of sound samples of the ABA-ABA pattern, which

was usually used in the published studies [3]. Variables included the tempo increasing linearly as a function of the duration of playing the sequence and differences in the pitch scale in which the samples were played.

1.3. THE SOUND MATERIAL

Repeated sequences consisting of three sounds at the perfect fifth interval. This interval was played in the great, one-line and three-line octaves. The sound frequencies were established in evenly tempered tune.

- in the great octave: (Tone: A) D = 73.416 Hz, (Tone: B) A = 110.000 Hz, (Tone: A) D = 73.416 Hz,
- in the one-line octave: (Tone: A) d1 = 293.666 Hz, (Tone: B) a1 = 440.000 Hz, (Tone: A) d1 = 293.666 Hz,

- in the three-line octave: (Tone: A) d3 = 1174.700 Hz, (Tone: B) a3 = 1760.000 Hz, (Tone: A) d3 = 1174.700 Hz.

The sounds were played in the following sequence: low pitched sound, high pitched sound, low pitched sound in each series. The time between the beginning of a sound and the beginning of the neighbouring one was taken as the basic time unit in measurements. One sound series in this experiment consisted of three sounds repeated alternately. The sound samples were played in the ABA-ABA pattern, where the dash denotes silence whose duration is equal to the sound duration, as in the experiment conducted by Leo van Noorden [3].

The duration of each sound was computer-controlled and ranged from 400 to 40 ms [4]. In order to avoid crackles when listening to the material, 10 ms of linear sound loudness increase and decrease was added in the sound envelope. The temporal sequence of the sounds was regulated and analysed by the computer program on the WPF .NET platform. The sound series was played 187 times at the most, which gives 561 sounds played in one presentation. The test was repeated three times with each participant in order to eliminate compression artefacts, which could appear in the respondents' responses. The agreed loudness level was approx. 70 phons. The respondents participating in the pilot study did not take part in the test proper [5]. All of the sound samples were generated in the mono system at the sampling frequency of 44.1 kHz, in 16-bit resolution.

1.4. LISTENERS AND LISTENING SESSIONS

Forty-eight people aged 21 to 27 years took part in the study, including 24 students of or graduates from the Academy of Music in Gdańsk and 24 students or graduates from the Academy of Fine Arts in Gdańsk. The group comprised 40 females and 8 males. The participants in both the groups were chosen at random and they had never taken part in such experiments before.

- Details of the musicians group: the participants had begun their musical training between the age of 5 and 10 years and they had completed the 1st and 2nd degree music school; they had practiced playing a musical instrument without a break for the past 13-22 years. The participants: did not have perfect pitch, played classical music, were all right-handed.
- Details of visual artists group (I): the participants did not learn to play any instrument or sing, nor did they play any music in an amateur environment, they usually listened to popular music in the broad sense of the term, they were all right-handed.
- More details of visual artists group (II): five participants played popular music; the participants had learned to play keyboard, piano, transverse flute and electric guitar at music centres for a period of 4 to 7 years; some of them also learned to sing at culture centres; the participants referred to above were currently playing popular music in amateur music bands affiliated with different culture institutions, with similarity of musical training, e.g. at culture centres, youth centres and music centres; they were all right-handed.

A demonstration series of sounds described in the study by Bregman [6] was played at the beginning of the session in order to familiarise the participants with the phenomenon of joining sounds into one perceptive stream and to explain the task in the experiment.

1.5. RESULTS

The test revealed that participants with no musical training did not perceive the galloping rhythm formed as a result of internal grouping processes when samples in the ABA-ABA pattern were played. Some non-musicians reported the temporary appearance of a galloping rhythm, but the impression did not persist at a growing sequence playing rate. The published findings [9] show that the galloping rhythm is usually perceived as increasingly fast with an increasing playing rate, whereas the non-musician participants with no musical experience reported that the rhythm became “blurred” and that they did not hear the galloping sequence but rather separate low-pitched and high-pitched sounds. Introducing to the experiment an extra factor (a super-imposed internal figure), which was formed as a result of interpretation by the auditory system of the galloping rhythm, revealed during the listening of the ABA-ABA pattern, poses a great problem to participants with no musical training, regardless of the pitch scale in which the sound samples were played. An analysis of the initial test results took into account the fact that sound diminution is accompanied by spectrum blurring, which is defined as a spectrum of a short tone or a multi-tone acquiring the features of a continuous spectrum, typical of noise. Identification of high-pitched tones becomes much less precise with a blurred spectrum than with longer sounds [7].

Interesting results were obtained in the group of 5 non-musicians, who had learned to play musical instruments as amateurs and performed in amateur popular music bands. The responses from this group indicated that the galloping rhythm was recognised and kept within the perception field at quick rates and at different pitch scales. This information can be regarded only as auxiliary because the group was too small to formulate reliable conclusions concerning generation of perceptive streams which are responsible for formation of the galloping rhythm.

These experiments confirmed that extended musical practice improves the listeners’ competence, and the effects of such training can be confirmed with psychoacoustic tests, provided the training lasted at least 4 years [8].

People with musical training recognised the galloping rhythm in the ABA-ABA sequences at different rates and in different pitch scales, which was consistent with the study assumptions. There was no spectrum blur in this case [7], because long-term, consistent musical training allowed for much more accurate perceptive analysis of the tones played in the test. A comparison of predispositions in participants with and without musical training shows that the former notice many more details even when the differences between the sounds are very small.

1.6. PROSPECTS FOR FURTHER DEVELOPMENT – CONCLUSIONS

Lack of information on whether the participants of the experiments described in the literature had any musical training is an important factor which makes comparison of the results difficult. Shortage of data probably resulted from the fact that the participants’ musical training was not taken into account and most of them probably were not musicians. However, it is noteworthy that the majority of these analyses were performed in North America and in The Netherlands. Although they may not have any specialist musical training, the American, Canadian and Dutch listeners probably had more musical competence and a better sense of rhythm than Polish non-musicians. The majority of young people in Poland cannot read notes or play an instrument as amateurs. The musical training syllabus in general education schools is often much better developed than in Poland. Having completed the equivalent of a Polish secondary school of general education, people with no musical training can often play a selected instrument as amateurs, read notes and know the basics of solfege. The term “person with no musical

training” acquires a completely new meaning depending on the syllabus in different countries and it means that the level of musical competences varies.

An analysis of the specialist literature cited above shows that routine audiometric tests (checking whether the respondents’ hearing is within the otological norm) are insufficient, because they should be expanded to include qualification criteria, i.e. musical training should be made an ordering factor. The fact that musical training and practice should affect cognitive processes in sound perception should be taken into account in recruiting participants for psychoacoustic studies because identical experiments performed in different groups produce completely different responses [9]. Musical training often has a significant impact on the experiment results and note should be taken of this information as it was not taken into account in planning psychoacoustic experiments.

The results of these analyses show clearly that long-term musical training brings tangible benefits, which means that people with musical training can draw on their knowledge even unconsciously and in tasks unrelated directly to music. Sound interpretation and processing in one’s mind – when sounds come from the external environment – shows that sound receptions by musicians has different characteristics. Grouping and segregation of sounds in the minds of people with musical training differs, as they pay attention to their diverse features, which is not the case in people with no musical training. This study shows that common musical training can bring interesting results, which can be helpful in areas unrelated directly to music, such as learning foreign languages as mentioned above.

1.7. REFERENCES

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