**FACTRETRIEVAL2: A PASCAL program for
assessing someone's recall of general-
information facts, confidence
about recall correctness, feeling-
of-knowing judgments for
nonrecalled facts, and
recognition of nonrecalled facts**

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FACTRETRIEVAL (Shimamura, Landwehr, & Nelson, 1981) was a BASIC program for general-information recall, pairwise relative feeling-of-knowing judgments, and forced-choice recognition of nonrecalled facts. Requests for diskette versions of that program were received from Europe, Asia, Canada, and throughout the United States. FACTRETRIEVAL2 is an updated version that has many new options and is written in PASCAL so as to be easier to modify by the individual user.

FACTRETRIEVAL2 presents up to 240 general-information questions from the Nelson and Narens (1980b) norms. The program consists of five main routines (in addition to the data-analysis routine): recall, confidence judgments of recall, relative feeling-of-knowing judgments for nonrecalled facts, absolute feeling-of-knowing judgments for nonrecalled facts, and recognition of nonrecalled facts.

General-information questions such as "What is the last name of the man who invented the phonograph?" and "What is the capital of Chile?" are presented singly on a video monitor, and the subject types an answer to each question on a typewriter keyboard. This sequence continues until the subject fails to recall a preset number of facts, either in terms of commission errors only or omission errors only, or errors without regard to commission versus omission (ramifications of these different types of retrieval failure are discussed in Krinsky & Nelson, in press). The user can opt to have six-place ratings of confidence for each of the subject's guesses, regardless of the correctness of those guesses.

The program continues with a feeling-of-knowing routine that elicits one-item-at-a-time absolute feeling-of-knowing judgments (Hart, 1965) or/and relative feeling-of-knowing judgments (Nelson & Narens, 1980a) on all possible N-tuples of nonrecalled items, where $1 < N < 6$. [Note: For 2-tuples, the user can have $n = 4$ to 12 items for $n(n - 1)$ paired comparisons, i.e., 6 to 66 paired comparisons, respectively; for 3-tuples, the user can have

15 or 21 items for 35 or 70 comparisons, respectively; for 4-tuples, the user can have 16 items for 20 comparisons; and for 5-tuples, the user can have 25 items for 30 comparisons. For absolute judgments only, the user can have from 1 to 50 items. For both absolute and relative judgments, the number of absolute judgments must correspond to one of the aforementioned numbers of relative judgments.] For each N-tuple of questions during relative judgments, the subject chooses the question to which he/she believes that he/she is most likely to recognize the correct answer. As an example for a 2-tuple, the subject might judge the answer to "What is the capital of Chile?" to be more likely to be recognized than the answer to "What is the last name of the man who invented the phonograph?" These relative judgments yield a feeling-of-knowing rank order of all the nonrecalled items. Then the user can opt to retest from 0% to 66% of the feeling-of-knowing judgments (regardless of whether they were absolute or relative judgments) to assess the subject's retest reliability on the feeling-of-knowing judgments. Finally, a seven-alternative forced-choice (7AFC) recognition test occurs for each of the nonrecalled items. The six distractors are drawn from a set of seven potential distractors in the same general category as the correct answer (e.g., for the item "What is the capital of Chile?", the seven recognition alternatives are Santiago—the correct answer—and six of the following seven distractors: Caracas, Lima, Acapulco, Quito, Curacao, Valparaiso, and Bogota). The choice of which one of the seven distractors is not used is determined by deleting a distractor if it matches the subject's recall response or, otherwise, is determined randomly; this procedure is desirable because it eliminates the possibility of perseveration errors in which the subject chooses the same answer on the recognition test that he/she gave during the recall test (Krinsky & Nelson, in press). The Goodman-Kruskal gamma correlation between the subject's feeling-of-knowing judgments and subsequent recognition performance provides a measure of the feeling-of-knowing accuracy for that subject (Nelson, 1984). A statistical analysis routine computes the various summary statistics described below (most of which are discussed in greater detail in Nelson & Narens, 1980a).

Input. There is a menu from which the investigator can specify whichever options are desired (described in the Options section below). The investigator needs only to input a subject-file name under which the data will be stored. Standard instructions for the subject are included in the program; the user can modify these instructions as desired.

Output. The program saves an extensive amount of data for each subject. First, a table of recall performance is displayed that shows for each trial (1) the trial number, (2) a number indicating which general-information question was presented (using the same identification num-

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bers as in the earlier FACTRETRIEVAL), (3) correctness of the subject's response (to minimize the effect of spelling errors, a response is scored as correct if the first three letters match the first three letters of the correct answer), (4) the subject's response, (5) the response latency, (6) the correct answer (from the Nelson-Narens norms), (7) the normative probability of recall (from the Nelson-Narens norms), and (8) confidence rating for recall (optional by menu).

Second, the following are listed: (1) the total number of recall trials before reaching the preset criterion for the number of items nonrecalled, (2) the proportion of correct recall, (3) $P(\text{omission}|\text{incorrect recall})$, (4) $P(\text{commission}|\text{incorrect recall})$, (5) median latency of correct recall, and (6) median latency of incorrect recall (cf. search termination in Nelson, Gerler, & Narens, 1984). If the confidence-rating option was selected via menu, then the following confidence data are presented: (1) for each of the six possible confidence ratings (0%, 20%, 40%, 60%, 80%, and 100% likelihood of being correct), the number of items to which the subject gave a given confidence rating and the percentage of items correctly recalled for that confidence rating, (2) for the calibration curve $Y = aX + b$ (cf. Lichtenstein, Fischhoff, & Phillips, 1982), where Y = actual percentage correct and X = predicted percentage correct, a and b are computed and listed, and (3) the gamma correlation between confidence ratings and recall correctness.

Third, the subject's choice is shown for each of the relative feeling-of-knowing judgments, including each of the retested judgments. The output also displays the number of intransitivities in the relative feeling-of-knowing judgments (i.e., if Item I is chosen over Item J and Item J is chosen over Item K, then an intransitivity occurs if Item K is chosen over Item I). For each intransitivity, the three items comprising the intransitive triple are listed. Then the following absolute feeling-of-knowing data are presented: (1) the absolute judgment (either YES-NO for two levels of fineness or a six-place Likert-scale rating for six levels of fineness—a menu option), (2) the latency of each absolute feeling-of-knowing judgment, (3) the median latency of all absolute feeling-of-knowing judgments, and (4) the number (and proportion) of items to which the subject gave a given absolute feeling-of-knowing rating.

Fourth, a summary table is displayed that shows (1) a rank-ordered listing of each nonrecalled item (based on the number of times that a given item was chosen over all other items during the relative feeling-of-knowing judgments), (2) the correctness of recognition performance on each item, (3) the recognition alternative that the subject chose for each item, and (4) the latency of each recognition response.

Fifth, the following summary statistics are listed: the $P(\text{correct recognition})$ and the 10 possible gamma correlations for all intercorrelations of (1) recognition correctness, (2) latency of incorrect recall, (3) normative

$P(\text{correct recall})$, (4) relative feeling-of-knowing rank, and (5) absolute feeling-of-knowing rating. Separate analyses occur for (1) all nonrecalled items (i.e., disregarding commission vs. omission during recall), (2) commission-error items only, and (3) omission-error items only.

Hardware. The program is written in UCSD PASCAL 2.1 for an Apple II, II+, or IIe computer with 48K, two disk drives, an 80-column board (any brand), an optional Mountain Computer clock card (required for response latencies), and an optional printer.

Options. The program provides the investigator with the following options: (1) predetermined choice of the number of nonrecalled items before termination of the general-information recall stage; (2) sampling scheme for determining the particular items that are selected from the normative distribution of items (several schemes are available, e.g., random sampling from the entire distribution, random sampling from user-defined portions of the distribution, and so on); (3) presence or absence of recall confidence judgments; (4) feeling-of-knowing judgments for omissions only, commissions only, or both omissions and commissions; (5) presence or absence of retested feeling-of-knowing judgments to assess feeling-of-knowing reliability; (6) absolute feeling-of-knowing judgments only, relative feeling-of-knowing judgments only, or both (and if both, the order of the two kinds of feeling-of-knowing judgments); (7) YES-NO versus six-place Likert ratings for absolute feeling-of-knowing judgments; and (8) the value of N for N -tuple relative feeling-of-knowing judgments.

Availability. A complete listing of the program, including text files of instructions to subjects and 240 general-information questions with distractors for the forced choice recognition test, is available for \$4 to cover copying and mailing costs from Thomas O. Nelson, Psychology Department (NI-25), University of Washington, Seattle, Washington 98195. For a copy of the complete program on diskette (and a brief instruction manual) at no charge, send three blank 5.25-in. single-density single-sided diskettes with a self-addressed return mailer and specify clock or no-clock version.

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