# A Brave New World? Ethical considerations for individual assessments based on advanced neuroimaging

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The last few years has seen tremendous advances in technical and computational approaches, such as machine learning and multivariate pattern analysis, that are now being used decode and predict cognitions, based on neuroimaging data. These approaches, coupled with the development of "big data" efforts, are also being used to identify brain biomarkers of disease and their risk factor/vulnerabilities, as well as individual traits. However, the validity of individual evaluations are critically dependence on the sensitivity and specificity of the neuroimaging task and study design, numerous technical and statistical criteria, and must avoid common flaws such as reverse inference that lead to misinterpretations. This symposium will provide an overview of these developments and discuss the ethical, societal, and privacy implications of a "Brave New World" in which brain imaging could identify individual characteristics, predict future behaviour and disease. The desired learning outcomes include gaining an understanding of:

- 1. New neuroimaging approaches (machine learning, multivariate pattern analysis, etc.), that can decode and predict cognitions, and identify disease biomarkers.
- 2. Reverse inference logic that can lead to misinterpretations, but can be avoided with careful study designs.
- 3. Technical and biological limitations of vascular-based (e.g., fMRI) and lectrical/magnetic-based (EEG, MEG) technologies at the individual subject level.
- 4. Neuroethical implications of neuroimaging-based diagnostic biomarkers and prediction of risk/vulnerabilities in individuals.

#### Learning Objectives:

- 1. To understand how new neuroimaging approaches (machine learning, multivariate pattern analysis, etc.), can decode and predict cognitions, and identify disease biomarkers.
- 2. To understand technical and practical limitations of neuroimaging at the individual level based on spatial, temporal, statistical, and study design (e.g., reverse inference).
- 3. To consider the neuroethical implications of neuroimaging-based diagnostic biomarkers and prediction of risk/vulnerabilities in individuals.

#### Neural mind-reading: Promises and limitations

Yukiyasu Kamitani, ATR Computational Neuroscience Laboratories, Kyoto, Japan

#### Brain decoding to predict pain: truths and myths

Giandominico Iannetti, UCL, London, United Kingdom

## Ethical considerations for research imaging: maintaining privacy, autonomy and the management of unexpected finding

Paul Matthews, Division of Brain Sciences, Imperial College London

### A need for an ethical framework in which to consider biological, neurophysiololgical and technical

factors that impact sensitivity and specificy of neuroimaging in individual subjects

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