

BrainX

Features

The screenshot displays the BrainX software interface, which is used for designing and arranging stimuli for experiments. The interface includes a menu bar (File, Edit, View, Auditory, Visual, Video, Sensorimotor, Cognitive, Paradigm, Tools, Window, Help) and a toolbar with various icons for stimulus design and arrangement.

The main window is divided into two panels:

- Design stimuli:** This panel shows a table of stimuli with columns for Stimulus ID, Mode, Trigger, Response, Trial, Duration, Interval, Name, SlfRnd-Tl..., SlfRnd-Intvl, and Enrollment. The table lists 7 stimuli with various modes (Auditory, Visual, Sensory, Motor, Parallel, Link, Response...) and triggers (PP1-71;).
- Arrange stimuli:** This panel shows a table of stimuli with columns for Present Order, Name, Duration(ms), Interval(ms), and Expected Time. The table lists 23 stimuli with various names (Sensory, PatternLink, PatternReversal, Response Sele..., SineSnd) and durations (300 ms).

Red text annotations are present on the screenshot:

- Design stimuli:** Located above the Design stimuli panel.
- What you see is what you get:** Located in the center of the Arrange stimuli panel.
- Arrange stimuli:** Located below the Arrange stimuli panel.

The status bar at the bottom of the window shows "Ready" and "NUM".

DISCLAIMER

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Features and specifications of this software program are subject to change without notice. This manual contains information and images about BrainX, its user interface, GUI and its other signal processing algorithms, publications that are protected by copyright.

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Sending Your Comments and Critiques: We'd like to hear from you. Your comments and suggestions for improving this document are welcome and appreciated. Please e-mail your feedback to: BrainX@live.com

Thank you.

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What You See Is What You Get (WYSIWYG)

BrainX has two panels. The stimulation panel enables users to design and edit the property and parameter of the stimuli. The presentation and delivery panels allow users to check and arrange how the stimuli will be presented and delivered. It provides the anticipated time points for users to check what you will get.

Multi-modal Stimulus Delivery

BrainX can deliver images, graphics, video, audio, language, somatosensory, motor, parallel pattern, link pattern, and response-selection pattern all at the same time. Play multiple videos and multiple sounds, mixed with any number of many graphical elements. You are only limited by the memory and speed of your computer system.

Productivity and Reliability

BrainX takes advantage of modern PC technology to provide intuitive graphic interface for users to design and implement experiments in a very efficient way. The foundation of BrainX and all features are designed and implemented with productivity and Reliability in mind.

Power and Precision

BrainX takes advantage of modern PC gaming technology and kernel driver to provide powerful and flexible stimulus displays, while at the same time accurately logging all stimulus and response events. The foundation of Presentation and all features are designed and implemented with precision in mind.

Multiple Graphical Elements

Arbitrarily many graphical elements of any type may be combined or displayed simultaneously - picture, drawing, image, motion, zooming and language.

Display Control

For common types of stimuli, the display can be changed on every vertical refresh. BrainX directly control the video cards and stimulus scheduling can be done to achieve desired refresh count durations. BrainX enables users to run paradigm at any display resolution that the video card supports.

Image Control (at Pixel Level)

BrainX enable users to generate random pixel/voxel to precisely define the stimulus. BrainX can generate random pixel with precisely defined color or gray scale. BrainX can apply a color profile to control the color balance of your display.

Multiple Display

BrainX enable users to control screen, you may have arbitrarily many stimulus displays showing stimuli, depending on your hardware and drivers.

High Synchronization

For visual stimuli, all display changes are synchronized with the vertical refresh of the video card signal. BrainX directly control the video card and stimulation times for visual events are synchronized with screen refresh.

Precise Image Position and Visual Angle

BrainX provides graphic tools for users to precisely define the position and visual angle. All visual stimuli related parameters for an experiment may be specified in pixels, or in your own custom units, including visual angles. A graphic visual angle calculator has been provided for productivity, accuracy and efficiency.

Language and Text

BrainX provides graphic tools for users to precisely define the text, font, color and background. It can generate text in any installed font. Unicode is supported.

Generate Patterns and Read Images (a variety of formats)

BrainX provides graphic tools for users to make patterns (e.g. Checker board, check circles, random pixel, random dots), shapes (annuli, linear gradients, polygons, circular gradients, radial gradients, square, ellipses, arrows, lines, Gaussians patterns) and motion picture (moving and zooming).

3D Pictures and Objects

BrainX supports Direct3D and OpenGL. It provides graphic tools for users to load and make 3D picture. It enables lighting control, stereoscopic display, camera control, texture control and a variety of shapes.

Video and Animation

BrainX supports DirectShow and enable user to customize display, size, location and the playback control. It can have multiple simultaneous videos. It allows users to control speed and mix with other stimuli, Kinect video streaming.

Sound and Vocalization

BrainX plays multiple auditory stimuli at the same time. It can loop auditory stimuli indefinitely. In addition, it can also record sound. It supports multiple speakers without limitation (depending on users' system). Furthermore, it can generate events and port output from cue events stored in the data.

Auditory Stimulation Control

BrainX can handle multiple simultaneous and/or sequential sound files, with control over left/right panning and frequency (Hz). It can highly synchronize auditory stimuli with other stimuli such visual, somatosensory and motor stimuli.

Making Tone and White Noise

BrainX can generate sine/cosine/square tone and white noise (random auditory signals). It directly controls the audio cards and provides sub-millisecond playback accuracy in qualified card. The program automatically reset the buffer for high-quality.

Feedback Control

Feedback or responses from subjects (Motor or vocalization) can be used to trigger fMRI/MEG/EEG systems. For motor response, the force or characteristic can be recorded.

Response Monitoring

BrainX can monitor responses from a variety of devices. Keyboard responses, Lumitouch, mouse, HID devices, customized port devices (serial, parallel and USB), DirectX compatible Game Controller, Joystick.

Sound Monitoring

BrainX can monitor sound from a variety of devices such as Microphone in computer or remotely connected sound recorders. BrainX supports sound thresholding. It can Generate response events by thresholding audio input data. Audio data following events can optionally be saved to disk.

Response Dependent Task

BrainX has a well-designed “Response-Selection” module. Automatic classification and pairing of stimuli and responses makes feedback easy. Consequently, it makes arbitrary response dependent task easy and reliable.

Response Time Coding

BrainX has timing resolution of sub-millisecond. Response timing is synchronized with the screen display so timing always begins when the screen first begins to draw (eliminates random error in typical software). It uses Microsoft's DirectX to gain the fastest access possible to input events from the keyboard, mouse, joystick and soundcard. BrainX can collect multiple response times on a single trial. It can also collect key release response times in addition to key press times. BrainX automatically check the valid keys for any response.

Multiple Response Inputs

BrainX has access to input events from the keyboard, mouse, joystick and soundcard. BrainX can collect multiple response times on a single trial. At the same time, BrainX can “hear” voice responses via microphone connected to the computer. In addition, BrainX can generate events with the “voice response” to select stimuli and trigger the fMRI/EEG/MEG systems.

Timing and Jittering (uncertainty)

BrainX has a great variety of features for visual, auditory, sensory and motor stimulus delivery, response monitoring, and interfacing. BrainX is specifically designed to allow simultaneous use of all of these features while still maintaining precise stimulus delivery and accurate event logging. For example, play multiple sounds, present multiple visual stimuli changing every vertical refresh, produce synchronized port output, and monitor responses occurring any time, all at the same time. If there are any performance issues for a particular system for a demanding experiment, you can address them before collecting data.

Run-Time Logging

BrainX is architected from the ground up to detect system interruptions that affect the accuracy of time measurements. It has a well-designed logging function which can save the events into log files. The files contain time and system uncertainty measures for all logged events. You control what is logged and how it is identified. In addition to analysis, you can use this data to ensure the accurate presentation and monitoring of your stimuli and responses on every run. For all logged events, BrainX reports a system uncertainty value that reflects the accuracy of the time measurement for that event. This ensures that system interruptions or other functions do not compromise time measurement without notification. Typical uncertainty values are in the tenths of milliseconds range.

Analysis of Event Data (in log file)

BrainX can save event data during the test into a ASCII file. In addition, users can copy and paste the log data straight into Excel or SPSS or other analysis software. You can use the data to analyze subject's performance, such as response time and correct ratio. In addition, combined with knowledge of the display, audio, and response hardware timing characteristics, you can analyze or ensure accurate timing of your experiment.

Advanced Port Controls

BrainX has advanced port control functions. It can store values and times for signals sent and received on supported ports. Those values can be accessed during the experiment as well as saved to data files. The software currently support standard Parallel ports, some customized parallel ports (e.g. national instruments device, USB-parallel adaptors), standard TCP/IP, standard serial port, USB port (1.0,2.0 and 3.0), eye tracker, BP monitor.

Powerful Randomization Function

BrainX has advanced functions to randomize stimuli (true random, ABAB pattern, AABB pattern, arrange stimuli with randomized codes from other software). It has extremely flexible trial design which can change from one trial to the next. With

Select and Jump during Run-Time

BrainX has "response-selection" module. Even during the test or task, BrainX can skip stimuli when a particular key is pressed on any trial. In addition, BrainX has the option of self-paced or time-limited responses.

Preface and Endnote

BrainX has preface to include an introduction or explanation for subjects to get ready. In addition, it has endnote to express acknowledgements or explanation of the next steps. When using multiple monitors, or during non-visual experiments, BrainX can display progress to the experimenter. Users can easily create full screens of instructions with formatted text.

Extensibility

BrainX provides interface for developers to add plugin or additional function. Developers can superimpose custom graphics you make (e.g., special rating scales) over any other image or text.

Other Technical Details

BrainX Features

- ❖ Text Display: Allows presentation of a full screen of text.
- ❖ Image Display: Allows presentation of images in multiple formats (e.g.: *.bmp, *.jpg, *.jpeg, *.gif, *.png, *.tif, *.tiff).
- ❖ Movie Display: Allows presentation of movies in multiple formats (e.g.: *.mpeg, *.avi, *.wmv).
- ❖ Slides: Allows presentation of a combination of text, images, movies and/or sound
- ❖ List Contains all independent variables, attributes, and stimuli as well as controls sampling.
- ❖ Speakers: Allows presentation of sound files in multiple formats (e.g. *.wav *.mp3 and *.wma).
- ❖ Microphone: Allows the recording of audio.
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