



Serious about science: Serious about timing

# The Black Box ToolKit

## PRESS RELEASE

For Immediate Release

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Suggested search terms: [Computer experiment psychology](#), [millisecond timing error psychology](#), [input lag](#), [sound card startup latency](#), [keyboard response time](#), [voice key latency](#)

### Are cutting edge psychology experiments really as accurate as we are led to believe?

London, England – Supposedly high tech functional neuroimaging, EEG, eye tracking and cognitive psychology studies all make use of computers to present stimuli, synchronize with other equipment and record a person's response. But what if the computers and software used were, at least in part, responsible for any experimental effects rather than the experiment itself?

Often the computers in psychology studies are not doing, or cannot do, what researchers ask of them: they do not display images at the correct time, play sounds when requested, synchronize with other equipment properly or measure responses accurately. Whilst seasoned researchers may be aware of the issue of millisecond timing error, many choose to bury their heads in the sand as scientific journals and funders do not currently ask them to state accuracy limits. Other researchers simply believe any computer will slavishly do whatever they tell it!

Psychology is currently undergoing a crisis of confidence with regard to replication where numerous studies findings cannot be repeated. The validity of computer-based research is an issue that cuts to the core of modern experimental psychology and one that is potentially far more serious and widespread than individual cases of fabricated data, statistical manipulation or overstated effect sizes. To date computer-based studies have avoided being brought under the spotlight as they have been perceived as being more accurate, unbiased, and 'somehow' more trustworthy and less open to error or the outright frauds perpetrated in social psychology. This is a myth many have been happy to perpetuate. Worryingly potential sources of error in computer-based studies are well known and controlled for in other scientific disciplines. The following quote exemplifies how two vendors of software commonly used to run psychology experiments view the situation at present:

*How Much Will Your Experiment's Timing Differ From Ours? Honestly, it's almost impossible to tell. There are many sub-optimal combinations of hardware and software that could negatively affect your experiment's timing.*  
<http://www.paradigmexperiments.com/timing.html>, 2016

*E-Prime 2.0 reports millisecond accurate timing. This does not mean that E-Prime 2.0 is capable of making hardware do things it cannot. For experiment paradigms that require auditory stimuli, much care and concern should be considered with the hardware being used. Sound cards can have good or poor startup latency, which is the time from when E-Prime tells the sound card to play sound to when the sound actually emits from the sound card or speakers.* <http://www.pstnet.com/support/kb.asp?TopicID=5628>, 2016

Our newly updated Black Box ToolKit v2 hardware addresses such concerns by allowing researchers to independently and objectively check whether the study they think they are carrying out is actually working in the real world. Acting as a programmable virtual human that can detect and respond to a stimulus with sub-millisecond accuracy, it enables the researcher to check the validity of their own study whilst running in situ on their own equipment (known as self-validation).

Why does this matter and why now? This matters because researchers are increasingly making use of more advanced technologies. Hardly a day goes by without a study appearing in the mainstream press that purports to have found a new effect using such advanced technologies, e.g. fMRI study links..., priming study proves attitude to..., eye tracking study shows shoppers... or, EEG study reads the minds of... In addition the clinical effectiveness of many new drugs are now often measured at the behavioural level, but again what is to say that patient improvements are not a result of measurement error? Unfortunately many computer-based studies ultimately prove difficult to replicate reliably in different labs using different hardware and software. Variations between equipment can weaken or strengthen an effect, or make it disappear completely, even when identical experiment generator scripts are used and the same protocols followed. Even more uncertainty is introduced when web-based methods are used. In short, there is currently little consistency across the field or within individual labs. The Black Box ToolKit hopes to reverse this worrying trend by acting as the new gold standard.

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Founded in 2003 by a team of psychologists, software experts and electronic engineers The Black Box Toolkit Ltd is a UK based company dedicated to improving the methods used by researchers in the behavioural and brain sciences.