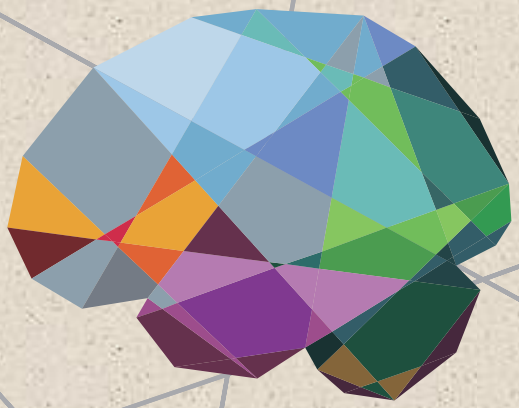
2014 Annual Report & 2015 Forecast



THEVIRTUALBRAIN.

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INTRODUCTION

When I look back on the year, the one word that comes to mind for The Virtual Brain (TVB) is *growth*. Up until this point, much of our group's efforts have been dedicated to development and refinement of the TVB software platform. With this, we have collectively witnessed TVB reach a level of functional competence and aesthetic enhancement that imparts a fully user-friendly environment for exploration and gained understanding of the brain. TVB is ready for world…but is the world ready for TVB? I think it is with perfect timing that TVB has arrived. With the current shift towards large data that is accompanied by the prerequisite for tools to manage big datasets and an increased public awareness for brain health, TVB offers an unrivaled opportunity to facilitate the much sought after quest to understand the human brain.

With a sense of comfortability in the software itself, we were granted a moment to step back and pause to reflect on the work that has been done. In parallel, this reflection time was equally met with questions of where do we go next? And although many ideas have been discussed up until this point, this year we actually started to do. We saw the establishment of several satellite projects, the commencement of our TVB Node workshops series, and a continued and inflated effort to support TVB through entrepreneurial activities.

Within the remaining pages of this document, you will find a review of the various activities and milestones that have taken place over the past year, as well as a summary of already planned items for 2015. As you will begin to see, we have come, we have conquered and it is up to us to secure a relevant and impactful future for TVB in all of it's various forms.

I would also like to extend sentiments of my appreciation for everyone's dedication and hard work to this project over the past year. With all the work that has been committed towards TVB in the past, it is hard not to become anxious when thinking of what the future holds.

Tanya Brown

Program Manager

THEVIRTUALBRAIN.

YOUR TEAM

Founders

Viktor Jirsa

Randy McIntosh

Jochen Mersmann

Petra Ritter

Program Manager

Tanya Brown

Team Members of 2014

- Software Development - (Framework & Scientific)

Mihai Andreai *Codemart*

Michael Burgstahler *Two Tribes*

Lia Domide *Codemart*

Henrik Matzke

Bogdan Neacsa *Codemart*

Timothee Proix

Simon Rothmeier

Paula Sanz-Leon

Michael Schirner

Marmaduke Woodman

- Research –

Michael Breakspear

Gustavo Deco

Nancy Lobaugh

Cathy Price

Steve Small

Ana Solodkin

Olaf Sporns

Stephen Strother

-Trainees & Contributors -

Gleb Bezgin

Jan Fousek

Mathieu Golos

Tom Hope

Robert Parcus

Dipanjan Roy

Kelly Shen

Huifang Wang

FUNDING SUPPORT

A special acknowledgement to the supporters of The Virtual Brain

James S. McDonnell Foundation

Founding Sponsors Dr. Max & Gianna Glassman

Helen & Walter Zwig Family Foundation in honour of Helen Zwig

Amidex, French Excellence Program
(Ageing, Complexity and Coordination Dynamics)

Agence Nationale de la Recherche (ANR)
(Virtual Brain-based interpretation of electrophysiological signals in Epilepsy)

German Ministry for Education and Research; Bernstein Program for Computational Neuroscience *(Petra Ritter)*

Max Planck Society *(Petra Ritter)*

Charité University Medicine Berlin *(Petra Ritter)*

REVIEW OF 2014

Here is a summary of the significant happenings related to TVB from the year of 2014. There are six (6) sections: Milestones, Events, Publications, Press, Releases and Satellite Projects.

Milestones :

1. TVB Node#1

Attendee Count: 42 (19 student; 18 non-student; 2 internal; 3 onsite registrations)

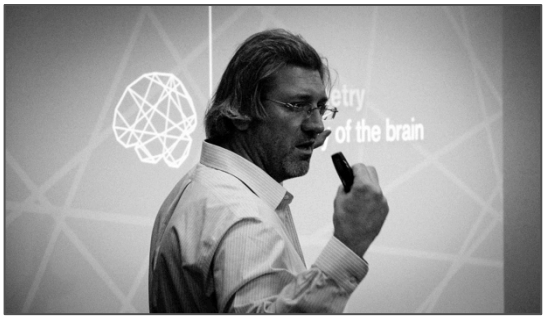
Summary: The first TVB workshop held in Hamburg Germany on June 7th, which purposefully took place between Brain Connectivity Workshop and OHBM. Feedback from our first iteration was mainly positive, but some refinement was necessary in terms of content. More specifically, we needed to reorganize the hands-on sessions to fewer instances and slower paced.

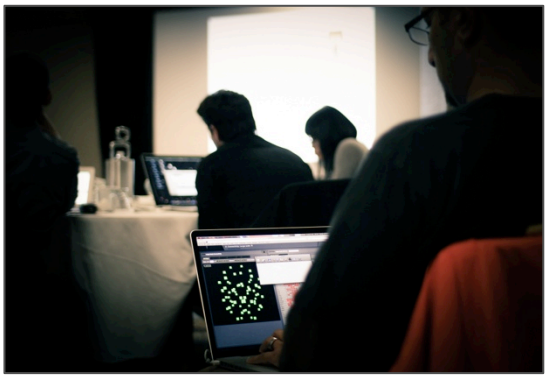
Team: Mihai Andreai, Tanya Brown, Michael Burgstahler, Lia Domide, Jan Fousek, Mathieu Golos, Viktor Jirsa, Randy McIntosh, Jochen Mersmann, Tim Proix, Petra Ritter, Paula Sanz-Leon, Ana Solodkin, Huifang Wang & Marmaduke Woodman

Location: University Medical Center Hamburg-Eppendorf, Hamburg Germany

2. TVB Node #2

Attendee Count: 15 (6 Student; 8 non-student; 1 onsite registration)





Summary: The second iteration of the Node workshops was held in Washington DC on the Friday before SfN began. It was conveniently held at the Renaissance Hotel, which was directly adjacent to the convention centre. The program for Node #2 was planned with consideration of the critique from Node #1 – namely fewer hands-on sessions and providing more time for attendees to click through the exercises. The feedback we received was minimal, but very positive.

Team: Tanya Brown, Michael Burgstahler, Lia Domide, Viktor Jirsa, Henry Matzke, Randy McIntosh, Jochen Mersmann, Petra Ritter, Simon Rothmeier, Paula Sanz-Leon, Michael Schirner, Kelly Shen & Ana Solodkin

Location: Renaissance Washington Downtown Hotel, Washington, DC, USA

Events :

- **November 15-19.2014**

Demonstration of latest features and research results of The Virtual Brain at the Annual Meeting of the Society for Neuroscience (SfN) at Washington, DC. This year we exhibited with a 10x20 booth size which imparted an increased audience capacity and marketing opportunity.

- **November 14, 2014**

TVB hosted their 2nd iteration of the Node series workshops in Washington DC as an official satellite event of SfN 2014. Registration did not reach capacity, however this allowed us to offer a high attendee/mentor ratio and enabled a smooth flow to the various hands-on sessions.

- **October 23-26, 2014**

TVB team members Lia Domide and Paula Sanz-Leon attended the10th Google Summer of Code Reunion in San Jose, USA, at which Lia gave a lightning talk about TVB in front of 600 fellow open-source developers.

- **October 8-12, 2014**

Viktor Jirsa presented a first prototype of the Virtual Epileptic Patient at the 23rd Annual International Epilepsy Symposia at Cleveland Clinic in Cleveland, Ohio, USA.

- **September 26, 2014**

Petra Ritter presented on how TVB opens up novel avenues in the tech sector in the Smart Systems for Unconventional Computing session at ICNAAM (12th international conference on numerical analysis and applied mathematics) in Rhodes, Greece.

- **September 12, 2014**

Robert Parcus, the student who worked with the TVB team for the Google Summer of Code, wrote about his pleasant experience in his blog. He also explains in more detail what he did for volumetric time series visualizers and refactoring others.

- **August 25, 2014**

Viktor Jirsa, scientific lead of the TVB team, presented the software as a keynote speaker at the INCF Neuroinformatics 2014 conference in Leiden (Netherlands).

- **July 31, 2014**

Randy McIntosh contributed to the 'Large-Scale Brain Structure and Dynamics" workshop at the Organization for Computational Neurosciences meeting in Quebec City, with a presentation about TVB.

- **July 25, 2014**

Randy McIntosh presented a 2-part workshop at UCLA's Neuroimaging Summer Program. The topics of his talks covered "Building TVB" and "Speed Dating with TVB".

- **June 17, 2014**

Paula Sanz-Leon presented 'Introducing TVB: the challenges and benefits of building a large-scale brain network simulator.' at the European Institute for Theoretical Neuroscience as an invited speaker to the 1st French Neuroinformatics Workshop, Paris, France.

- **June 7, 2014**

TVB hosted the first international workshop, titled TVB Node #1. We strategically planned for the workshop to take place in connection with the annual Brain Connectivity Workshop and Human Brain Mapping Conference as bookends to our event in order to capitalize on attendance.

- **March 10, 2014**

The TVB website and the registration/download server upgraded to a new publishing platform called "Zwei". This has permitted a more user-friendly features in the future, faster updates and more efficient administration.

- **February 25, 2014**

TVB offered 5 exciting student projects for the Google Summer of Code 2014 – participants were presented with the opportunity to work on a well-kept codebase and contribute to better therapies for brain diseases.

Publications :

2014

Deco G., McIntosh A.R., Shen K., Hutchison R.M., Menon R.S., Everling S., Hagmann P. & Jirsa V.K. (2014) Identification of optimal structural connectivity using functional connectivity and neural modeling. Journal of Neuroscience 34 (23): 7910-7916.

Jirsa, V.K. (2014) Large Scale Brain Networks of Neural Fields. In Coomes, S., Graben, Pb., Potthast, R. & Wright, J. (Ed.) Neural Fields: Theories and Applications (417-432). Berlin Heidelberg: Springer.

Jirsa V.K., Stacey W.C., Quilichini P.P., Ivanov A.I. & Bernard C. (2014) On the Nature of Seizure Dynamics. Brain doi: 10.1093/brain/awu133.

Roy D, Sigala, R., Breakspear, M., McIntosh, A.R., Jirsa, V., Deco, G., Ritter, P. (In press) The Virtual Brain reveals how local plasticity shapes the brain´s dynamical landscape and the role of oscillations in this. *Brain Connectivity*, 4(10):791-811. doi:10.1089/brain.2014.0252.

Proix T., Bartolomei F., Chauvel P., Bernard C. & Jirsa V.K. (2014) Permittivity coupling across brain regions determines seizure recruitment in partial epilepsy. The Journal of Neuroscience 34(45):15009 –15021.

Sanz-Leon P., Knock S.A., Spiegler A. & Jirsa, V.K. (In press) Mathematical framework for large-scale brain network modelling in The Virtual Brain, *NeuroImage*. 01/2015; DOI: 10.1016/j.neuroimage.2015.01.002.

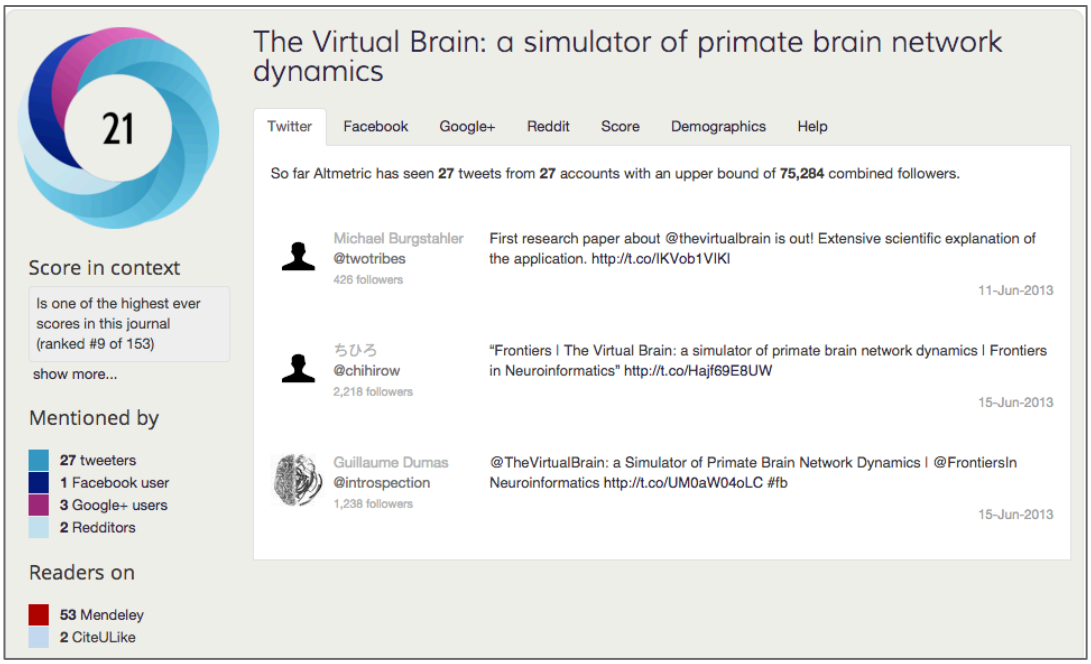
Wang, H. E., Bénar, C. G., Quilichini, P. P., Friston, K. J., Jirsa, V. K., & Bernard, C. (2014). A systematic framework for functional connectivity measures. *Frontiers in Neuroscience*, 8, 405. doi:10.3389/fnins.2014.00405.

Woodman, M. M., Pezard, L., Domide, L., Knock, S. A., Sanz-Leon, P., Mersmann, J. & Jirsa, V. (2014). Integrating neuroinformatics tools in TheVirtualBrain. *Frontiers in Neuroinformatics*, *8*, 36. doi:10.3389/fninf.2014.00036.

2013

Ritter P., Schirner M., McIntosh A.R., & Jirsa V.K. (2013) The virtual brain integrates computational modeling and multimodal neuroimaging. *Brain Connectivity*, 3(2), 121-45. doi: 10.1089/brain.2012.0120.

Sanz-Leon P., Knock S.A., Woodman M.M., Domide L., Mersmann J., McIntosh A.R. & Jirsa V.K. (2013) The Virtual Brain: a simulator of primate brain network dynamics. *Front. Neuroinform.*, doi: 10.3389/fninf.2013.00010.



Press :

- **June 16, 2014**

The Huffington Post reported about the latest epilepsy research of the TVB team. It's an easy introduction to the new epileptor model which will become available in the TVB software.

- **May 5, 2014**

A reporter from the Toronto Star got her brain scanned for TVB! Here's her report, explaining how The Virtual Brain works and how it can one day play a role in preventing and treating such diseases as Alzheimer's, schizophrenia and autism.

On the Web

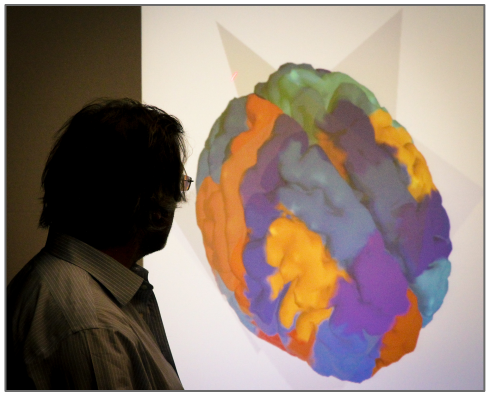
- Approx. 1700 downloads (including people who came back to get an upgrade)
- Subdomain <http://docs.thevirtualbrain.org/> activated to host online TVB documentation
- TVB now present in two big online scientific software repositories:

  INCF --- http://software.incf.org/software/the-virtual-brain-tvb

  NITRC --- http://www.nitrc.org/projects/tvb/

- Our repos on Github have become a place where we exchange ideas and code with contributors! See for instance https://github.com/the-virtual-brain/tvb-library/pull/29
- Host to a very active Google Group, where answers to posed questions are answered within 1 day of being posted. These actions have now enabled us to begin to generate a FAQ section in the TVB documentation.
- We have started building a data repo with the handouts, slides and projects. These data are publicly available, although not visible from the official website:

  http://www.thevirtualbrain.org/tvb/zwei/client-area/public



Releases :

- **November 11, 2014**

Release of The Virtual Brain 1.3.0 - The latest release brings more than 100 improvements and bug fixes with a notable focus on usability and surface simulations, e.g. speed improvements up to 800% and resilience to damaged surface structures with holes and the like. New visualizers for Phase-Plane and TimeSeries Volumes are included, as well as importers for NetworkX and MAT data – available for download for all supported platforms.

- **June 4, 2014**

Release of The Virtual Brain 1.2.0 - Another big release with over 80 improvements across the board: bug fixes, speed-ups and better usability in many areas – available for download for all supported platforms.

- **April 9, 2014**

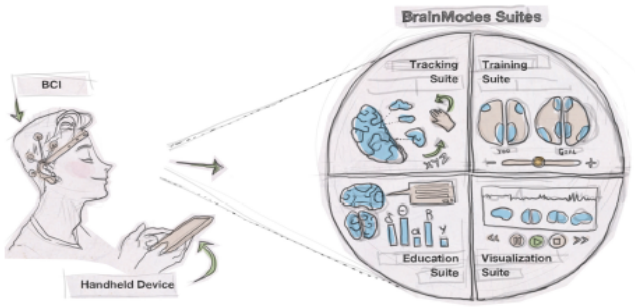
Release of The Virtual Brain 1.1.3 - available for download for all supported platforms, with a bunch of minor bug fixes, cleanups and improvements.

- **April 1, 2014**

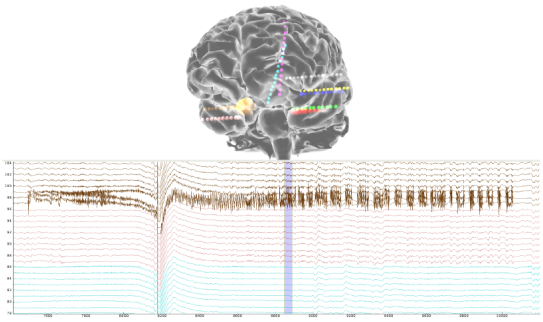
Release of The Virtual Brain 1.1.2 - The biggest release ever with over 130 enhanced features and extensions! More and improved visualizers, beautiful 3D surfaces with an importer for the common OBJ format, hemisphere separation for surfaces, support for proxy metastability in time series and much more - available for download for all supported platforms.

Satellite Projects :

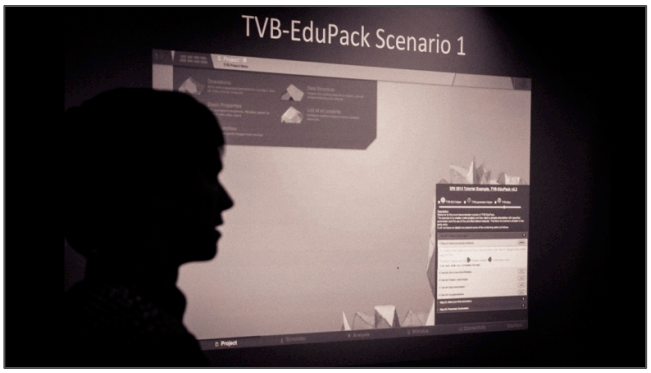
BRAINMODES



Epileptor



TVB EduPack



2015 FORECAST

- **September 2015**

  Node #3 to take place in Berlin, Germany

- **October 17-21, 2015**

  Society for Neuroscience (SfN) 2015 Conference in Chicago, Illinois – TVB to have annual exhibit booth installation (10x20) for the duration of the conference

  TVB to host invite-only social as an official satellite event of SfN

- **Ongoing**

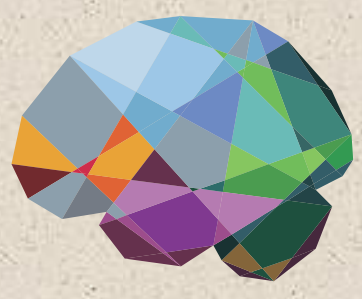
  Journal article tracking will commence – biannual review of published journal articles that incorporate the use of TVB; this will include both internal TVB people, as well as external (e.g. Node attendees, download registrants).

  Implementation of the monkey brain model will be completed by Gleb Bezgin and Kelly Shen (McIntosh Lab in Toronto). This will complement the recently added mouse brain model implemented by Jirsa et al., allowing for an extension of TVB to modeling other species, not just human.

  Plans for a 3-day Summer School in Marseille, France, which will offer an intense training course for TVB. Dates to be confirmed.

  TVB developers will once again participate in the Google Summer of Code 2015. Dates to be verified.

Photo courtesy of Tanya Brown



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