

The *PsyScope* experiment-building system

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Abstract—*PsyScope* is a system for building behavioral experiments on the Apple Macintosh computer using a graphic user interface that requires no computer programming. The program supports a wide variety of experimental designs, multimedia formats, and stimulus control. A freeware version is available at the author's web site.

1. DESCRIPTION

PsyScope is a system for building behavioral experiments on the Apple Macintosh computer. Many researchers have developed systems for laboratory timing and stimulus presentation using this computer (Chute, 1986; Bharucha *et al.*, 1987; Westall *et al.*, 1989; Rensink, 1990; Enns and Rensink, 1991; Busey, 1992; Doenias *et al.*, 1992; Goolkasian, 1993; Haxby *et al.*, 1993). Of the various experiment-building systems currently available, both on the Macintosh and the IBM-PC (Schneider, 1988), *PsyScope* is one of the most complete and powerful (Cohen *et al.*, 1993). Moreover, all of its basic functions can be accessed by the non-programmer user through a graphic user interface (GUI) that requires no experience with computer programming. Advanced users can modify the operation of the program by using the underlying structured programming language called PsyScript. Programmers can also extend the program by building plug-ins called PSYX extensions.

PsyScope is made available in two forms. As freeware, it can be retrieved from the authors' web site or from mirrors that are maintained in Japan and Belgium. Researchers who wish to use *PsyScope* as freeware have access to a full, working version of the program, the manual, and related resources. However, no help or support is provided for freeware users. Researchers who wish to use the newer PowerPC version of the program, who want to support the development effort, who want to use the QuickTime or EEG control plug-ins, or who have special support needs are encouraged to join the non-profit *PsyScope* consortium. The current fee for consortium membership is \$750 for the first machine and \$125 for each additional

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machine. Further information regarding consortium membership can be found at the authors' web site.

Because of its extensive facilities for controlling stimulus placement and sequencing, *PsyScope* is well-suited to work in the area of vision and psychophysics, as well as other parts of experimental psychology that focus on basic information processes and reaction-time methods. Because picture stimuli can be preloaded into memory, the display of pictures is limited by the power of the computer, rather than by the workings of the program. A graphic element, called the 'Factor Table', allows the user to represent the basic within-subject design types in terms of crossing and nestings of rows and columns. Possible designs include Latin square, Graeco-Latin square, blocked, nested, linked, matched, random factor, fixed factor, and all other major design types. Between-group factors and blocking factors can be controlled through a separate higher level of icon types. The actual events in a given trial can be determined by moving icons representing times and stimuli in an 'event template' window, based on the notion of time as moving left to right.

2. SAMPLE SCRIPTS

A variety of basic experiment types have been implemented as examples for students and are available at our web site. These include classic experiments such as Stroop, Encoding Specificity, Signal Detection, Mental Rotation, to cite just a few examples of the 30 different sample paradigms for which student scripts are available. Students can easily modify these sample scripts using the GUI to change stimulus duration, font size, screen placement, and other variables. A separate Macintosh application that facilitates analysis of the output from *PsyScope* is the PsyDat program which allows the user to tabulate means, trim outliers, and reformat groups of data output files in preparation for more extensive further analysis by programs such as SPSS, StatView, or SuperANOVA.

3. CODING FORMATS

PsyScope supports all of the major coding formats: it is capable of playing digitized sound or speech in AIFF, SDII, or SoundEdit16 formats; it can present words in Roman or non-Roman alphabets; it can display PICT and TIFF format, as well as QuickTime animations. For researchers who need full precise control over experimental timing, *PsyScope* can be run in conjunction with a piece of external hardware called the 'PsyScope button box' which provides timing accurate to one millisecond. The low-level timing routines required for this box and for the precise control of the screen have been worked out in detail and have been thoroughly tested on all machines in the Macintosh line. The only current limitation in timing relates to the fact that computers using Apple 3.0 Sound Manager will have a delay in the actual playing of sounds which must be calibrated separately for each machine type.

4. FUTURE VERSIONS

A new version of the program is currently under development in collaboration with Walter Schneider of PST, the developer of the MS-DOS program called MEL. The new version will run on both Macintosh and Windows operating systems and will provide greater user-determined extensibility through plug-in Visual Basic code fragments that can alter the working specific components of the system. The new system will include expanded Wizard support, a fuller system for output data management, and richer logging and testing capacities. This new system will also provide additional user control over psychophysical properties of the screen display that are currently addressed by systems such as *Morphonome* (Tyler and McBride, 1997) or *VideoToolbox* (Pelli, 1997).

5. AVAILABILITY

Researchers can retrieve *PsyScope* 1.1 and the *PsyScope* manual from the web site. The manual is available in Acrobat 3.0 pdf format which allows for printing, viewing, and moving across hypertext links.

REFERENCES

- Bharucha, J. J., Meike, B. and Baird, J. C. (1987). The Macintosh as a user-friendly laboratory for perception and cognition. *Behav. Res. Methods Instrum. Comput.* **19**, 131–134.
- Busey, T. (1992). Tachistoscopic software for Macintosh computers. *Behav. Res. Methods Instrum. Comput.* **24**, 426–430.
- Chute, D. L. (1986). MacLaboratory for Psychology: General experimental psychology with Apple's Macintosh. *Behav. Res. Methods Instrum. Comput.* **18**, 205–209.
- Cohen, J., MacWhinney, B., Flatt, M. and Provost, J. (1993). *PsyScope*: An interactive graphical system for designing and controlling experiments in the Psychology laboratory using Macintosh computers. *Behav. Res. Methods Instrum. Comput.* **25**, 257–271.
- Doenias, J. M., Langland, S. E. and Reisberg, D. (1992). A versatile, user-friendly tachistoscope for the Macintosh. *Behav. Res. Methods Instrum. Comput.* **24**, 434–438.
- Enns, J. T. and Rensink, R. A. (1991). VSearch Color: Full-color visual search experiments on the Macintosh II. *Behav. Res. Methods Instrum. Comput.* **23**, 265–272.
- Goolkasian, P. (1993). A review of Macintosh-based instructional software. *Behav. Res. Methods Instrum. Comput.* **25**, 164–167.
- Haxby, J. V., Parasuraman, R., Lalonde, R. and Abboud, H. (1993). SuperLab: General-purpose Macintosh software for human experimental psychology and psychological testing. *Behav. Res. Methods Instrum. Comput.* **25**, 400–405.
- Pelli, D. G. (1997). The *VideoToolbox* software for visual psychophysics: transforming numbers into movies. *Spatial Vision* **10**, 437–442.
- Rensink, R. (1990). Toolbox-based routines for Macintosh timing and display. *Behav. Res. Methods Instrum. Comput.* **22**, 105–117.
- Schneider, W. (1988). Enhancing a standard experimental delivery system (MEL) for advanced psychological experimentation. *Behav. Res. Methods Instrum. Comput.* **21**, 240–244.
- Tyler, C. W. and McBride, B. (1997). The *Morphonome* image psychophysics software and calibrator for Macintosh systems. *Spatial Vision* **10**, 479–484.
- Westall, R., Perkey, M. and Chute, D. (1989). Millisecond timing on the Apple Macintosh: Updating Drexel's MilliTimer. *Behav. Res. Methods Instrum. Comput.* **21**, 540–547.