Ability of reproduction rhythm and sustain it in dancers

Schopnost tanečníků reprodukovat rytmus a udržet ho

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Abstract

The aim of the study was with using peer review to determine how the active dancers can reproduce the rhythm and also to maintain this rhythm. The average age of tested people is 21,53 years ± 6,8. As motion – dance act of reproduction rhythm we chose simple locomototion, which is an essential element in dance and walk. Group of 102 dancers was tested on 4 different rates of the rhythm, so in order to determine their ability to reproduce the rhythm from slow to fast rhythms. We chose the rates 80 BPM, 100 BPM, 120 BPM and 140 BPM (Beat Per Minute). The evaluation was carried out by the method of expert assessment on the basis of scale. Testing was carried out by a qualified person with more than 20 years of experiences in the dance field. From the obtained data we found that the slower rate is for the person to be tested more difficult to reproduce it and keep up the rate. On the contrary, the faster rate is for the person being tested easier to reproduce and maintain the rate – Spearmann´s correlation coefficient of sequence is statistically significant, p-value < 2.2e–16. For evaluation of the faster rate of the rhythm we can explain this result, that reproduced rate is so fast that it may goes to some error in expert assessment. We demonstrated that this testing can be performed in any sport that puts high requirements on rhythm and rhythmic skills.

Abstrakt

Cílem našeho měření bylo pomocí odborného posuzování zjistit, jak testované osoby, aktivní tanečníci, dokáží reprodukovat rytmus a zároveň tento rytmus udržet. Průměrný věk testovaných osob je 21,53 let, směrodatná odchylka je 6,80 let. Jako pohybový – taneční akt reprodukci rytmu jsme si zvolili jednoduchý lokomoční pohyb, který je základním prvkem v tanci – chůze. Soubor 102 tanečníků byl testován na 4 různá tempa rytmu, tak abychom zjistili jejich schopnost reprodukovat rytmus od pomalých až po rychlé rytmy. Zvolili jsme si tempa 80 BPM, 100 BPM, 120 BPM a 140 BPM (beat per minute). Hodnocení bylo prováděno metodou odborného posuzování, na základě škálování. Testování prováděla kvalifikovaná osoba s více jak 20letou praxí v tanečním oboru. Ze získaných dat jsme zjistili, že pomalejší tempo je pro testované osoby náročnější na jeho reprodukci a udržení tempa. Naopak, rychlejší tempo je pro testované osoby jednodušší na reprodukci a udržení tempa – Spearmanův koeficient pořadové korelace je statisticky významný p-value < 2.2e–16. U hodnocení rychlejšího tempa rytmu můžeme tento výsledek vysvětlit tak, že reprodukované tempo je natolik rychlé, že může docházet i k určité chybě při odborném posuzování. Prokázali jsme, že toto testování lze provádět v každém sportovním odvětví, které klade vysoké nároky na rytmus a rytmické schopnosti.

Keywords

Expert assessment, rhytmic skills, rhythm, BPM

Klíčová slova

Odborné posuzování, rytmické dovednosti, rytmus, BPM

Introduction

The aim of our research was to determine the use of expert assessment of the ability of people tested, reproduce rhythm to the sound stimulus, on different speeds pace. Most people think they know what rhythm in music is. Similarly, of course, people often talk about rhythm in movement activities, such as dancing, gymnastics, skating, aerobics and other sport disciplines where movement is performed to music, and the rhythmic elements are evident. (Parry J., 2012) Dance in its many forms will exist as long as man moves and imagines. It is an experience through which mobile expression is given to what might otherwise remain inert. It gives structure to sensation and invests form with feeling. Dance can be one more way of enabling a human being to command his powers more fully. It is a civilizing force. (Hypes J. 1978)

"Music unfolds only in time" (Thaut, 2005). As such, time is extremely important for all musical activities. To better understand how time impacts movement activities, it is essential to understand the concept of rhythm and how it relates to brain functions. (Wiens, K. F., 2015). The basis of all rhythm is the pulse (Krumhansl, 2000). From pulse we move to beat. Pulse and beat are sometimes considered the same, but Thaut (2005) indicates that these are two separate events. "Beat events are perceived in relation to the steady, immutable pulse, leading, for instance, to perceptions of rushing or driving in contrast to dragging or slowing" (Thaut, 2005). The speed of these beats is determined by the tempo. Tempo can vary in speeds throughout selections of music. In Western music, meter is used to organize rhythms. "While rhythm can be characterized as the varying pattern of durations that is physically present in the music, meter involves our perception and, more importantly, anticipation and prediction of such rhythmic patterns. (Honing, 2012).

Rhythm as a core element of complex coordination is the key to efficiently acquiring motor skills specific to sports activities in curricula. Therefore, practicing physical training in primary education allows children to increase their physical training and their motor skills. (Gradinaru S., 2015) Where Does Rhythm Occur In The Brain? Pulse, beat, tempo, and meter are all functions of rhythm. How does the brain process rhythm? "Temporal grouping processes (i.e. rhythmic processes) commonly occur in the left hemisphere" in the brain (Edwards, 2008, p. 30). In addition, "rhythms appear to have effects on three psychological levels: cognitive, motoric and affective" (Krumhansl, 2000, p. 164). The ability to feel one's way into songs, dances, marches, or symphonies, swing along with them and, as it were, ›join in‹ on their movement, is a basic experience of every musician and every listener. Once we have ›gotten‹ the beat, we get a feeling of security enabling us to experience the varied event of a piece of music with pleasure. To sense the beat means for many to ›know‹ the rhythm. (Petersen, P., 2013)

Much research has been conducted on how the brain responds to rhythm. Several of these studies involve tapping activities. One such study was conducted by Chen, Penhune and Zatorre (2008) where they had subjects listen to and then imitate three different rhythm patterns. Their subjects were divided into two categories, musician and nonmusicians. (Wiens, K. F. 2015) Dance teachers are fond of saying, "if you can walk, you can dance." We would go one step further and suggest that if you can breathe, you can move, and if you can move, so too, you can dance. Dance is, after all, our moving imagination. It is the kinaesthetic manifestation of expression or as modem dance pioneer, Martha Graham famously exclaimed, "Dance is the hidden language of the soul." (Alexander, N., & LeBaron, M., 2012). If we were to insist that everything is rhythm (or is rhythmical), we would lose a distinction that is very important for appraisals of sport and dance, in which we often want to single out some performances from others for praise, as being rhythmical. (Parry J., 2012)

Methodology

The aim of our study was with using expert observation determine the ability of people being tested, reproduction rhythm. The research sample consisted of 102 people being tested, active dancers who devote to dance in the range from 0,5 year to 40 years.

The average age of tested people is 21,53 years ± 6,8. As motion – dance act of reproduction rhythm we chose simple locomototion – walk.

Test protocol

First we determined the range of assessment reproduction rhythm, where the lowest rating of 1 (very non-rhytmic) means, that the tested person is not able to keep the rhythm, i.e. the person not hear the rhyhm. The steps are carried out of the rhythm of the playback music, the tested person has a problem with to start to walk to the beat. Conversely, the highest rating of 5 (very rhythmic) means, that the tested person has maintained a regular rhythm, the steps are performed to the beat of the playback music, walking is relaxed and confident (table 1). Furthermore we have chosen 4 different pace reported in BPM (beat pear minute), in our case it was 80 – 100 – 120 – 140 BPM. The musical accompaniment formed a audio recording metronome at the rate of BPM. Befor starting the test, the tested people were acquainted with the course of testing, it was explained to them and illistratively shows an exemplary course of the testing. The test track has been always long up to 15 metres. Each person could launch a test at any time after the start of the audio recording of the rhythm. The test is always the slower pace after a higher tempo. Position of expert reviewer was approximately in the middle of the test track, facing it, with a distance of at least 3 metres (fig. 1).

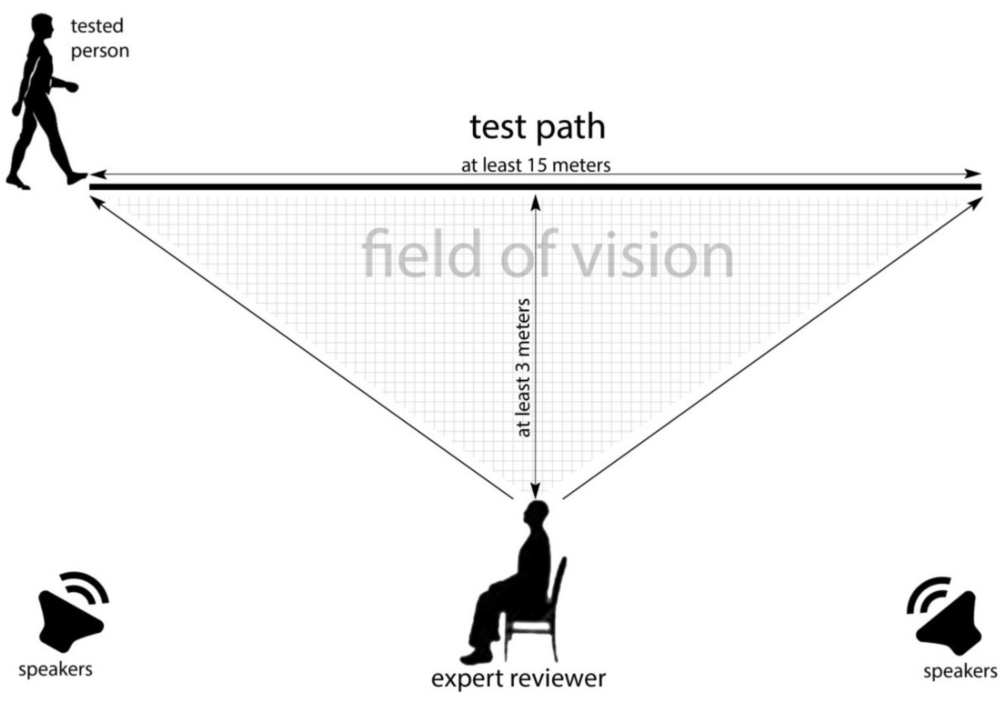


Fig. 1 – research group – the test track, sample of distribution of the persons involved in testing

The tested person prepared at the beginning of the test track, then started an audio recording of the rhythm at a given pace. The tested person has started a test with starting the walk. Expert reviewer watching each foot of the steps of the tested person on the ground and assess deviations from linear audio recording metronome and the step. Using expert assessment the reviewer classified the tested person by a predetermined range, which has 5 possible marks and this mark he recorded in to the predetermined poised table. (Tab. 2).

Tab. 1 – scale reproduction rhythm

1	very nonrhythmic	unable hold rhythm, ie. not hear rhythm – music, walk is out of the rhythm music, problem is with begin walk on rhythm
2	less rhythmic	at the start of holding the rhythm, but gradually falls from it out, effort rhythmic walking, but out of rhythm
3	rhythmic	keeps regular rhythm walk, but goes out of music, effort to maintain the rhythm, high effort
4	good rhythmic	holds regular rhythm, walking is not too sure, we can watch the light level of concentration
5	very rhythmic	keeps regular rhythm, walk into the rhythm – into music, walking is relaxed and confident

Tab. 2 – record of results reproduction rhythm – a sample of 20 people tested

	age	**sex**	**Period of sports (years)**	**walk 80 BPM**	**walk 100 BPM**	**walk 120 BPM**	**walk 140 BPM**	**total**	**diameter**
1	60	male	40	5	5	4	5	19	4,75
2	30	female	13	5	5	5	4	19	4,75
3	43	male	0,5	5	5	2	4	16	4
4	26	male	21	5	5	5	5	20	5
5	16	female	9	3	4	5	4	16	4
6	16	female	7	3	2	5	3	13	3,25
7	17	female	13	2	4	5	5	16	4
8	18	female	6	1	1	4	5	11	2,75
9	56	female	38	5	5	5	5	20	5
10	16	female	3	5	5	5	5	20	5
11	21	female	5	3	3	5	5	16	4
12	15	female	6	4	4	5	3	16	4
13	18	female	7	1	2	4	3	10	2,5
14	21	female	6	5	5	5	5	20	5
15	19	female	5	5	5	5	4	19	4,75
16	22	female	10	5	5	5	4	19	4,75
17	19	female	4	5	5	5	5	20	5
18	20	female	4	5	5	5	5	20	5
19	16	female	6	2	5	4	1	12	3
20	16	female	6	1	2	5	5	13	3,25

Results

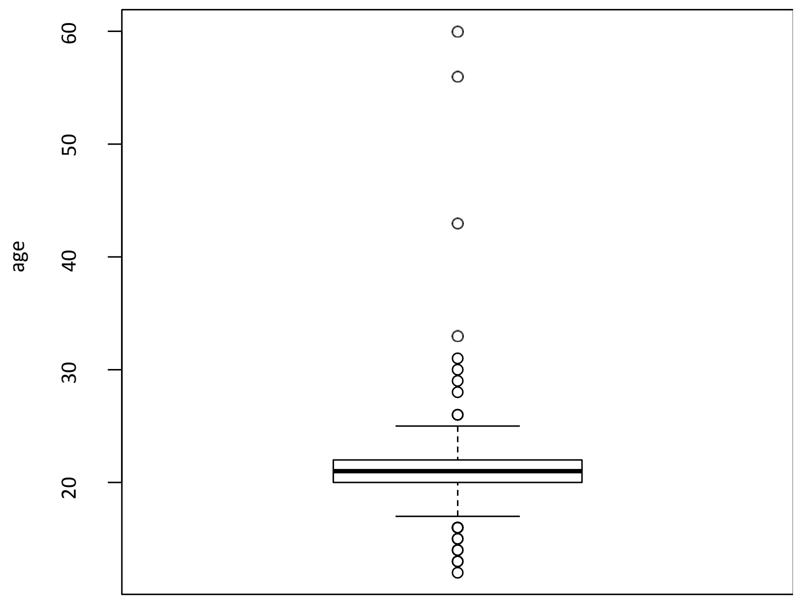
Our measurements showed that the age of tested persons does not affect the reproductive rhythm. The oldest tested person was 60 years old and the youngest 12 years old, the average age was 21.53 years old dancers ± 6.80 years (Tab. 3). Scattering ages was 46.29 years. The lower quartile is equal to the 25th percentile of the data which separates the smallest 25 % of the data from the highest 75 % and is equal to 20.00 years. The median is equal to the 50th percentile data, divides the sorted data in half and forms 20.00 years. The upper quartile is equal to the 75th percentile of the data which separates the smallest 75 % of the data from the highest 25 % in our case is 22.00 years. It is also important to mention that, according to Figure 1, there were not all ages equally represented, frequency ages had a great variance 46.29 years, but for our measurements was this not significant. In a total was tested 102 people, including 19 men and 83 women (Tab. 4). From a sample of measured data (Tab. 2) we can show the record of an individual evaluation of tested persons.

The structure of the research sample (Fig. 1) determine the distribution of people and the necessary tools that we ensure maximum objectivity of expertise. Measurements were divided into four separate parts, which varied according to the speed of the tempo. Testing was conducted in diverse groups, each composed of different ages, gender and duration of sport – dancing. From the measurements walk at 80 BPM, we found that the results are very different in scope and evaluation is large (Figure 3). Conversely, at higher beats variance evaluation decreased and at a tempo of 140 BPM achieve better results in the tested persons. These results can justify such that the frequency of the steps is so fast, that it could be some error from a specialist assessor.

Tab. 3 – Age

	years
Maximum	60.00
The upper quartile	22.00
Median	21.00
Diameter	21.53
The lower quartile	20.00
Minimum	12.00
Dispersion	46.29
Standard deviation	6.80
Skewness	3.26
Sharpness	14.89

The most represented group of the tested persons were in the age range from 18 to 25 years (Figure 1). Average age was 21.53 years ± 6.8 years (Tab. 3)



Graph 1 – Graphic representation of the frequency of ages

Tab. 4 – Sex

	Absolute frequency	Relative frequency
Man	19.00	0.19
Woman	83.00	0.81

Tab 5. – Correlation walk with the time sport

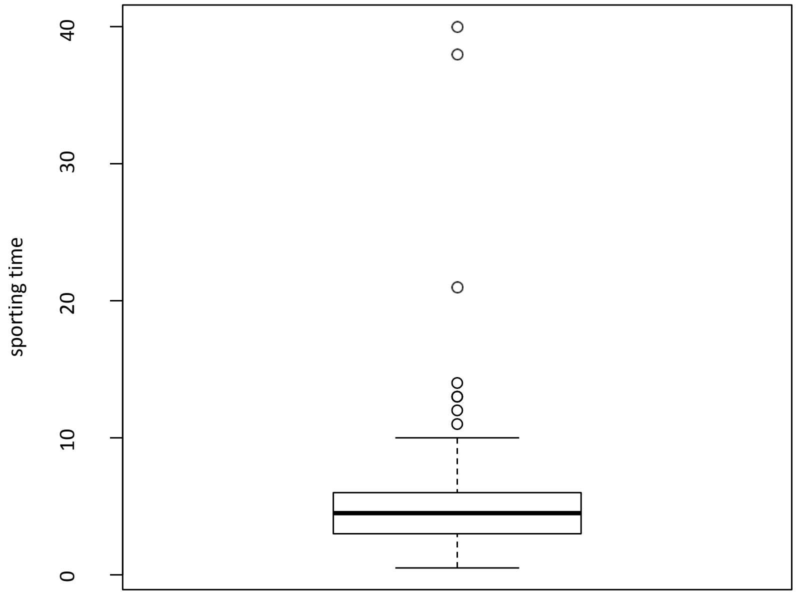
Walk	Spearman´s rank correlation rho
80 BPM	S = 3462622, p-value = 1.042e-06 rho 0.2749021
100 BPM	S = 4221625, p-value = 0.04266 rho 0.1159613
120 BPM	S = 3803482, p-value = 0.0003394 rho 0.2035235
140 BPM	S = 4167017, p-value = 0.02585 rho 0.1273967

Calculated Spearman's rank correlation coefficient – for walking 80, 100, 120 and 140 appeared in all cases, a statistically significant positive correlation (we can say that if the tested persons engaged in the dance a longer time, reproduction rhythm is at a higher level). This is a serial correlation where we are not interested in the original values that we measured, but their order. I.e. we arrange the data from lowest to highest value, in our case from 1 to 102. Thanks to we completely lose the remote or extreme values because we give them only the order and normality may not be fulfiled – it is a serial correlation.

Tab. 6 – Sports length

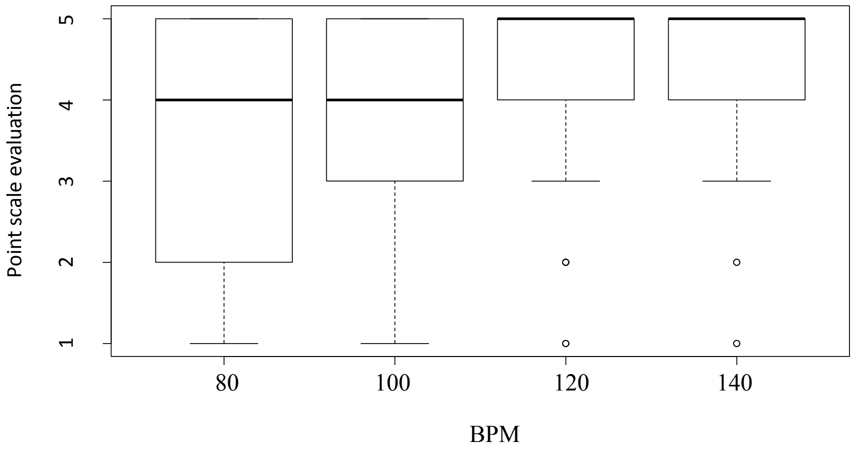
Maximum	40.00
The upper quartile	6.00
Median	4.50
Diameter	5.75
The lower quartile	3.00
Minimum	0.50
Dispersion	34.91
Standard deviation	5.91
Skewness	3.67
Sharpness	17.44

The average length of sports, in our case dancing, is 5.75 years ± 5.91 years (Tab. 6). Results show that the correlation is statistically significant positive (Tab. 5). The highest frequency of sports length is from up 0.5 to 10 years (Graph 2).



Graph 2 – Graphical representation of frequency sports length

Walking is an essential element of locomotion, which is often used in dance. His expression can show us the level of rhythmic dancer skills. It is interesting that walking at a slower rhythms of the test subjects made trouble with keeping rhythm and scattering evaluation according to a predetermined range of 1–5 was great (Graph 3). From statistically processed data, our results showed that the Spearman's rank correlation coefficient came out significantly positively correlated rs = 0.229617651187913 (Tab. 7)



Graph 3 – Graphical representation walk ratings

Tab. 7 – Spearman's rank correlation coefficient – a walking rhythm

Spearman's rank correlation coefficient	rho 0.2296177
Walk and rhythm	S = 235450185, p-value < 2.2e−16 rs = 0.229617651187913

Discussion

When measured at a rate of 80 BPM tempo the results showed us that the most people measured pace does slow reproduction problems keeping the rhythm and the results are very different (Graph 1). Conversely, when the BPM is higher, their reproductive ability and scattering successful evaluation is significantly smaller, increasing the number of highs (Graph 1). Spearman's rank correlation coefficient rho 0.2296177 proved us, that walking and rhythm are significantly correlated. This finding is attributable to such that at higher tempos pulse rate is so high, that there may be some error professional assessor. Walking in higher tempos is so fast that the tested subjects cannot this tempo immediately reproduce when it start.

Conclusion

At present's offer dance courses, groups and schools very varied. You can choose anyone, according to that which they are interested. The specific choice of the so-called. auditioning dance activities, is carried out only in the form of so-called. recruitment – writing, when the candidate is accepted without any claims. Over regular training will sooner or later approve oneself the individual, either as a useful part of a collective formation, or as a member of a group an ordinary. This is due mainly commercial approach dance institutions.

Our research this can negative fact completely changed. If new candidates have tested by our method they can dance groups will more effective the selection of potential candidates and according to the achieved results of our testing thus obtain higher dancers rhythmic abilities.This would shorten the time learning basic rhythmic skills, which would lead to increasing levels of dancers in the group and thus to raising the level of dance creations, then a the better placing on competitions.

Measurement rhythm reproduction is not time consuming, so the measurement can be performed even on larger groups. The result of this measurement may be benefit for the further testing of athletes in aesthetic-coordination sports. This test method can be used in all age groups. From obtained data, we can draw conclusions that will help us build a test method that we evaluates the level of reproduction rhythm and will help us in selecting people not only for dance, but also for sports, which is part of the rhythm of reproduction. They can also be used to build a test battery that will allow us to evaluate the overall rhythmic abilities in athletes of any sport and subsequently the possibility of their of mutual comparison.

Literature

Alexander, N., & LeBaron, M. (2012). Dancing to the Rhythm of the Role-Play, Applying Dance Intelligence to Conflict Resolution. *Hamline Journal Of Public Law & Policy*, 33(2), 327–362.

Edwards, R. D. (2008). *The neurosciences and music education: An online database of brain imaging neuromusical research* (Doctoral Dissertation, University of North Carolina at Greensboro). (UMI 3307191)

Grădinaru, S. (2015). Educating the sense of rhythm in primary education students. *Timisoara Physical Education and Rehabilitation Journal*, 8(15), 32–35.

Hypes, J., & American Alliance for Health, (1978). *Discover Dance: Teaching Modern Dance in Secondary Schools.*

Honing, H. (2012). Without it no music: Beat induction as a fundamental musical trait. *Annals of the New York Academy of Sciences* 1252, 85-91. doi: 10.1111/j.17496632.2011.06402.x

Chen, J. L., Penhune, V. B., & Zatorre, R. J. (2008). Moving on time: Brain network for auditory motor synchronization is modulated by rhythm complexity and musical training. *Journal of Cognitive Neuroscience*, 20(2), 226-239. doi: 10.1162/jocn.2008.20018

Krumhansl, C. L. (2000). Rhythm and pitch in music cognition. *Psychological Bulletin* 126(1), 159–179. doi: 10.1037/10033-2909.126.1.159

Parry, J., & Skála, T. (2012). David Best on rhythm in movement. *Acta Universitatis Carolinae: Kinanthropologica*, 48(2), 102–110.

Petersen, P., & Bernhardt-Kabisch, E. (2013). *Music and Rhythm : Fundamentals, History, Analysis*. Frankfurt am Main, Germany: Peter Lang AG.

Thaut, M. H. (2005). *Rhythm, music, and the brain: Scientific foundations and clinical applications.* New York: Routledge.

Wiens, K. F. (2015). *Music, Movement and the Brain*. Canadian Music Educator / Musicien Educateur Au Canada, 57(1), 34–37.

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