Are Prepared Random Sequences and Real Time Random Generators Interchangeable

Charles T. Tart
Department of Psychology
University of California
Davis, CA 95616

Abstract: The widespread use of real time, electronic random number generators (RNGs) to select targets as needed in parapsychological research has been a great convenience compared to traditional methods of shuffling cards or pre-experimental target list preparation. Electronic RNGs are subject to psychokinetic influences, however, and this and other considerations have led to suggestions that pre-experimentally prepared target lists replace real time RNGs as standard operating procedure. If prepared target lists are experimentally and psychically equivalent to real time RNGs, this suggestion has merit. An experiment was carried out in which some runs on two ten-choice ESP feedback training devices used targets generated on demand for each trial by a real time electronic RNG, while for other runs on one device the targets had been generated before the run and stored in the controlling computer's memory. Neither experimenters nor percipients were aware of this difference. Because of the probable existence of trans-temporal inhibition, an information processing mechanism involved in ESP functioning, I hypothesized that the two target conditions would not be equivalent in terms of +1 precognitive scoring. While intended, real time scoring was not significant, the predicted difference was, $P < .05$, 2-tailed. Thus real time RNGs and pre-prepared stored targets may not be psychically and experimentally equivalent.

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Electronic random number generators (RNGs), which generate a random target number on demand for each trial, became widely accepted in parapsychological research following their use by myself (Tart, 1966a) and Schmidt (1970). The convenience and experimental elegance of real time RNGs over the tedious mechanical shuffling of cards or pre-experimental preparation of target lists from random number tables seemed to be substantial. Numerous studies have now shown, however, that electronic RNGs are significantly susceptible to PK effects (Honorton, 1978). Thus when an electronic RNG is used as a real time generator in any ESP experiment, the possibility exists that some unspecifiable proportion of significant results might be due to PK action rather than ESP. This was the case in my own first study of the effects of immediate feedback on enhancing ESP ability (Tart, 1976; 1979a). As we do not, at present, have a way of partialing out possible PK effects from possible ESP effects, this leads to ambiguity in understanding experimental results.

One result of this ambiguity has been a call by several colleagues in the last few years to use prepared random number tables to pre-experimentally set up ESP targets as standard operating procedure. In this case the characteristics of the target distribution are always known and acceptably random, and distribution characteristics would not be altered by possible PK effects. <u>If prepared, stored random numbers and real time RNGs are indeed experimentally equivalent</u>, this suggestion has great merit. The data presented

in this paper suggests, however, that they are not experimentally equivalent.

In two reported studies (Tart, 1976; 1979b ; Tart, Palmer, & Redington, 1979) using a real time electronic RNG, I found a strong and statistically significant negative correlation between positive scoring on a designated real time target and +1 precognitive scoring on the upcoming but not yet determined next target. That is, the more a percipient tended to score positively on the intended real time target, the more he tended to score below chance expectation on the immediate precognitive future target. I proposed a theory of trans-temporal inhibition to account for this (Tart, 1979b), hypothesizing that the part of the mind which uses psi is less "localized" in space and time than our ordinary brain-mediated consciousness. Simply activating this psi part of the mind per se might produce ESP-mediated information not only about the desired, real time target, but also about immediately temporally adjacent targets as well. Although it is mediated by ESP, information about an immediately future target when one's desire is to get the real time target is error and noise. The theory of trans-temporal inhibition states that on those trials on which ESP is activated, some non-conscious part of the mind discriminates the immediately future and real time targets, and then creates a psychological inhibition against calling the immediately future target, thus enhancing (by contrast) the chances that the real time target will be called correctly. Other phenomena, such as one I called psi-stuttering, a lack of sufficient hits in a row, support the trans-temporal inhibition idea (Tart, 1979b). Further pilot work I have carried out but not yet reported also supports it.

Insofar as trans-temporal inhibition theory is valid, it suggests that an already prepared, stored sequence of targets is not experimentally equivalent to a real time RNG, where a new target is not determined until after a previous response. In the already prepared target case, at a time of any

given response all of the targets exist and some sort of "spatial" discrimination, as well as possible temporal discrimination, may be required by the percipient. In the case of real time RNG, only the present target (and records of past targets) exists in real time on any given trial. Although I have not yet conceptualized the exact nature of the differences which might be expected given the hypothesized reality of trans-temporal inhibition, different kinds of performance in terms of hitting or missing on immediately future targets might be expected when comparing stored random target sequences with target sequences generated by real time RNGs.

Method

In the course of a third study on the effects of immediate feedback on ESP performance, a modification of equipment was made which allowed a test of whether percipients responded differently to stored targets versus targets generated on line. The third Training Study was carried out in the fall through spring quarters of the 1977-1978 academic years. As the basic procedure was similar to that of the two previous training studies (Tart, 1976; Tart, Palmer, & Redington, 1979), I will only outline it here.

The student-experimenters in my experimental psychology class tested large groups of students at the Davis campus of the University of California in classroom situations. The test was a single clairvoyance and single GESP run with cards, conducted in the last few minutes of the class. Students' responses were scored individually, and those showing some suggestions of above chance scoring were asked to participate in a second confirmation phase of individual testing. Here they received half a dozen individual runs of 20 trials each on one of two ten-choice trainers.

The first ten-choice trainer was the Ten-Choice Trainer (TCT) device used in the first Training Study (Tart, 1976). It consisted of a circle of 10 unlit lamps with a push button beside each. A separate real time RNG of

electronic
the roulette wheel type, activated by the experimenter for each trial, generated a single target. This target was then transferred to the sender's TCT control console through a time delayed system that provided uniform timing between trials. The percipient indicated his call by pushing a response button on his TCT console. Immediate feedback was provided by the correct target light coming on immediately following each response. Target and response data were recorded by the experimenter.

The Apple-ADEPT ten choice training device (A/ADEPT) was a more sophisticated version of the TCT. An Apple II microcomputer controlled the functioning of the display and response consoles, as well as electronically recording data. From the percipient's point of view, the machines were ~~visually~~ slightly different in one looking more professional than the other, although arranged in the same general manner, and the basic task on each was to push the button beside one of the 10 unlit lamps that corresponded to the target. The A/ADEPT system used here utilized the same display consoles as the ADEPT (Advanced Decimal Extrasensory Perception Trainer) system used in the second Training Study (Redington & Tart, 1976; Tart, Palmer, & Redington, 1979), but rather than the special analog circuits used in the original ADEPT, the Apple II computer controlled both target generation, console operation, and data scoring and storage.

The Apple II computer contains a typical computer pseudo-random number generator. A seed number in the computer is processed by a complex algorhythm on each occasion that a random number is requested, and the algorhythm presents the last digit of the computation as a random output. Numerous testings of this pseudo-random generator in batches of 10,000 outputs have shown no significant biases by Chi-square test at the singlet, doublet, or triplet level. Our control program, developed by Dana J. Redington, turned the Apple II into a true random generator rather than a pseudo-random generator in the following

way. The time in milliseconds between each response of a percipient was measured, and this highly variable value was used to provide a brand new seed for the Apple II pseudo-random generator on every single trial.

Dana Redington further modified the Apple II control program, at my request, in the following manner. During the initial setup of each run, 10 lever presses on the ADEPT control console were required from the experimenter. These lever presses were rather vaguely described to experimenters as generating a series of random numbers which set the initial random parameters for the Apple II's random number generator. Actually, each lever press activated a separate decimal electronic RNG. If an even output came up on the first press, this meant that the real time true RNG function of the Apple II was used, and the output of the following nine lever presses was ignored by the computer, although there was no indication to the experimenter that the computer was not using all this information. If an odd output came up on this first lever press, however, the Apple II computer took this as an instruction to draw targets sequentially from a stored table of 1,000 random decimal digits. The following nine lever presses, activating a decimal RNG, were used to determine a three digit starting point number for entering the stored table. Usually only the second, third, and fourth lever presses were necessary for this, but we did program in the restriction that there had to be at least 30 numbers left in the table from the entry point: if too high a number were accidentally generated on the second through fourth lever presses, it was rejected and the later lever presses were used to find the entry point. The stored table of 1,000 digits in the Apple II computer memory consisted of sequential selections from the RAND (1955) table of random digits. A random entry point into the RAND tables was used to obtain such selections. This stored table was completely replaced with new selections from the RAND tables at several irregular intervals throughout the experiment to minimize the probability of any target sequence repeating an earlier target sequence.

None of the student experimenters who actually worked with percipients in the third Training Study had any knowledge about the exact functioning of the RNG or of the modification which randomly chose to use the real time RNG or the stored target numbers on any particular run. I, Dana Redington, and Henry Bennett, my teaching assistant for the class, knew of this modification, but we spoke to no student experimenters or percipients about it, thus hopefully minimizing ~~the~~ experimenter influence here.

The theory that immediate feedback training ought to enhance psi performance in talented subjects (Tart, 1966b; 1977) requires that percipients show some initial ESP talent on this particular type of repeated guessing task before beginning training if feedback is expected to be effective. As it turned out, the sequential sampling procedure of group selection phases and individual confirmation phases did not produce percipients who showed any certain signs of ESP talent. Because of the educational obligation to my student experimenters, however, I encouraged them to use any suggestive signs of ESP in percipients' Confirmation Study scores as criteria for selecting percipients and working with them through the Training Study proper. While I had the impression that we were scraping the bottom of the barrel this way, I deliberately refrained from looking too closely at Confirmation Study scores at the time in order to try to avoid a feeling of disappointment in myself, a feeling which might transfer on to the student experimenters and inhibit results. From later scoring of the Confirmation Study, however, it is clear that, according to the learning theory application, no real results should have been expected from the third Training Study. Ideally, the third Training Study should not have been carried out: rather, efforts should have been put into further Selection and Confirmation Studies to find talented percipients. The academic obligation to complete the student experimenters' education, however, dictated that the Training Study be completed. Thus 14 percipients completed 20 runs of 20 trials each. Nine

of these percipients worked on the A/ADEPT training device and six worked on the TCT. One percipient did not quite complete his planned series but his results were added into the total anyway for completeness.

In terms of the question of the experimental equivalence of real time RNGs versus stored targets, then, what we have in this experiment are conditions that in some ways are alike. In every trial, on either the TCT or the A/ADEPT, the real time target consists of a signal lamp lit on the experimenter/sender's console, plus a second display of the same target in numerical form, either on the LED display of the TCT's RNG or on the TV screen readout of the Apple II's program, plus an electronic representation of the target in the TCT RNG's or Apple II's electronic circuits. In the case of stored targets, however, all the future targets in a given run also exist in real time in terms of electronic representation in the Apple II's circuitry.

Results:

As a group, the 15 percipients did not show any evidence for ESP functioning in terms of hitting on the intended, real time target. They made 609 hits when 591.3 were expected by chance, corresponding to an insignificant Z-score of + .77. One individual percipient scored significantly above chance (53 hits when 40 were expected by chance, $P \approx .03$, 2-tailed), but this is probably not significant when 15 individual significance tests were conducted. There were no suggestions of significant differences (by t-test) between the TCT and A/ADEPT devices, or between the real time RNG versus stored target conditions of the A/ADEPT.

The principal hypothesis of a scoring difference on +1 future displacement scoring between real time and stored targets was tested in two ways. First, the real time and stored conditions on the A/ADEPT were compared by a t-test between the standard Z-scores of each percipient on +1 scoring. The mean Z-score for real time RNG targets was -.13, while for stored targets it was +.78, $t = 2.11$, $P \approx .06$, 2-tailed. Second, the RNG conditions on the TCT and A/ADEPT

are essentially equivalent, so those data were combined for a more sensitive test of real differences with a larger data base. The mean Z-score for scoring on +1 displacements with the real time RNG changes trivially to -.06, and for the comparison, $t = 2.34$, $P < .05$, 2-tailed.

Discussion

The present study is limited, first in being only a single study, and second in not having any significant amount of ESP occurring in it overall by conventional scoring. With little or no apparent ESP manifesting on the intended real time targets, the effects of trans-temporal inhibition on the hypothesized non-equivalence of real time RNG and stored target conditions might be minimal or non-existent. Nevertheless, a significant difference was found on +1 precognitive scoring, and the study strongly suggests that stored random number targets and targets generated by real time RNG are not equivalent experimental conditions in terms of the way psi works. In spite of the conveniences that might be gained in some experiments by routinely using stored targets then, I would suggest that this is a more complex matter than we think and one warranting further investigation before stored target lists become a standard operating procedure.

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