Title of Project： **Understanding and breaking the limit of human minds and performance**

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Number of Research Area：20B102   Researcher Number：20505979

【**Purpose of the Research Project**】

Our research project aims to understand the mechanisms that underlie the limits of our performance and contribute to developments of new methods that enable to overcome the limits. As a patient with disease, normal person, or expert in a certain field, we all constantly make efforts to improve our own performance. However, such improvements typically end up reaching the ceiling. In most cases, this ceiling prevents us from breaking the limits of our performance. On the other hand, a handful of greats eventually break the limits and show outstanding performance and exceptional recovers from serious disorders. Understanding of how such break occurs should lead to the developments of the methods to overcome the limits.

Our research project focuses on our mind and brain that lead to the limits of our performance. We aim to understand the mechanisms by which our mind and brain control our performance, develop new methods to overcome the performance limitations, and consider how these methods will be assimilated with our society in the future through discussions about ethical and normative impacts that are expected in response to the developments of these methods. Our interdisciplinary framework likely contributes to various fields including cognitive science, brain science, engineering, medicine, arts, sports, pedagogy, philosophy, and ethics.

【**Content of the Research Project**】

Our project assumes that the limits of our performance are constrained by the following three mechanisms: mind, skill, and brain connections. This framework would allow us to comprehensively understand the performance limits of patients, normal persons, and experts (see below).
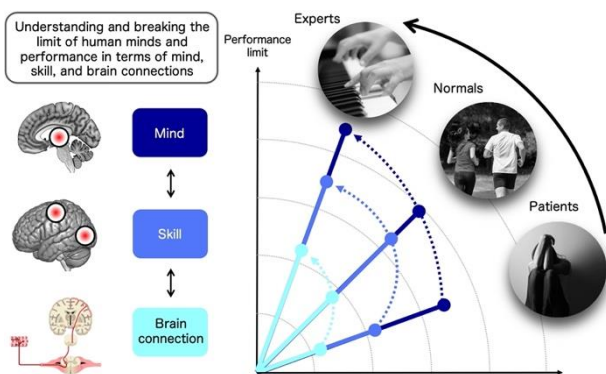
Three mechanisms that constrain the limits of our performance

Our research project will investigate these three mechanisms by using cutting-edge techniques. For example, we plan to utilize behavioral measurements, neuroimaging methods, computer simulations, robots, neurofeedback, brain prosthesis.

【**Expected Research Achievements and Scientific Significance**】

Findings from our research project will make better understanding of mechanisms that underlie the limits of our performance. Such understanding is expected to lead to new intervention and/or methods that allow us to overcome the limits.

In addition, our research project will consider what changes will occur once each of us has an access to the methods to overcome the limits of our performance. If everyone has a chance to benefit from such methods, it is likely that our ethics and morals will waver in a great degree; breaking the limits of performance will give a sense of superiority to beneficiaries, but a sense of unfairness and/or fear to the rest of people. It will be necessary to establish concrete public systems that accommodate possible advantages and disadvantages for our society. Indeed, it has been recently shown that our abilities can be enhanced by human augmentation technologies. At the same time, it is possible that understanding and breaking the limits of our performance will lead to reform of our view of humans in a positive manner. Thus, our research project will start discussing these issues ahead of the times and grope for the ways to assimilate our new methods with the society in the future.

【**Key Words**】

Neurofeedback:
A method to provide a user with his/her brain activations and allow the user to control the activations.

Brain prosthesis:
A method that connects distant brain regions by a computer.

【**Term of Project**】 FY2020-2022

【**Budget Allocation**】 97,500 Thousand Yen

【**Homepage Address and Other Contact Information**】
https://sites.google.com/view/brainlimit/home
Twitter: @nou_limit