Demonstration experiments in perception and cognitive psychology for the Macintosh computer

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A package of programs demonstrating psychology experiments widely cited in perception and cognitive psychology textbooks is described. The programs are suitable for laboratory research projects and in-class demonstrations. An attractive feature of the programs is that they have provisions for changing experimental parameters to allow students to design different experiments from the original programs. Iconic memory, memory scanning (using the additive factors approach), lexical decision, target detection, speeded classification, picture recognition/picture memory, and the Phi phenomenon can be demonstrated.

This paper describes a package of programs that demonstrate perception and cognitive psychology experiments. The programs are intended as an in-class and laboratory tool to demonstrate a number of research methods and paradigms used in perception and cognitive psychology research. In addition, the programs have provisions for changing experimental parameters so that students can design experiments different from those in the original programs. Programs follow the Macintosh user-interface guidelines and are, therefore, simple to use for students (and instructors) with minimal computer experience.

The software is written in Microsoft BASIC, with the occasional use of machine language routines (Lane & Ashby, 1987) for quick randomization, tachistoscopic presentation, response timing, stimuli creation, graphics presentation, and utilization of the Macintosh sound driver for auditory stimulus presentation. The programs are compiled (Microsoft BASIC Compiler) and, therefore, do not require the user to have a copy of Microsoft BASIC.

Figure 1 shows an example of the initial screen presented at the beginning of each program. The user has the option to run a demonstration of the experiment, run practice trials, run experimental trials, display experimental parameters, or quit. Selecting the PARAMETERS function allows the user to display preset parameters for the experiment and change these parameters, if necessary (see Figure 2). There are two options for data storage: one file per subject or one file containing data from a group of subjects. In addition, the user can specify whether data storage should include raw data, condition means, or both. Data are written to disk as text files with data points separated by tabs, thus making them easy to

read by other Macintosh programs. Once the OK button is selected on the parameters screen, the program returns to the initial screen. The user can then run practice trials, experimental trials, or a demonstration of the experiment. Prompts (i.e., a screen prompting the user to enter a subject identification) and experimental instructions are presented where appropriate. If the "display means" option is selected on the parameters screen, then the means are displayed at the conclusion of the experiment. As can be seen in Figure 3, a scroll bar is provided if there are more means than can be displayed on one screen. The user can scroll through the entire set of means and select the OK button when finished. The program then returns to the initial screen.

Documentation includes a section on each experiment, beginning with an explanation of the psychological phenomenon in question and a description of the classic experiment that the program was designed to replicate. Next, the included experiment is described. Both the how-tos of running the program and the methodological considerations, such as counterbalancing requirements and instructions to give a subject, are discussed. Documenta-

Figure 1. An example of the initial screen.

We thank Dean G. Jensen for his help in programming the speeded-classification experiment, Brad A. Ashby for his help in programming the target-detection experiment, and Cary R. Jensen for his help in generating the lexical-decision stimuli. Requests for reprints should be sent to the authors at Rice University, Department of Psychology, P.O. Box 1892, Houston, TX 77251.

SPEEDED-CLASSIFICATION PARAMETERS

NUMBER OF REPS ☒ 1 ☐ 2 ☐ 5 ☐ 10

NUMBER OF TRIALS ☐ 8 ☐ 12 ☐ 24 ☐ 48
 ☒ 96 ☐ 120

FIRST DIMENSION ☒ width ☐ height

KEEP MEANS ☒ yes ☐ no

DISPLAY MEANS ☒ yes ☐ no

KEEP RAW DATA ☒ yes ☐ no

SUBJECTS PER DATA FILE ☒ one ☐ multiple

Figure 2. An example of the parameters screen.

tion for the experiments also includes a general description of how to display the preset experimental parameters, change these parameters, and store and access means and/or raw data.

PROGRAM USES

The experiments are intended for use in perception, cognitive, and/or experimental psychology classes, although some of the experiments may be appropriate for introductory psychology classes as well. The programs are suitable for the following uses: (1) *In-class demonstrations of a classic experiment or experimental paradigm.* Selecting the DEMONSTRATION function on the initial screen runs a brief version of the experiment (under 5 min). Classrooms equipped with large monitors or a projection system can use this option to demonstrate an experiment

to an entire class. (2) *Laboratory experimentation.* In addition to providing students with firsthand experience in psychological research by enabling them to participate in classic experiments, independent research projects are possible since the experiments permit manipulation of experimental parameters.

EXPERIMENTS

Sperling's (1960) Partial-Report Paradigm

This experiment examines how much information subjects possess immediately after the presentation of a stimulus array (span of apprehension). A 3×4 array of letters is briefly presented. After a varying interval, a high, medium, or low tone indicates which row of letters to report. Accuracy in the whole-report condition, in which subjects attempt to report the entire array, is compared with accuracy in six partial-report conditions. The presentation time of the letter array, the cue-delay condition presented on the first block of trials, and the number of trials per cue-delay condition can be manipulated.

Sternberg's (1969b) Memory-Scanning Paradigm Demonstrating the Additive-Factors Method (Sternberg, 1969a)

Subjects are presented with a memory set containing one to four digits. They then determine whether a probe digit was among the memory set items. The stimulus quality of the probe digit (intact or degraded) and the correct answer (positive or negative) are manipulated. Both accuracy and reaction time are recorded. The level of stimulus quality presented first, the size of the first memory set, the key which indicates a positive response, the number of trials per memory set, and the number of replications can be manipulated.

SPEEDED-CLASSIFICATION MEANS				
Number of Blocks	Dimension	Condition	Trials Correct	Mean RT
1	width	neg corr	20	338.5
1	width	orthog	21	433.2146
1	width	control	21	394.60937
1	width	pos corr	23	284.46875
1	height	neg corr	19	249.14062
1	height	orthog	21	440.328125
1	height	control	22	367.59375
1	height	pos corr	23	267.84375
2	width	neg corr	22	361.02545
2	width	orthog	21	455.9812
2	width	control	20	401.325
2	width	pos corr	24	389.09764

Figure 3. An example of the means displayed at the conclusion of an experiment.

Meyer and Schvaneveldt's (1971) Lexical-Decision Paradigm

Two letter strings are presented simultaneously on the display, and subjects determine whether or not both letter strings are words. The relationship between the letter strings is varied. Four levels of relationships are included (associated-word pairs, unassociated-word pairs, word/nonword pairs, nonword/nonword pairs).¹ Both accuracy and reaction time are recorded. The stimulus set, the key that indicates a "word" decision, and the number of associated-word, unassociated-word, word/nonword, and nonword/nonword pairs can be manipulated.

Shiffrin and Gardner's (1972) Target-Detection Paradigm

This experiment examines the serial versus parallel processing issue. Four stimuli are displayed either simultaneously or successively. Subjects determine which target (the letter T or F) was among the stimuli displayed. This experiment includes distractor items that are confusable with the targets (a visual hybrid of T and F). Accuracy is recorded. The duration of the target presentation, the number of replications, and the level of display size presented first (simultaneous or successive) can be manipulated.

Felfoldy's (1974) Speeded-Classification Paradigm

This experiment examines the integral processing versus separable processing issue. Subjects classify one dimension of a rectangle (height or width) as either small or large. The other dimension is then varied in a positively correlated, a negatively correlated, or an orthogonal manner. Performance in these conditions is compared with performance in a control condition. Both accuracy and reaction time are recorded. The level of dimension presented first (width or height), the number of replications, and the number of trials can be manipulated.

Schiano and Watkin's (1981) Memory-Span Paradigm

This experiment tests whether word length affects memory for pictures the same way as it affects memory for words.² Subjects are first introduced to the entire set of pictorial stimuli. The Macintosh sound driver is used to name each picture while it is being displayed.³ Then the experiment begins. Subjects are presented with a list of pictorial or word stimuli. Pictorial stimuli have either short or long names, and word stimuli have either short or long word lengths (i.e., *jet-airplane*). Following the list presentation, an array of pictures (or words) is displayed and subjects indicate the items that were part of the original list. An up-and-down memory-span procedure is used to determine list length. The duration of the stimulus presentation and number of replications can be manipulated.

Three Demonstrations of the "Phi Phenomenon," the Illusion of Apparent Movement (Westheimer, 1912)

Two stimuli are presented side by side in a sequential

fashion. Both the interstimulus interval between stimuli and the duration of stimulus presentation can be manipulated. Changes in these times can be made while the stimuli are displayed so that the effect of the time changes is immediately observed.

AVAILABILITY

This package of programs is included in the Rice Psychology Project Disk. This disk, which also includes PsychLib (Lane & Ashby, 1987) and Geometrically Rotated Fonts (Kluger & Lane, 1984), can be obtained for \$15 by writing to the authors.

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NOTES

1. Associated and unassociated words were taken in part from Keppel and Strand's (1970) word association norms. Remaining word stimuli and nonword stimuli were created by Cary R. Jensen, Rice University.
2. This program used the digitized pictures from Brooks (1985), based on a standardized set of 260 pictures (Snodgrass & Vanderwart, 1980).
3. This program requires the application Apple MacinTalk in order to speak the names of the pictorial stimuli. The program will work without the Apple MacinTalk application, since the name of each picture is also displayed on the screen just below the location of the picture. The experimenter or subject can then name each picture aloud. Information about Apple MacinTalk is available from: Apple Programmer's and Developer's Association, 290 S.W. 43rd Street, Renton, WA 98055.