Bussey-Saksida

The Second Generation Touch Screen System

A Translational Cognition Task Battery

Rodent Continuous Performance Task

Two-choice Visual Discrimination Reversal

Lafayette Instrument®

THE BEHAVIORAL COGNITION TEST BATTERY

A decade of continuous development.

Where it all began

In 2009, Professors Tim Bussey and Lisa Saksida, of the Translational Cognitive Neuroscience Lab Cambridge University, England; began a partnership with Campden Instruments to enlist our engineering & manufacturing expertise and the Bussey-Saksida Rodent Touchscreen System was born. This rodent system was a progression of the CANTAB touch screen systems for NHP and Human subjects used in cognitive testing and diagnosis.

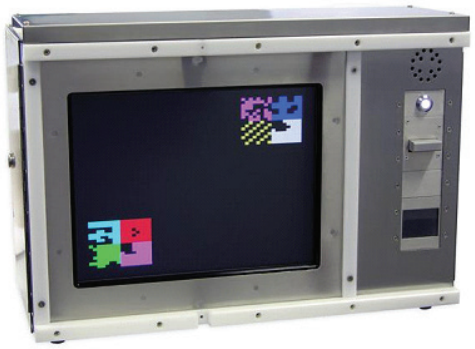
New - Day/Night dimmer-timer control option

A decade of development

Campden Instruments has built **over 1800 individual Bussey-Saksida Touch Screen chambers for over 300 Research Groups in over 25 countries**, integrating many third-party systems including optogenetics, video tracking, photometry, wireless and tethered electrophysiology, modular designs for exercise and dietary studies, day- night environmental control, and air-puff aversive stimuli.

Successful species

The Grey Mouse Lemur and Tree Shrew have also successfully been published in the rodent touch screens along with the 14 standard Tasks for rat and mouse.



MCANTAB touch screen system

The multiple Task battery translates to primate species using the MCANTAB system include, Macaque, Squirrel Monkey, Rhesus, Baboon & Marmoset and human CANTAB Tasks.

MCANTAB and WhiskerServer® originate from the Department of Experimental Psychology, University of Cambridge, England. Whisker® has been cited in over 142 publications across more than 30 journals.

Bussey and Saksida are now resident at University of Western Ontario and provide a center for the global community of researchers in rodent cognition.

Full Paradigm task reference and bibliography is available

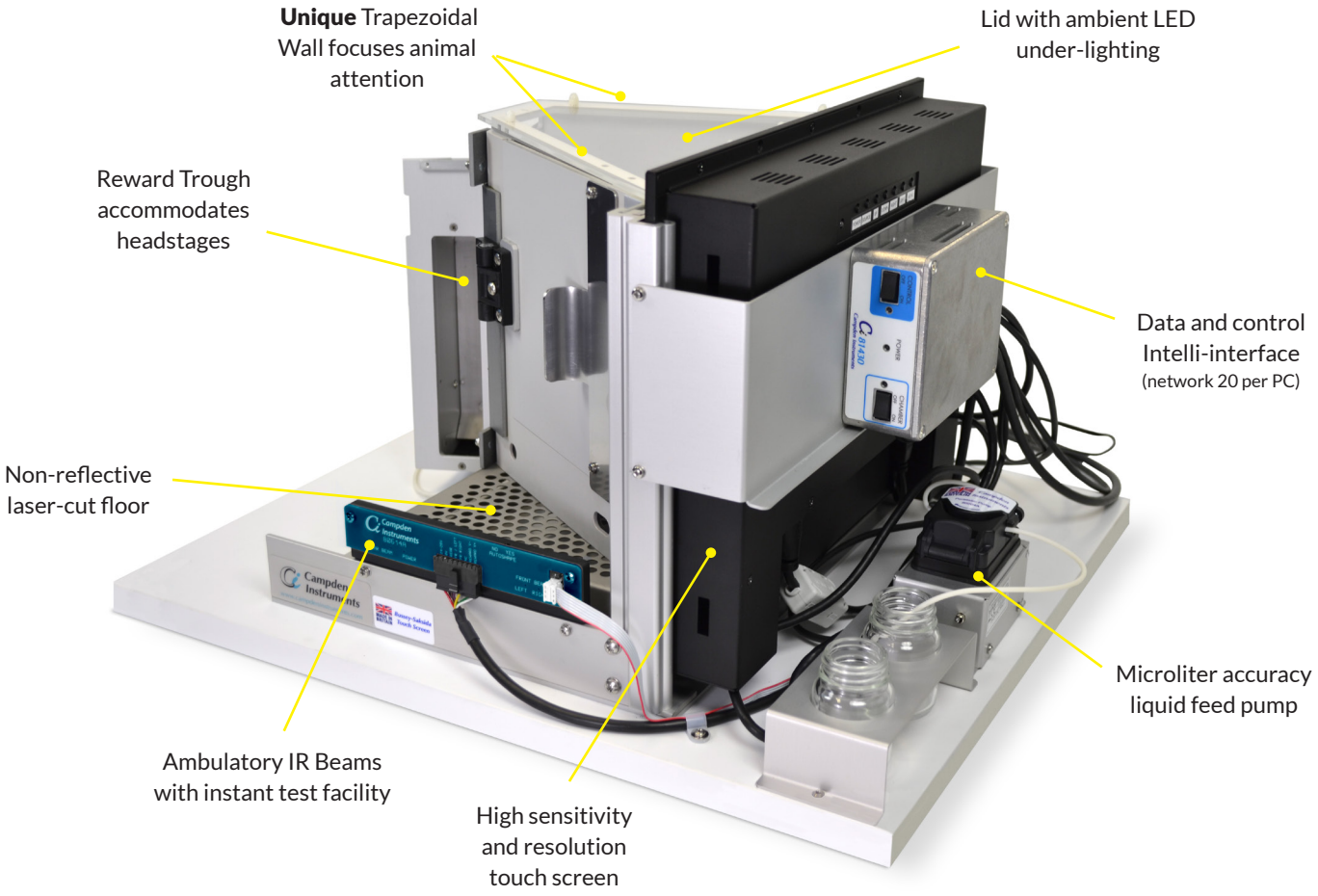
Selected References

Palmer, D., Dumont, J. R., Dexter, T. D., Prado, M. A. M., Finger, E., Bussey, T. J., & Saksida, L. M. (2021). Touchscreen cognitive testing: Cross-species translation and co-clinical trials in neurodegenerative and neuropsychiatric disease. In Neurobiology of Learning and Memory (Vol. 182, p. 107443). https://doi.org/10.1016/j.nlm.2021.107443

Lopez-Cruz, L., Bussey, T. J., Saksida, L. M., & Heath, C. J. (2021). Using touchscreen-delivered cognitive assessments to address the principles of the 3Rs in behavioral sciences. In Lab Animal (Vol. 50, Issue 7, pp. 174–184) https://doi.org/10.1038/s41684-021-00791-2

THE SECOND GENERATION SYSTEM

Evolution: the new Bussey-Saksida Chamber.



The Bussey-Saksida Chamber has always featured a **unique trapezoidal wall shape** in order to focus the animal's attention and facilitates the efficient and high-throughput cognitive evaluation of rodents. The chamber is **easily reconfigured** to a modular square arena with panels, levers, lights, and a range of other operators.

New Features

- On-chamber intelli-interface, allows **up to 20 chambers to be networked to a single computer or laptop**
- Intelli-interface eliminates any possible interruption of the millisecond timing by third party software
- Opto-isolated TTL input and output lines available for 3rd party systems.
- Easier animal handling with side or top loading as standard
- Ambulatory motion IR beams now have an **instant test facility and greater sensitivity**
- **Video and observation is improved** by lighter walls and a non-reflective floor
- Chamber lid contains built-in ambient IR and visual LEDs for even lighting while eliminating reflectance and glare
- Reward trough has pellet and dual liquid feed options plus a wider aperture to accommodate head-staged animals
- Modular design **minimizes reconfiguration** to accommodate tethered animals and/or electrophysiology recording
- For Integration with electrophysiology, all contact points between animal and chamber (floor, reward trough etc.) have **optional electrical isolation** coating to prevent movement artifacts

OPERANT CONTROL SOFTWARE

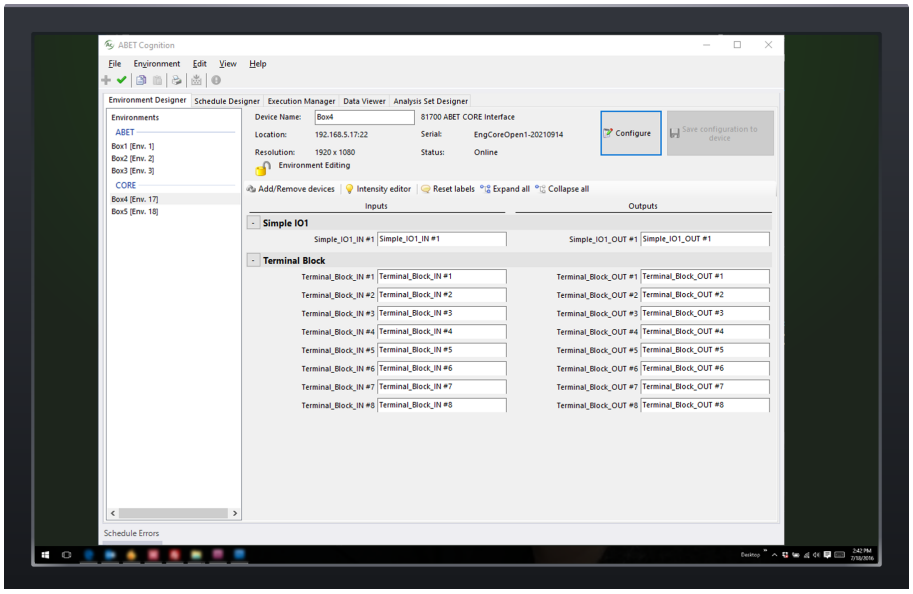
Sophisticated and user-friendly software makes controlling your chamber easy.

Tasks are designed to be plug and play and include all training stages

All Tasks can be edited for your own requirements

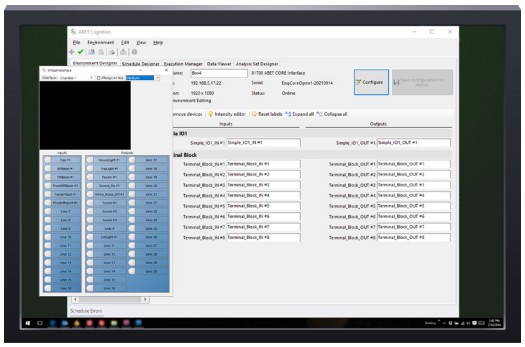
Write your own tasks from first principles and test them in the Virtual Interface

Import your own images and define on-screen location



ABET Cognition

The standard Bussey-Saksida applications have been created using Lafayette Instrument's ABET Cognition software. ABET **controls all aspects of acquisition, control, and data analysis**. Standard Tasks with training are prepackaged in a format that the user may **easily use or edit and modify**. Every effort has been made to make this **intuitive and logical to the non-programmer**, but we are on stand by, ready to assist in your efforts to produce original research.



ABET Virtual Interface

ABET Cognition can be installed on your office PC or laptop to use the Virtual Interface to duplicate the testing environment that you have in your lab - including a virtual touch screen giving a preview from the perspective of an animal. Write/program, review, and test schedules or analyze lab data while offline or disconnected from the lab hardware. Schedules and data are easily passed to and from your lab via a network connection or any removable media.

Contact us for a demonstration!

Touch Screen Webinar

Our full Touch Screen webinar entitled **"Using Touchscreen Operant Systems to Study Cognitive Behaviors in Rodents"** is available from InsideScientific, by scanning this code on your mobile device or visiting: **https://youtu.be/JBh5BJ-kUuA**

BENEFITS OF STANDARD PARADIGMS

Prewritten Standard Paradigms with established neuro-pathological relevance.

ABET allows usage of standard, original, and customized paradigms. Standard Task Paradigms are available by our arrangement with the University of Cambridge. Standard tasks include popular Tasks such as PD, PAL, 5CSRT, PRC, Location Discrimination, and many more. **All paradigms include training routines as well as the main experimental paradigm and the data analysis sets.** Full descriptions of our standard paradigms are available upon request or by visiting our website.

NHP/Human CANTAB Equivalent	Standard Tasks	Typical time to reach baseline (post-pretraining) RATS	Typical time to reach baseline (post-pretraining) MICE*	Example neural systems involved	Clinical area showing impairment
NHP	**Pretraining to touch an image and initiate a trial (PD, PAL, LD, VMCL & TUNL)**	1-2 weeks	1-2 weeks (e.g., 7-8 week old C57BL6J mice: 5 days)		
Human/NHP	**Pairwise / Visual Discrimination (PD)**	5-7 days	5-7 days for young mice	Prefrontal Cortex, Perirhinal Cortex, Striatum, Dopamine system, Cholinergic system, NMDA receptors	Huntington's, Schizophrenia, Parkinson's
Human/NHP	**Paired Associate Learning (PAL)**	35-45 sessions to 80%	35-45 sessions to 70%	Hippocampus, Cholinergic system, NMDA Receptors, AMPA Receptors	Alzheimer's, Schizophrenia
NHP	**Visuomotor Conditional Learning (VMCL)**	Approximately 20 sessions	Approximately 20 sessions	Dorsal Striatum, Posterior Cingulate Cortex	Huntington's, Parkinson's
NHP	**Location Discrimination Learning (LDL)**	2-4 weeks	2-4 weeks	Hippocampus, Neurogenesis	Alzheimer's, Schizophrenia, Depression
Human/NHP	**Trial-Unique Nonmatching-to-Location (TUNL)**	Approximately 4 weeks	6-24 Sessions to acquire the basic task	Hippocampus, Cholinergic system, NMDA Receptors	Alzheimer's
Human/NHP	**5 Choice Serial Reaction Time (5CSRT)**	30 sessions	Pretraining (ave 10 days) + 3 weeks to 80% @ 2 sec baseline	Prefrontal Cortex, Basal Forebrain, Cholinergic (Accuracy), Serotonin (Impulsivity), Noradrenaline (Distraction), Dopamine (Motivation)	Alzheimer's, Depression, Huntington's, Schizophrenia, ADHD, OCD
	Autoshaping (AUTO)	Several sessions	Several sessions	Ventral Striatum, Amygdala, Anterior Cingulate Cortex	Huntington's
NHP	**Extinction (EXT)**	Approximately 4 days training + a few days extinction	Approximately 4 days training + a few days extinction		ADHD, OCD
	5-Choice Continuous Performance Task (5C-CPT)**	Approximately 24 weeks (based on training in 5-hole box)	Approximately 13 weeks (based on training in 5-hole box) after training to 5-CSRTT	Dopamine, Serotonin, Colinergic, Parietal, Muscarinic.	Schizophrenia, ADHD, OCD, Alzheimer's
Human/NHP	**Rodent Continuous Performance Task (rCPT)**	Approximately 20 days	Approximately 35 sessions	Dopamine, Serotonin, Colinergic, Parietal, Muscarinic	Schizophrenia, ADHD, OCD, Alzheimer's
Human	**4-Choice Gambling Task (4C-GT)*****	Approximately 20 sessions (based on training in 5-hole box)	Training times to be confirmed	Dopamine, Serotonin	Bipolar Disorder, Gambling
NHP	**Progressive Ratio (PR) Task**	Results for rats not yet available	16 days from first habituation to reach stable PR performance	Dopamine	Motivation

* Depends on strain and age

** Young et al, The 5-Choice Continuous Performance Test: Evidence for a Translational Test of Vigilance for Mice. Plosone, January 19, 2009 DOI: 10.1371/journal.pone.0004227
Barnes et al. D_1 receptor activation improves vigilance in rats as measured by the 5-choice continuous performance test. Psychopharmacology (Berl). 2012 Mar;220(1):129-41

*** Zeeb et al. Sertonergic and Dopamine Modulation of Gambling Behaviour as Assessed Using a Novel Rat Gambling Task. Neuropsychopharmacolgy 2009 34,2329
van Enkhuizen et al. Differential effects of dopamine transporter inhibitors in the rodent Iowa Gambling Task: Relevance to mania. Psychopharmacology (Berl). Feb 2013; 225(3): 661–674

DELIVERED READY TO WORK

Plug & play hardware and tasks make set up a breeze.

All validated Tasks are complete with all training stages (Habituate, Initiate Touch, Must Touch, and Punish Incorrect) along with the main paradigm, and data analysis sets for each stage.

- Load ABET Cognition software and run a Task in a few mouse clicks.
- Use the Database Explorer to compare sessions by strain, by date, or by Task, By experiment and more
- Use the Virtual Touch screen to visualize the Task as the animal does.
- Analyze data and build new programs away from the lab with the Virtual Interface

The Importance of Acoustic Isolation: Prevent distraction during cognitive tasks

The Touchscreen chamber is akin to a student examination hall. People need a quiet environment without distractions to accomplish a task, and it is the same for an animal.

- Our Isolation Chambers were designed with the Institute of Sound and Vibration at the University of Derby England.
- Attenuation level ensures that sound between chambers is attenuated to around 35 DB, approximating to the background noise of a quiet room.
- Ergonomically designed for ease of animal handling and welfare with a ventilation fan.
- Remote camera observation/recording system that uses visual or IR illumination.
- Isolation Chambers are optionally available with built-in Faraday Cage for electromagnetic compatibility, to ensure artifact free in-vivo recording.

Isolation Chamber with Faraday cage lining

Easy Install System

The Easy-Install System

The Easy-Install trolley system rolls into your lab with all cables in place ready to connect to a PC and with a power distribution panel for all chambers, to statutory regulations.

- Keeps laboratory organized by hiding the many cables in trunking and the whole system is easily moveable for cleaning. The system is heavy due to the sound attenuation materials.
- User workstation with PC and camera observation monitor are located remotely from the system.

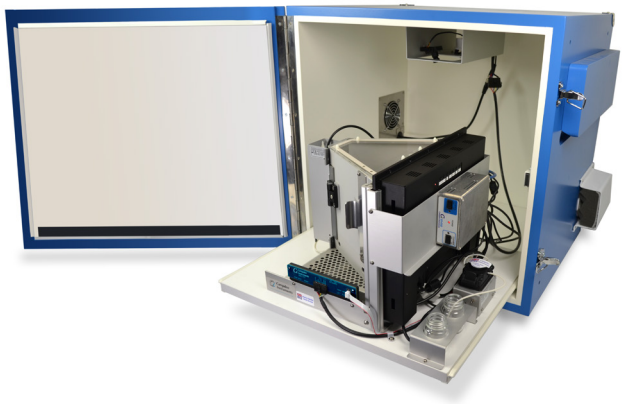
SYSTEM INTEGRATIONS

Customized system integrations also available.

Optogenetic Integration

Optogenetic-Integrated Bussey–Saksida Touch Screen chambers are available for single chambers, and dual or four chamber Easy- Install systems. The system has been designed to minimize the torque experienced by the animal while maximizing the light at the end of the implanted ferrule. Each chamber has independent ABET II linked control over each Optogenetic LED with easily defined simple or complex light patterns in software.

- Single chamber or Four chamber systems
- Flexible 0.5MA fiber cables
- 0.66NA 200/230µm Fiber stubs
- Response to Touch Screen: 1 or 2 LEDs per chamber – dual or single control
- TTL inputs (START/STOP/PAUSE/UNPAUSE)



Electrophysiology Integration

- Specially designed Lid and Door to accommodate Tethered Headstages
- Low Emission Pellet Dispenser Or Liquid pump
- Shielded Touch Screen Open Reward Trough for Headstages
- Faraday Cage and EMC Gasket

Video Tracking Integration

- Optimized IR lighting, illuminates subject but minimizes reflection
- Chamber design and materials for contrast as well as illumination
- No interference with other IR devices
- Software accounts for behavioral stimulus light
- Algorithms eliminate touch screen images and reflection
- Image contour is captured accurately and without distortion

New Illumination for high contrast video

Contact Us for a Quotation, a Full Bibliography, and More

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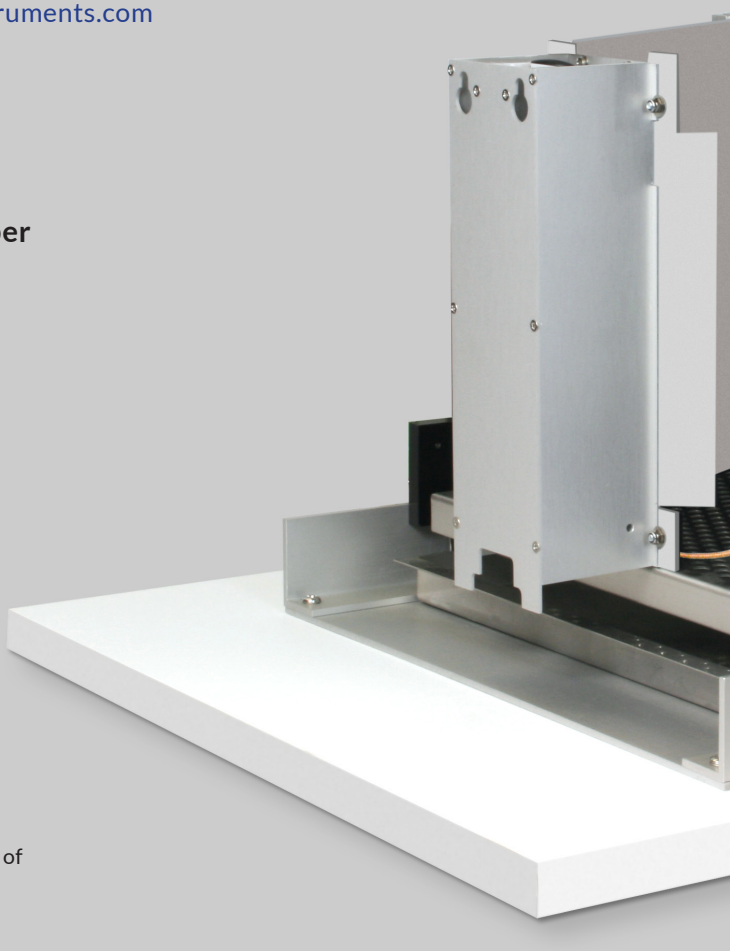
The Second Generation Bussey-Saksida Chamber

A control system for more chambers and data

Chambers with more features and flexibility



The Bussey-Saksida Chambers and WhiskerServer® originate from the department of Experimental Psychology, University of Cambridge, England.

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