Final/Annual/Midterm Report for AOARD Grant 114103

"The efficiency of musical emotions for the reconciliation of conceptual dissonances"

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Name of Principal Investigators (PI): Nobuo Masataka

- e-mail address : masataka@pri.kyoto-u.ac.jp
- Institution : Kyoto University
- Mailing Address : Kanrin 41, Inuyama, Aichi 484-8506, Japan
- Phone : +81 568 63 0552
- Fax : +81 568 62 9552

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Abstract: Short summary of most important research results that explain why the work was done, what was accomplished, and how it pushed scientific frontiers or advanced the field. This summary will be used for archival purposes and will be added to a searchable DoD database.

In the present project, PI developed theoretical foundation for the evolution of music in cooperation with an AFRL scientist, Leonid Perlovsky and considered the implications of our findings about the reconciliation of cognitive dissonance which was experimentally created in 4-year-old children, who obeyed an experimenter's warning not to play with a desired toy. Without exposure to music, it was found that an experimenter's mild warning led to stronger devaluation of the toy than an experimenter's severe warning, confirming the findings of previous research. When the children were exposed to one of Mozart's sonatas, however, this devaluation of the toy was not induced by the mild warning. The results indicate the possibility of the efficacy of music for reconciling cognitive dissonances. Moreover, further experiment revealed that an exposure to a Mozart minuet mitigates the cognitive interference whereas on the contrary when the music has been modified to consist of mostly dissonant intervals the interference effect has been intensified.

Introduction: Include a summary of specific aims of the research and describe the importance and ultimate goal of the work.

Recently, the author have presented a hypothesis about the fundamental cognitive function of music, which suggested that the evolution of language led to relatively fast cultural evolution of multiple mutually contradictory concepts (any different concepts must be contradictory to some extent, otherwise one concepts would be sufficient). This could lead to cognitive dissonances and consequently to devaluing knowledge. If cognitive dissonances could not be mitigated, our progenitors would devalue knowledge, and human language, knowledge, and culture would not evolve. It was hypothesized that the fundamental function of music in cognition was to serve precisely this function. The purpose of the study reported here was to theoretically explore this possibility. Here we evaluate music effects on cognitive interference.

Experiment: Description of the experiment(s)/theory and equipment or analyses..

In the data collected by previous study, cognitive dissonance was experimentally

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14. ABSTRACT
In the present project, PI developed theoretical foundation for the evolution of music in cooperation with an AFRL scientist, Leonid Perlovsky and considered the implications of our findings about the reconciliation of cognitive dissonance which was experimentally created in 4-year-old children, who obeyed an experimenter?s warning not to play with a desired toy. Without exposure to music, it was found that an experimenter?s mild warning led to stronger devaluation of the toy than an experimenter?s severe warning, confirming the findings of previous research. When the children were exposed to one of Mozart?s sonatas, however, this devaluation of the toy was not induced by the mild warning. The results indicate the possibility of the efficacy of music for reconciling cognitive dissonances. Moreover, further experiment revealed that an exposure to a Mozart minuet mitigates the cognitive interference whereas on the contrary when the music has been modified to consist of mostly dissonant intervals the interference effect has been intensified.

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created in 4-year-old children using a well-established method. This protocol was developed on the basis of classical cognitive dissonance (CD) theory, which proposes that CD is an uncomfortable feeling caused by holding conflicting ideas simultaneously and that people are provided with a motivational drive to reduce dissonance. If a person is induced to cease performing a desired action, a CD will be experienced. The cognition that the person is not performing the action is dissonant with the cognition that the action is desirable. An effective way of reducing CD is by devaluing the action. A strong prohibition of an action could lead to a lesser CD, because a severe threat is consonant with ceasing to perform the action. Therefore, a person's tendency to devalue the action is expected to peak at a mild threat. For creating cognitive interference, we used a prototypical task, known as "Stroop interference task".

Results and Discussion: Describe significant experimental and/or theoretical research advances or findings and their significance to the field and what work may be performed in the future as a follow on project. Fellow researchers will be interested to know what impact this research has on your particular field of science.

The attractiveness of a toy for the children tended to be enhanced if it was merely withdrawn temporarily from them. This tendency was observed in all three of the groups to which the present participants were randomly assigned, and is consistent with previously reported findings. When forbidden to play with the toy with no exposure to music, moreover, the 25 children in the group that had experienced mild warning (MW) were more likely to devalue that toy than the 25 children of the group that had experienced severe wrning (SW). These findings are also in accordance with the following notion proposed by the classical theory of CD: when a child experienced SW, his cognition that he did not play with an attractive toy was consonant with his cognition that he was strongly prohibited to play with the toy. On the other hand, when a child refrained from playing with a toy in the absence of a strong prohibition, he experienced a CD. His cognition that he did not play with the toy was dissonant with his cognition that it was attractive. To reduce this dissonance, he devalued the toy. Under the same circumstances, however, the 25 children in the group who were exposed to Mozart's sonata were less likely to devalue the toy. The experience of being exposed to that music appears to have exerted an influence that acted to reconcile such CD. Our results about the Stroop experiment support the notion that music effect on cognitive dissonance depends on hedonicity of music: pleasant music better helps overcoming cognitive dissonance than unpleasant music. This gives tentative support for our hypothesis about the fundamental cognitive function of music: it helps resolving cognitive interferences and dissonances.

List of Publications and Significant Collaborations that resulted from your AOARD supported project: In standard format showing authors, title, journal, issue, pages, and date, for each category list the following:
a) papers published in peer-reviewed journals,

Masataka, N. & Perlovsky, L.I. (2012). The efficacy of musical emotions provoked by Mozart's music for the reconciliation of cognitive dissonance. Scientific Reports, 2, doi:10.1038/srep00694

Masataka, N. & Perlovsky, L.I. (2013). Cognitive interference can be mitigated by consonant music and facilitated by dissonant music. Scientific Reports 3, Article number: 2028 (2013)

doi:10.1038/srep02028

b) papers published in non-peer-reviewed journals and conference proceedings,

Masataka, N. & Perlovsky, L.I. (2012a). Music can reduce cognitive dissonance. Nature Precedings: hdl:10101/npre.2012.7080.1.

Attachments: Publications a), b) and c) listed above if possible.

Foe two articles listed above a), see the follwing URL:
http://www.nature.com/srep/2012/120925/srep00694/full/srep00694.html
http://www.nature.com/srep/2013/130619/srep02028/full/srep02028.html

Future Direction of the Present Research:

As a future direction of the present research, the PI is planning to develop theoretical foundation for the application of the present findings with Dr. Perlovsky to the therapy (music therapy) for individuals with psychiatric disorders, particularly, those with PTSD. With the financial support by other organizations, I have already started to engage with preliminary experiment investigating those people in order to evaluate effects of exposure several types of music, and found that some Mozart music as well as Buddhist chant is effective as a part of meditation treatment for PTSD. I have also been working to establish the method of assessment of the effects with using "Emotion-Stroop test" as an extension of my previous work of "Stroop test" to evaluate the cognitive interferences. The findings should be intriguing, given the fact that among roughly 1,600,000 US veterans who had been to Iraq and Afghanistan, 15% - 20% of them suffer from PTSD. And, indeed in US, some PTSD veterans receive Buddhist meditation treatment, but without exposure to music. They would be very suitable for my research plan. I am corresponding to Prof. Wang, University of Toledo, OH, who works with US veterans with PTSD. At the moment, what I feel uncertain is whether Buddhist chant is effective for US people as well as for Japanese people. They should mostly be unfamiliar to Asian tradition and have been unfamiliar with Buddhism culture. Seemingly the chant is effective for people grown up in the East while I am afraid that people in the West might feel that just strange. However people who are familiar with Buddhist habit should be no longer resistant with the chant. Probably we can divide the entire group into two, and one of the two is to receive meditation with chant and the other is to receive meditation without chant, and we can compare the effect of the treatment between the two groups. In the near future, I will start this research project first in Japan, confirm my hypothesis in the Japanese sample, and then, wish to collaborate with US psychiatrists. And in order to develop the theoretical foundation on the basis of these empirical findings, collaboration with Perlovsky, an AFRL scientist, is indispensable. Therefore, I will be extremely happy if you could provide me with such opportunity with financial support under the research title "Establishing method of music therapy as a treatment for PTSD". The duration of the research should be two years, effective November or December, 2013, and the amount of the support would be $50,000.