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"Immunology of music"?
A short introduction to cognitive science of musical improvisation[60]

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Abstract

Studies on music in the area of cognitive sciences – quite varied despite their short history – meet with scepticism. The author of this introduction, presenting some spectacular examples of research on musical improvisation, tries to demonstrate that they enrich rather than reduce our understanding of this phenomenon.

Keywords: cognitive science; creativity; interdisciplinarity; musical improvisation; reductionism.

Humankind seems to approach creativity with particular pride. Its role in science, education or management is immeasurable; nevertheless, many of us appear to consider artistic creation, and particularly music, to be its pinnacle. Musical creativity is researched within an ever-widening theoretical and empirical spectrum, including in conjunction with education (Mazzola et al. 2012). In this context, the art of musical improvisation appears to be creativity magnified. It does not merely constitute, in the framework of playing music, an important value added to the musical composition, but, ever so often, the latter is overshadowed by the former (Berkowitz 2010; Benson 2003).

As other forms of human activity, music has also become the subject of analyses and scientific research. Humankind remains child-like in this aspect: after all, children do not merely play with a toy, but they also strive to understand its structure and the way it works, to look inside (often with irreversible results). Nevertheless, a degree of scepticism or even resistance can be detected when it comes to analysing and researching music. It is no coincidence that the saying "talking about music is like dancing about architecture" has gained such popularity and

[60] Special acknowledgments to Jakub R. Matyja whose valuable suggestions I have used in this text.

wide use. Let us not forget, however, that while reflection and speculation have accompanied music for thousands of years, research into biological underpinnings of creativity and musical perception is relatively new. This research is accused of ignoring the "intangible" aspect of the phenomenon or of simple reductionism (Przybysz 2006). The word "neuroaesthetics" receives a cold welcome also in academic circles, in the form of sceptical or ironic comments from lecturers asking "what do neurons and aesthetics have to do with one another?"[61] Well-known composers and musicians likewise declare their aversion to neuroresearch into music (e.g. Branca 2011; Zorn 2012; cf. Sting's reaction in the film *The Musical Brain*)[62].

Does science really try to compete with the musicians' opinions, to explain "better" and to "demistify" (cf. Fidlon 2010, with a telling title)? If so - then perhaps music does need defence against scientific reductionism, demonstrating what remains outside the grasp of science, its own "immunology"? Especially considering the fact that some musicians have opted to even assist neuroresearch with personal input - as some of the cited sources attest (cf. Norgaard 2011).

In light of the accessible data, I venture to state the following interpretative hypothesis: research into music arising from the cognitivist paradigm does not compete with the musicians' opinions, nor with those of classical musicologists; on the contrary: it answers completely different questions. I believe that it is worthwhile to pay attention to books on the subject of musical improvisation - as it is considered to be such peculiar a phenomenon, ostensibly outside the rules of music, but by some, seen to constitute its very core (i.a. Benson 2003).

Let us make it clear what phenomenon we are discussing here. To put it short: improvisation comprises creating a piece of music while performing it. It is the art of controlled reorganizing of sound. The spontaneous element is no accident or free choice, because the art of improvisation is too deeply rooted in individual experience and musical knowledge. Specialists in the subject have been known to compare musical improvisation to language: free choice in the latter does not consist in making up new words, and similarly, in the former, improvisers use e.g. phrases which they know well, and do not make them out of thin air. In conclusion: idiomatic compositions, presented by the improviser *in statu nascendi*, are the result of musical education and hard work (Berkowitz 2010; Knittel 2010; Fulara 2012; Henderson 1992). It does not seem as though neuroscientists were attempting to pin down the phenomenon of musical improvisation differently, or from the position of ignorants. Charles J. Limb - one of the preeminent researchers of improvisation - writes that he does not want to approach this phenomenon differently than musicians do[63]. Therefore, it is worthwhile to acquaint oneself with what cognitive science of music actually says.

[61] One of similar statements heard in academic circles.
[62] *http://www.sbs.com.au/documentary/program/570/The-Musical-Brain*.
[63] Source: an e-mail exchange between the Editorial Board and the Researcher (2012).

Neuroresearch into music posits a remarkable opportunity for a better understanding of the organization of the human brain (Levitin 2006). As musical creativity involves only a specific section of society, research into it can help to bring us closer to understanding human potential in this domain (Peretz and Zatorre 2003). Not everyone realizes how many processes are involved in the creation and reception of music. These include, after all, perception, emotions, attention, learning, remembering, semantic creativity, human interaction, etc. Just the psychology of music involves a wide interdisciplinary range (Koelsch 2012). In cases of neuropathology, the phenomenon of music appears to us from an unusual perspective (Sacks 2008). Research into these issues is also part of cognitivist and philosophical disputes between classical and embodied approaches to cognition (Raffman 2011; Leman 2007).

As examples of research projects regarding musical improvisation, we would like to list a few rather spectacular and, at the same time, diverse ones, as they provide an outlook of the vastness of this domain of study. As such we have deemed (1) research within the computational model, (2) the alternative to the former, namely research within the dynamic paradigm, (3) an experiment involving an improvising robot, (4) an experiment involving children with autism, and (5) a report from a neuronal study of the undercurrents of spontaneous musical performance, conducted with the use of a functional magnetic resonance imaging (fMRI).

The author of the first work, Philip N. Johnson-Laird, adopting the paradigm within which music is integrally connected to improvisation - often more so than with composition - consistently defends computational analysis of musical creativity. Analysing the case of jazz improvisation, he concludes the existence of three types of algorithms associated with such creativity (including “neo-Darwinian” and “neo-Lamarckian”), each of which implies a certain set of limitations (Johnson-Laird 2002).

David Borgo and Joseph Goguen suggest using non-linear theory of dynamic systems for research into musical improvisation, as in their opinion it allows for the adequate accounting for the unpredictable behaviour of the sets. Without offering a tool for a comprehensive and detailed grasping of the richness of this phenomenon of musical creativity, they place considerable value on utilizing within this research such categories of the dynamic model as “basin of attraction” and “direction of motion”, which do not reduce the aspect of complexity and spontaneity (Borgo and Goguen 2004).

The robot named Shimon is an odd musician, playing the marimba in the company of humans. Its improvised playing is assisted by visual expression of gestures, in interaction with its partners - human musicians. On the basis of this experiment Guy Hoffman and Gil Weinberg argue that musicality constitutes not merely the generating of sequences of sounds, but also the entire choreography of movements and communication with the remaining members of the band as well as the audience (Hoffman and Weinberg 2010).

Jinah Kim, Tony Wigram, and Christian Gold present the results of intriguing studies involving pre-school aged children with autism. The results show how strongly they were influenced by musical therapy involving improvised music. As the authors claim, it resulted in significant improvement of attention and a range of interpersonal skills - compared to children who were only playing with toys during the study (Kim, Wigram and Gold 2008)[64].

In the experiment described by Charles J. Limb and Allen R. Braun, experienced pianists performing improvised jazz were examined with fMRI. This enabled the monitoring of the sections of the cerebral cortex active at the given moment. Such studies bring us closer to identifying the characteristic neuronal model of musical performance in which brain sections responsible for specific psychological processes are involved (Limb and Braun 2008).

The scope of research into creation and perception of music shows what a broad and vast domain of human nature this field of study touches upon. One cannot describe it as reducing the "essence" of the phenomenon to biological categories or as discrediting the authority of a musician. One should remember that this research, especially into improvisation, is in its infancy. The aforementioned Charles J. Limb states that he sees no "demystifying" effort in his research, as his goal is only to improve the understanding of this phenomenon. He merely wants to know the neurobiological underpinnings of this incredible area of human activity, and he is still far from accomplishing that[65].

References

Benson, B.E. 2003. *The Improvisation of Musical Dialogue: A Phenomenology of Music*. Cambridge University Press.

Berkowitz, A. 2010. *The improvising mind: Cognition and creativity in the musical moment*. Oxford University Press.

Borgo, D. and Goguen, J. 2004. Sync or Swarm: Group Dynamics in Musical Free Improvisation. *Conference of Interdisciplinary Musicology* (CIM 04) April 2004, Graz, Austria.

Branca, G. 2011. Symphony No . Interview. *AVANT*, 2/2011: 107-110.

Fidlon, J. 2010. Demystifying jazz, *www.tmec.org/conventions_files/2010handouts.htm*, 19.08.2012.

Fulara, A. 2012 (forthcoming). Model of polyphonic improvisation. *AVANT*, 2/2012.

Johnson-Laird, P.N. 2002. How Jazz Musicians Improvise. *Music Perception*, Spring 2002, Vol. 19, No. 3: 415–442.

Henderson, S. 1992. *Melodic phrasing*. Hollywood: REH Warner Bros.

[64] Critical review: *http://www.uwo.ca/fhs/csd/ebp/reviews/2009-10/Malczewski.pdf*, 19.08.2012.
[65] Cf. footnote 4.

Hoffman, G. and Weinberg, G. 2010. Gesture-based Human-Robot Jazz Improvisation. *Robotics and Automation* (ICRA), 2010 IEEE International Conference. Georgia Tech Center for Music Technol., Atlanta: 582-587.

Kim, J., Wigram, T. i Gold, Ch. 2008. The Effects of Improvisational Music Therapy on Joint Attention Behaviors in Autistic Children: A Randomized Controlled Study. *Journal of Autism and Developmental Disorders*, (2008) 38: 1758–1766.

Knittel, K. 2010. Without possibility of correction. Interview. *AVANT*, 1/2010: 367-375.

Koelsch, S. 2012. *Brain and Music*. Wiley-Blackwell.

Leman, M. 2007. *Embodied Music Cognition and Mediation Technology*. The MIT Press.

Levitin, D. 2006. *This is Your Brain on Music: The Science of a Human Obsession*. New York: Dutton.

Limb, Ch.J. i Braun, A.R. 2008. Neural Substrates of Spontaneous Musical Performance: An fMRI Study of Jazz Improvisation. *PLoS ONE*, 3(2): e1679.

Mazzola, G., Park, J. and Thalmann, F. 2012. *Musical Creativity: Strategies and Tools in Composition and Improvisation*. Springer.

Norgaard, M. 2011. Descriptions of Improvisational Thinking by Artist-Level Jazz Musicians. *Journal of Research in Music Education*, 59(2): 109–127.

Peretz, I. and Zatorre, R.J., eds. 2003. *The Cognitive Neuroscience of Music*. Oxford University Press.

Przybysz, P. 2006. Wstęp. W stronę neuroestetycznej teorii sztuki. A. Dziarnowska and A. Klawiter, eds. *Mózg i jego umysły. Studia z kognitywistyki i filozofii umysłu*, 2(2006). Poznań: Wydawnictwo Zysk i S-ka: 321–325.

Raffman, D. 2011. Music, Philosophy and Cognitive Science. T. Gracyk and A. Kania, eds. *The Routledge Companion to Philosophy and Music*. Routledge.

Sacks, O. 2008. *Musicophilia: Tales of Music and the Brain*. Vintage.

Zorn, J. 2012. Five. Interview. *AVANT*, T/2012: 307-308.