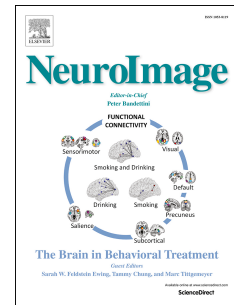


# Accepted Manuscript

Warnings and caveats in brain controllability

Chengyi Tu, Rodrigo P. Rocha, Maurizio Corbetta, Sandro Zampieri, Marco Zorzi, S. Suweis



PII: S1053-8119(18)30298-2

DOI: [10.1016/j.neuroimage.2018.04.010](https://doi.org/10.1016/j.neuroimage.2018.04.010)

Reference: YNIMG 14857

To appear in: *NeuroImage*

Received Date: 25 December 2017

Revised Date: 9 March 2018

Accepted Date: 6 April 2018

Please cite this article as: Tu, C., Rocha, R.P., Corbetta, M., Zampieri, S., Zorzi, M., Suweis, S., Warnings and caveats in brain controllability, *NeuroImage* (2018), doi: [10.1016/j.neuroimage.2018.04.010](https://doi.org/10.1016/j.neuroimage.2018.04.010).

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

## Warnings and Caveats in Brain Controllability

Chengyi Tu<sup>1,6</sup>, Rodrigo P. Rocha<sup>1,6</sup>, Maurizio Corbetta<sup>2,3,6</sup>, Sandro Zampieri<sup>4,6</sup>, Marco Zorzi<sup>5,6,7</sup> & S. Suweis<sup>1,6\*</sup>

<sup>1</sup>*Dipartimento di Fisica e Astronomia, ‘G. Galilei’ & INFN, Università di Padova, Padova, IT.* <sup>2</sup>*Dipartimento di Neuroscienze, Università di Padova, Padova, IT.* <sup>3</sup>*Departments of Neurology, Radiology, Neuroscience, and Bioengineering, Washington University, School of Medicine, St. Louis, USA.* <sup>4</sup>*Dipartimento di Ingegneria dell’informazione, Università di Padova, Padova, IT.* <sup>5</sup>*Dipartimento di Psicologia Generale, Università di Padova, Padova, IT.* <sup>6</sup>*Padova Neuroscience Center, Università di Padova, Padova, IT.* <sup>7</sup>*IRCCS San Camillo Hospital Foundation, Venice, IT.*

### Abstract

A recent article by Gu et al. (Nat. Commun. 6, 2015) proposed to characterize brain networks, quantified using anatomical diffusion imaging, in terms of their “controllability”, drawing on concepts and methods of control theory. They reported that brain activity is controllable from a single node, and that the topology of brain networks provides an explanation for the types of control roles that different regions play in the brain. In this work, we first briefly review the framework of control theory applied to complex networks. We then show contrasting results on brain controllability through the analysis of five different datasets and numerical simulations. We find that brain networks are not controllable (in a statistical significant way) by one single region. Additionally, we show that random null models, with no biological resemblance to brain network architecture, produce the same type of relationship observed by Gu et al. between the average/modal controllability and weighted degree. Finally, we find that resting state networks defined with fMRI cannot be attributed specific control roles. In summary, our study highlights some warning and caveats in the brain controllability framework.

**Keywords:** Brain Controllability; Complex Networks; Null Models; Brain Networks; Whole Brain Modelling

Download English Version:

<https://daneshyari.com/en/article/8686817>

Download Persian Version:

<https://daneshyari.com/article/8686817>

[Daneshyari.com](https://daneshyari.com)