2012 Brain-Art Competition Submissions

Image Captions

1. Best Representation of the Human Connectome

Model of Temporal Lobe Epilepsy based on Causal Theory
AM Mohan Rao

Causality as described by Judea Pearl, enunciates the effects of disrupted function. For example, he asks what could be the cause of certain observed effect. Multiple causes may be attributed for an effect. In such a case sustenance of a cause to its effect can be attributed by observing the cause and effect structure more closely. In the temporal lobe epilepsy (TLE) there are changes in limbic system. There is a possibility that 3 dimensional spatial changes in limbic system can effect their functionality. There is also a possibility that temporal changes are also involved in their effects.

Here I present a representative model of brain function by its connections and its effects if they are disrupted. Limbic system (amygdala, hippocampus and parahippocampal gyrus) is shown along with caudate, hypothalamus and pituitary. Amygdala, parahippocampal nuclei (B,C,A) has connections to cortex and subcortical nuclei (D,E,F). If any nuclei (eg., C) is conditioned, then the pathways of these connections can change (as represented by sustenance of causal theory) giving rise to epilepsy. Thus causal theory can be used to explain the effect of lesions in brain.

HIV in the elderly human connectome
Neda Jahanshad

About one-third of HIV patients are over the age of 50 and with the availability of antiretroviral therapies, this proportion is sharply increasing. As the aged brain itself shows altered and deteriorating network organization, the additional effect of this prevalent virus is of interest. Testing differences between 55 patients and 30 controls (all aged 60-80), we map the altered connectivity with respect to the virus in a floating brain representation. Non-significant tested connections and nodes are in black. Blue connections represent those where the degree of connectivity between nodes is reduced in HIV patients as compared to age-matched controls. The connection strength (defined as the total fiber density for each region) is significantly lower in the presence of the virus (green spheres) Larger spheres indicate greater effect sizes (lower p-values). The axial slice, on which the brain floats, is segmented into the cortical regions of interest; red-yellow coloring represents the right and the blue-green coloring the left hemisphere. Data and resources provided by Victor Valcour and Paul Thompson. MATLAB was used to generate the figures.

AICHA : Atlas of Inter-Connected Homotopic Areas
Naveau, Joliot

AICHA is a whole-brain population-level atlas of homotopic regions of the resting brain. This atlas was created at the basis of BOLD fMRI resting-state functional connectivity of 282 subjects. Homotopic regions were mapped with the same color. Only 6 color were used for the color mapping, regions sharing a border were mapped with different colors, accordingly to the 3-Dimensionnal version of the “4 color map theorem”.

Space Ship
Alexander Schäfer

Connectivity was assessed using DSI. Parcellation into 1016 regions from the lausanne2008 atlas. Vizualisation using gephi.

Super highways of the brain
Sudhir Pathak

These are seven major fiber bundle in human brain. These fiber tracks are created using DSI Studio and render in TrackVis.

Edge-bundled DSI and resting-state connectivity
Joachim Böttger

The image shows the result of the application of a method from the field of information visualization, force-directed edge-bundling, to two connectivity datasets. Both graphs (DSI-based on the left and resting-state based on the right) contain nearly 4000 single connections between 1015 regions of interest, which makes their visualization in anatomical 3D brain space a challenge. Edge-bundling groups together similar connections through the simulation of electrostatic attraction forces, and thus helps to make underlying structure visible.

Pieces of the puzzle
Erik Ziegler, Cyclotron Art Committee

The piece depicts functional connectivity networks and their interplay in the brain.

Mapping Morphometry and Connectedness of the Human Brain
John Van Horn

A representation of brain morphometry and connectivity obtained from anatomical and diffusion magnetic resonance imaging (MRI) of N=110 adult human subjects. Colors of the outermost ring map to the regionally-specific colored parcellations. The innermost rings represent average regional volume, surface area, thickness, curvature, and degree of regionally-specific connectedness, respectively. Connections between regions obtained using 30-direction diffusion weighted imaging are weighted by color (reflecting white matter fiber integrity; low=blue; medium=green; high=red) and opacity (reflecting fiber bundle density). Such maps provide a comprehensive picture of the brain’s information processing architecture as viewed using in vivo neuroimaging methods. Courtesy of C. Torgerson, M. Chambers, A. Irimia, and j. Van Horn, Laboratory of Neuro Imaging (LONI).

2. Best Abstract Brain Illustration

Brain String Theory
Jeremy Strain

This is a fractional anisotropy map with exaggerated tensors (Jagged Lines). White matter regions are accented by overlaying each generated fiber bundle.

Left Brain! Right Brain.
Christopher R Madan

Inspired by the popular science view of brain lateralization, where the left hemisphere of the brain is responsible for art and creative thought, and the right hemisphere is the basis for logic and scientific endeavours. As researchers we often have to find a balance when describing and illustrating our results in manuscript prose and figures. We need to ensure we stay true to the facts and nuances of our experiments and their findings. However, we also need to be creative in finding connections between our present study and existing research, as well as everyday life.

Designed from a structural image of my own brain, rendered in MRIcroGL, composed in Adobe Photoshop.

Color Illustration Charges
Lucina Uddin

The cost of color illustrations will be charged to the authors at the rate of $650 per color illustration for the first color figure in each article and $100 for each additional figure.

Cajal
Beatriz Martin Villalba

To commemorate the 160th birth anniversary of Nobel laureate and father of neuroscience Santiago Ramon y Cajal, this editorial illustration was created with pastel, Adobe (c) Photoshop and Adobe (c) InDesign.

White Matter Font
Jeremy Strain

Combinations of the white matter tracts from the JHU atlas were used to make the letters. The actual images were created in FSL and then put together in photoshop. The image includes the following tracts; Corticospinal tract, Forceps Major, Forceps Minor, Inferior longitudinal Fasciculus, Fronto-Occipital Fasciculus, and Frontal Thalamic Radiation. Can you identify them all?

"We do not look at fiber tracts but ghosts of fiber tracts."
Lars Meyer

The image was created on single-participant DWI data from which a DTI representation was generated. Based on the BOLD response during working memory-intensive or shuffled word orders, the crucial white matter connections of the involved brain regions were unraveled. The submission title is a quote by Nina Dronkers—nutshellishly describing the phenomenology of fiber tracking.

Neuron Network
Christian Behl

The painting (Neuron Network) was made by myself. The piece of art shows acryl colors on canvas, the blue neuron structures are made by methylen blue, a dye that we also use for the staining of tissue. For me as neurobiochemist neurons are the network structures of the brain, of course, but they open also the world of thinking, symbolized by the white window in the painiting!

Connectome Turtle
Alexander Schäfer

Connectivity derived from resting state data. Lausanne Parcellation2008 in 463 regions. Visualization using gephi.

Lace Brain
Michel Thiebaut de Schotten, Benedicte Batrancourt

The piece was created using diffusion images, photoshop color filters and a final filter called percolator.

Throw the DICE
Erik van Oort

It depicts the frequency dependence of resting state networks. Current belief is that this information lives below 0.1 Hz. These results prove that this belief is wrong.

Psychedelic Parcellations
Erik van Oort

Parcellations of the human cortex based on single subject ICA.

Something's Fishy
Jeremy Ullmann

Visualizations of fiber track data from dMRI of the Zebrafish brain

Portrait Sagittal
Marie-Luise Brandi

A portrait in profile including an illustration of a sagittal view of the brain. The picture was made with drawing ink and colored pencils.

Masked Fears
Carlos Toledo

Allegoric depiction of fear masking in amygdala. One group of nerve cells in the brain controls the fear behaviour (right). This can be suppressed by a second group of nerve cells (left) – but the fear is only masked, and has not disappeared completely. Slightly modified version of illustration used for:

Vlachos I, Herry C, Lüthi A, Aertsen A and Kumar A (2011) Context-Dependent Encoding of Fear and Extinction Memories in a Large-Scale Network Model of the Basal Amygdala. PLoS Comput Biol 7(3): e1001104. doi:10.1371/journal.pcbi.1001104

It's in your hands
Dietsje Jolles

Brain development is not just the unfolding of a genetically preprogrammed trajectory. You influence the development of your brain by everything that you do, think, and feel. It's in your hands.

I created this image when I was writing my PhD thesis about Neurocognitive development and training of working memory.

The Blood-Brain Barrier, Networks, and Memories
Rick Garner

This image contains tree, vascular, mapping and graphing imagery that symbolically represents the functions of the brain and the workings of neuroscience. It visually depicts the layers of complexity in the brain's functioning and networks, as well as the intricate task of deciphering the brain-mind.

Brain and Mind
Tullio DeSantis

Computer generated and altered images of artist-rendered pen and ink drawing superimposed over digitally altered image of human brain, interwoven with EEG map of artist's brainwaves.

3. Best Educational Brain Illustration

Cerebral Infiltration
Maxime Chamberland

Effects of a high-grade brain tumor on the white matter fibers of the brain. Fibers are colored (red to blue) according to their closest distance to the tumor, which provides an efficient way to visualize the impact of the tumor or tumor resection on the brain's white matter.

Interactive 3D-Brain
dasGehirn.info, 3 de luxe

dasGehirn.info is a project of the German Society for Neuroscience (NWG), Hertie-Foundation and the centre for art and media technology (ZKM). It is a journalistic multimedia website to inform interested laypersons about the brain. Every six weeks we cover a new topic , like "emotion", "memory" or "money and the brain".
One speciality of dasgehirn.info is an interactive 3D-Brain. Users can rotate it, mouse over labels to highlight the structure, click to get more information - including interactive graphics, animations and text – and zoom into the structure. For example Limbic system > Hippocampus > cell structure. There are also filters (three by now) to show special functional areas.
The brain is closely linked to the other content on the portal: An article about seeing depth might link to the visual pathway, while in the 3D-Brain the visual pathway offers an animation about vision in 3D or an interactive graphic about the effects of lesions on the visual pathway.
The informations about the anatomy of the brain were gathered with graphics, real brain scans and advices of an anatomist from the NWG. Everything we offer can be used for non-commercial purposes. Most of it – apart from the 3D-Brain – can be downloaded.
The link below won´t work with IE. If you go to http://dasgehirn.info you find the 3D-Brain on the right side. http://dasgehirn.info/#3dgehirn

Optic Radiation with End points
Sudhir Pathak

This is the fiber tract create usign DSI Studio and render in TrackVis. Yellow point are endpoints of optic Radiation fiber tracts.

Corpus Callosum
Sudhir Pathak

Corpus Callousm is major fiber bundle connecting two hemisphere. This image is create using DSI Studio and rendered in TrackVis.

MyAmazingBrain
James Rowe

This montage was created by 7 year olds, during an Outreach Neuroscience Day at Newnham Croft Primary School. The children were so engaged by talking about what their brains were for, how they worked, and how to look after their brains (exercise, good food, bicycle helmet and lots of learning!). They had a hilarious time getting tendon reflexes, pulillary refelxes and a shout-it-out-loud Stroop test. However, the highlight for me is always when the children draw their own brains, with such creativity, vivacity and imagination, whether picking up on localisation (see the blue picture's annotations of 'food bit' and 'thinking bit') or the colours or the gyrating gyri. Truly amazing brains.

4. Best Humorous Brain Illustration

Discover your self
Andreas Hahn, Georg S Kranz

Pictured is the human brain's activity of the default mode network reflected by the serotonin-1A receptor distribution in the mirror. This major inhibitory receptor subtype of the serotonin system modulates the default mode network which is in turn active during self-referential processing classically depicted by the reflection of oneself in a mirror.

Latest Trend
Jeremy Strain, Bambi Delarosa, Hsueh-Sheng Chiang, Neena Rao

Dresses were selected to represent increasing intensity from trend level to significant. The color bar at the top right shows the price scale similar to one seen for activation maps for fMRI images. Brains were made from FSL using the 3D viewer.

Brainunculus
Judy Kipping

The piece was created using 3DSlicer (http://www.slicer.org/) and an anatomical cerebral and thalamic volume.
Both, resemblance of the shape of the thalamus and the cerebral cortex represented here in 3D and the importance of the thalamus as a gating station in conveying information to the cerebral cortex, inspires the thalamus to be seen as the brainunculus.

Mind map
Paul Holloway

"If only creating the human connectome were as easy as drawing a map"
Collage and pen on paper.

CogniToo
staff CogniToo

Instead of submitting an illustration, we send you the concept for a hompage.
Everyone's individuality is expressed by unique neural signaling in the brain. Likewise, we observe a growing desire of the (high)society to express the individuality through fancy tattoos. With our new start-up we take the opportunity and satisfy this need with the most unique and individual solution the world of science currently offers. Bringing together state-of-the-art neuroscience and the most recommended international tattoo artists,the CogniToo is the best way to express one's individuality. This new brand label offers a broad range of high-quality brain-art products that are in a visually appealing and, surely, idiosyncratic way.
As the homepage www.cognitoo.com has not been launched yet, we apply for this year's Brain-Art Competition with a prospect of what can be expected soon. Our team currently refines the design language of our brain-art products to offer the most compelling tattoo-art experience. Nevertheless we are convinced that the committee will honor the CogniToo project and recognizes our efforts to satisfy the needs of society with the tools that science offer.
If you are interested in getting a CogniToo ahead of the official release date you will negotiate a special offer. This should not be considered a bribe - what we would unreservedly condemn - but give you the unique opportunity to complement your judgement with the personal experience of wearing a CogniToo.

Kind regards,
The CogniToo Staff

Anti-Brain
Martin N. Hebart, Christopher R. Madan

[to be read with an ominous voice]
Brain space – the final frontier. Imagine a transformation of your brain to a brain template. In brain space this moves your brain to the center of space: The template or NEXUS of brain space. If you reapply this transformation you end up at the opposite location in space. You have created – the ANTI-BRAIN.

Cool brain
Elisenda Eixarch, Dafnis Batalle, Ariadna Arbat, Emma Munoz-Moreno

Step 1. T1-weighted, diffusion MRI and tractography of the brain.
Step 2. Put the brain in the ice cube tray
Step 3. Freeze your brain
Now, you have a cool brain!!

From the brain of:
Christopher R Madan

Inspired by letterheads and stamps that say "from the desk of".

Designed from a structural image of my own brain, rendered in MRIcroGL, composed in Adobe Illustrator and Photoshop.

The Long and Winding DETI Road
Rumana Chowdhury

5. Best Video Illustration of the Brain

Spontaneous connectivity dynamics at rest
R. Matthew Hutchison

Dynamic correlations in the anesthetized monkey brain. Resting-state fMRI was collected at 7T. A sliding window correlation analysis (30s window) was used to reveal changing cortical correlation patterns over time with a seed region placed in the left frontal eye field.

The Brain at Rest
Martijn D. Steenwijk

By visualizing both diffusion tensor and resting-state functional MR data, this movie illustrates different concepts of image processing, connectivity and activity in a real human brain at rest. Background music was composed by assigning a musical instrument to the ten strongest functional patterns in the brain. The intensities of these patterns vary over time while the person is at rest in the scanner – these are “spontaneous” brain fluctuations that receive much attention in fMRI research now. By linking the intensity of each pattern to the pitch of its respective instrument a melody is generated, thereby making brain activity audible. The first part of the movie illustrates the source of the melody by showing functional patterns and their varying strengths. The second part shows the major fiber bundles which were obtained by running deterministic tractography from atlas seeds. In the third part, the seeds were replaced by spherical objects 'running' around the cortical surface. The last part combines structural connectivity with functional connectivity. Here, functional connectivity is visualized using volume rendering of the voxelwise functional correlation matrix. Together with its structural counterpart, this last part illustrates that structural and functional connectivity are quite different.

Dynamics of fMRI-based neurofeedback training: sensorimotor cortices responsible for finger movements
Tibor Auer

Left and right sensorimotor cortices (SMC) were identified on single subject level using a functional localizer task (green blobs). During four weeks of training (three sessions per week), the fMRI signal difference between the left and right SMC, elicited by motor imagery, was visually presented to the subjects in real time. Each session consisted of two runs of right-sided and left-sided imaginary movements each. For a successful subject, each run was analyzed using FSL and thresholded using iterative two-threshold analysis (Abstract number: 5312). Activation (red-yellow) and deactivation maps (blue-white) were overlaid on the subject’s cortical surface reconstructed using Freesurfer.

The videos demonstrate that, during the initial sessions the right-hand training recruits an ipsilateral deactivation, whereas the left-hand training elicits a higher contralateral activation. In the second half of the training sessions the ipsilateral deactivation vanishes and the strength of the contralateral activation reaches a plateau for both hands. (Abstract number: 6742)

Memory on the level of cells
dasGehirn.info, 3 de luxe

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One of the videos we offer is about long term potentiation. The text is unfortunatly in German. It is the most viewed video on dasGehirn.info

BOLD Response
Alex Turbyfield

This film depicts what occurs in the brain during the BOLD Response of an FMRI scan. It was made through a combination of 3d animation and composition.

Colour makes the world go round
Erik van Oort

3D rotating render, created with an homebrew matlabscript, of a single subject ICA based parcellation of the human brain.

Re:Vision
Dan Lloyd

The textbook model of the brain imagines a task-driven organ that switches from task to task in lockstep with experimental conditions. Vision a classic example, as a flashing checkerboard drove activity in occipital cortex in the earliest demonstrations of fMRI research potential. But even as the visual cortex "lights up," what is the rest of the brain doing? This video displays more of the story. One subject gazes at a fixation point while an annular checkerboard flashes right, then left, and as it flashes he taps thumb to fingers in succession on the same side as the checkerboard. Here, in real time, a stationary checkerboard marks the onset and offset of the stimulus. Independent Component Analysis extracts twenty temporally coherent networks, each with its own color, ranging from red to blue proportionately to its overall oscillating frequency. For clarity, components most coordinated with the stimulus are yellow. Visualization is enhanced with sonification, where pentatonic tones correspond to frequencies, and loudness to the intensity of activity. Toward the middle, the video mixes an alternative data-driven sonification method, where rhythm also indicates increasing activity, to provide some aesthetic variation. In our brains, we find a symphony. (Data and ICA toolbox: http://mialab.mrn.org/software/)

Brainflow
Alfred Anwander and Robin M Heidemann

The brain consists of a complex 3D network of connecting axons. Ultra-high resolution Diffusion MRI reveals traces of the brain architecture by measuring the influence of the tissue structure on the mobility of water molecules. Following the traces in 3D highlights the amazing arrangement of the labyrinth of connections.

The video shows a series of coronal, sagittal and axial slices of a healthy human brain measured at 1mm isotropic resolution with a 7T MR scanner and reconstructed using fiber tractography and track-density imaging. The color correspond to the local tissue orientations (red: left-right, green: front-back, blue: top-down) and the intensity to the number of locally reconstructed traces.