

# 脳波解読による認知機能評価システムの開発

## Development of an EEG-based Cognitive Assessment System.

本研究では、注意のレベルを反映する脳波成分（**事象関連電位**）を指標とした認知機能評価システムの試作開発を行った。

In this study, we have developed an EEG-based cognitive assessment system, especially focusing on the EEG component (event-related potential, **ERP**) that reflects the attention level.

### Original Needs: Communication Aid

Communication is like "playing catch" of messages

**Totally Locked-in State (TLS)**

- Neurological diseases (e.g. ALS)
- Stroke
- Head trauma or Cervical cord damage

Severe motor disability by a disease or an accident → makes it impossible to talk or write

Patients with severe motor deficits need communication aid without any body action.

### Methods: Cognitive Tasks.

Task Difficulty →

"Single" "Oddball" "Selection"

We used 3 cognitive tasks with different levels of difficulties.

### Original Seeds: "Neurocommunicator®"

(1) Presentation of candidates of messages

(2) EEG recording by a compact/wireless device

(3) High-speed and high accuracy decoding

(4) Expression of the decoded message via the avatar

I did it!

I want to turn over on my left side.

Raw EEG data

Pattern recognition of the Event-Related Potential (ERP)

We have developing the Neurocommunicator, an EEG-based communication aid.

### Results: Individual difference of the ERP

● Example of ERP of a Subject

"Single" "Oddball" "Selection"

● Accuracy of Decoding

(N=10)

(N=10)

"Normal" Subjects

"Suspicious" Subject

The system may detect a symptom of mild cognitive impairment (MCI).

### Application: Cognitive Assessment

High? Cognitive Function

Low?

It is difficult to test cognitive functions of patients with motor deficits...

We focused on the ERP as a biomarker of the cognitive function.

### Ongoing project: "Neurotrainer"

Concept of neurofeedback game "Neurotrainer" in order to improve the cognitive function, which is based on the real-time analysis of the ERP.

Nontarget Nontarget ... Target

Hit

Miss

Users Candidates

- Patients with motor deficits.
- Senior people
- Children (including ADHD)
- Performer (e.g. athlete)

This neurofeedback game is designated to improve the cognitive function.