Software Announcements

New Software

ERTS: A Flexible Software Tool for Developing and Running Psychological Reaction Time Experiments on IBM PCs

The Experimental RunTime System (ERTS) is a software package for developing and running nonadaptive, trial-oriented reaction time experiments (Beringer, 1993). ERTS is based on a special-purpose programming language consisting of a small set of high-level data types and commands, which can be used to formulate an experimental paradigm (average about 90 commands per paradigm). The experimenter is freed from using general programming languages (such as PASCAL or C) and from considering system-dependent aspects, such as timing accuracy, screen synchronization, asynchronous response registration, and graphics mode programming. The command files are created and edited with any conventional text editor. After preparing the command code, ERTS directly executes the experimental session. ERTS outputs a results table that lists reaction times, responses, and other information in fixed-format ASCII for each trial. Because of the short command code and the high-level data type checking mechanisms, experimental definitions are more likely to be free of error than when conventional programming languages are used. An add-on software tool (ERTSCODE) is available for coding and transforming raw scores into factorial descriptive statistics. ERTS and ERTSCODE may be run in batch mode to automate experimental sessions and data management.

Runtime performance is optimized. Response registration is exclusively asynchronous (interrupt triggered) and is not affected by ongoing stimulus presentations. The registration of make and release actions from standard keyboard, mouse, external keys (via LPTx), and voice-key (via soundcard) is supported. Response registration and event timing is controlled with millisecond accuracy, with the exception of hardware-dependent distortions of response devices (Beringer, 1992). Timing is accurate across trial boundaries, because results are stored only at the end of each block. Thus, continuous, trial-oriented paradigms (e.g., sustained attention tasks and tapping) can be realized.

ERTS implements VGA graphics. Pictures are not screen oriented, but are defined, separate components that are independent of screen locations. Text and graphics pictures are both displayed in high-resolution graphics mode. Besides using the regular systemfont, text pictures may also be displayed in high-quality, large-scale

bitmap fonts (up to 60 pt), which come with the ERTS package. The unique Intelligent PreLoad Algorithm (IPL) automatically takes care of optimized pseudotachistoscopic image switching (Beringer, 1993). Onset of any new screen image occurs within one vertical retrace by switching memory, and blanking intervals between images are not required.

ERTS supports the presentation of speech files, MIDI-sound, and the sending of byte patterns to the parallel port for communicating with external devices (e.g., EEG recorder, tone generator). A variety of random mechanisms are supported for selecting random stimuli, including the random selection of screen locations and the automatic filling of empty locations with random pictures. Test options such as scaling execution speed, executing single-trial and block definitions, auto-execution mode, and checking of event timing support the developer even further.

ERTS has been used since 1987 by many universities, clinics, and pharmaceutical companies. It was also used at the German/Russian MIR project in 1992 to evaluate cognitive impairments due to microgravity. ERTS comes with about 250 pages of documentation and about 30 sample definitions of key functions, as well as cognitive paradigms such as Sternberg memory search, visual search, Eriksen, Posner, Stroop, mental rotation, vigilance, PSE-estimation, visual masking, and so on. These samples make up about 7,000 lines of documented source code, which are also available as a no-save demo version.

System requirements. The system requires any IBM-PC-compatible (286 CPU or better) and VGA-compatible graphics card. Also required is DOS 3.0 or higher and a text editor for creating and editing ERTS definition files. Optional hardware includes Microsoft-compatible mouse and driver, Sound Blaster Pro Sound Card, EXKEY (keyboard logic for connecting external keys via parallel port), Sound Blaster Pro drivers CT-VOICE.DRV and CTVDSK.DRV, and graphics software for the creation of graphics pictures (Import via PCX or screen dump).

The user must have knowledge of experimental psychology, basic DOS commands, operating knowledge of a text editor, and knowledge about exporting data to statistical and graphical software packages.

Availability. ERTS is distributed through BeriSoft Cooperation, Wildenbruchstr. 49, 60431 Frankfurt am Main, Germany. The cost of the main license for two computers is \$750 plus shipping. This includes ERTS, ERTSCODE, and one set of manuals. Site license conditions

are available upon request. Direct inquiries via e-mail (beringer@bwl.bwl.th-darmstadt.de).

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Jörg Beringer
BeriSoft Cooperation

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SCRT 1.1: Single-Case Randomization Tests

SCRT (Version 1.1) is a software package for designing single-case experiments and performing graphical and statistical analyses on data collected within such a design. The major types of single-case experimental designs that are included as defaults are (1) alternating-treatments designs; (2) AB designs and extensions (ABA, ABAB, etc.); and (3) multiple-baseline designs (see Barlow & Hersen, 1984; Kazdin, 1982). Furthermore, a facility to build and analyze any other tailor-made randomized design is provided.

All statistical tests of SCRT are based on the principle of randomization (see Edgington, 1987). One of the strengths of these *randomization tests* is that the test statistics are not restricted to those whose sampling distribution has been derived analytically. Therefore, SCRT provides a Test Statistics Editor, with which customized statistics may be built and selected as the criterion for the randomization test.

For small-*N* designs or larger projects involving replications of single-case experiments, a nonparametric meta-analytic procedure is included. The integration of single-case designs and meta-analysis provides the researcher with a bottom-up methodology for analyzing experimental data. In the usual top-down approach of group designs, all data are entered into an overall analysis first, and then the question of the generalizability of the mean effect to the individual is addressed. The bottom-up approach of single-case meta-analysis allows the researcher to analyze the data on an individual level first, and to integrate the results on a group level afterward.

In addition to statistical tests, descriptive statistics, graphical analyses, plots of the randomization distribution, and plots of the evolution of the *p* value during the analysis can easily be obtained as well. Before the analysis, ordinal, *z*, square root, or other data transformations are possible. After each randomization analysis, a report with descriptive statistics and the results of the tests is generated. If the randomization test is based on random

shuffling, 95% and 99% confidence intervals for the *p* value are provided.

User interface. The program can be either mouse driven or keyboard driven. Options are selected from pull-down menus or in dialog windows. Analyses are performed by using hot keys or by pushing screen buttons. Multiple design windows may be active at the same time. It is possible to edit design windows while statistical analyses are running in another window.

Data can be loaded from an ASCII file or entered directly into the SCRT Data Editor. Output may be directed toward an ASCII file or immediately to the printer. Graphs may be downloaded with a memory-resident screen capture utility.

System requirements. The program requires an IBM-compatible PC with a minimum of 640Kb RAM, running DOS 2.0 or higher. Useful supplementary hardware are a hard disk, a mouse, a RAM drive (for fast access to temporary files), a mathematical coprocessor, or 80386 or 80486 processor (for fast execution of computer intensive statistical analyses), and a printer.

Availability. An executable file, together with graphical drivers, an extensive README file with examples, and a 30-page manual can be obtained without charge via e-mail (fpaag02@blekul11.earn, or patrick.onghena@psy.kuleuven.ac.be) or by writing to Patrick Onghena, Katholieke Universiteit Leuven, Department of Psychology, Tienestraat 102, B-3000 Leuven, Belgium. Include \$20 for the cost of shipment and copying.

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Patrick Onghena and Geert Van Damme
Katholieke Universiteit Leuven

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Technical Typesetting Using LaTeX

In this announcement, we describe one of the best "mark-up" document-preparation programs now available for both personal and mainframe computers and demonstrate a number of advantages that such a system has over the more "traditional" PC word processor. Although many people may have had some experience with mark-up text-processing programs, such as those commonly used on mainframe computers, the use of such programs is not as widespread on personal computers. Such software, however, has much to offer authors, particularly those dealing with highly technical subject mat-