

For presentation at the 25th meeting of the Parapsychological Association
Cambridge, England, August 1982.

An Inexpensive, Electronic Clairvoyance
Tester/Trainer for Parapsychologists
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The major problem of parapsychology today is the extremely low quantitative level and unreliability of psi manifestations in almost all laboratory situations: this means we have hardly any signal mixed in with enormous amounts of noise, making fruitful study extremely difficult.

In 1966 I proposed that if talented percipients received immediate feedback about success or failure each time they tried to use ESP, they might be able to discover successful internal strategies for using ESP and thus improve their performance with practice (Tart, 1966). If immediate feedback training of talented percipients led to substantial improvements in the quantity and reliability of psi produced in the laboratory, a major advance in the field would occur, both as a result of being able to demonstrate psi on demand and because fruitful studies of the psi process would be feasible.

What evidence is there to support this theory? In my last systematic review of the literature (Tart, 1976), it was clear that the provision of immediate feedback almost totally eliminated otherwise common decline effects, as predicted. Further, I find the evidence strongly suggestive that feedback training can help some talented percipients improve their ESP performance, but this aspect of the data is not strong enough to find general acceptance. Given that a fair amount of psi talent is called for before feedback training can be expected to be clearly effective, and given the fact that the vast majority of percipients readily available to investigators show no psi talent or psi talent well below that estimated as required, the most crucial aspect of the learning theory application, that learning improved psi performance is possible, rests in limbo. Only feedback training with an adequate number of highly talented percipients can adequately test it.

Implementing Feedback Training:

In an ideal world, mass screening tests would test hundreds of thousands of people for psi, and those with high levels of psi talent would be brought to well-equipped laboratories for feedback training under optimal psychological conditions. The theory would be well tested, and a breakthrough might result. Since parapsychology does not have the kind of funds that would be required, we can neither do mass screening and further testing of the very best, nor can we have hundreds of parapsychology laboratories equipped with fine feedback training equipment just waiting for masses of people to drop in.

Two other possibilities exist. One is to hope that by "luck" (or experimenter psi), some very talented percipients will just happen to walk into our laboratories and we will just happen to have the equipment and time to work with them. The second, the major concern of this paper, is that we can make immediate feedback training equipment inexpensive enough (without sacrificing adequate quality) so that it becomes more widely available, thus allowing much larger numbers of people to work with immediate feedback training. Some of those larger numbers of people may be highly talented, and demonstrate improved psi performance.

The feedback training theory stresses the importance of immediate feedback on every trial, carried out in a training situation where there is minimal distraction from focusing on internal psychological processes that

may be relevant to using psi (Tart, 1966; 1976). These requirements make manual methods of feedback training inherently inferior. A person could, e.g., shuffle a deck of cards, draw out one at random, write down his or her call, turn the card over for feedback, write down the card's identity, put it back in the deck, thoroughly reshuffle the deck ("thorough" may mean five to ten shuffles), and repeat the above cycle for the next trial, but this is hardly conducive to delicate introspection! Having a helper, an experimenter, shuffle the cards, and/or drawing from a large reservoir of cards approximating an open deck helps, but the mechanical procedure is still distracting.

Special electronic equipment makes the task far more optimal. The machine randomly picks a target and all the percipient need do is press a response button and observe the immediate feedback. Various electronic devices have been designed and successfully used by parapsychologists with encouraging results, but such devices, being individually custom designed and constructed, are inherently expensive. Until the financial picture in parapsychology changes drastically, they will always be limited to a few laboratories. The widespread availability of microcomputers and the willingness of parapsychologists to readily share some software psi testing programs, which can easily have immediate feedback incorporated in them, is helpful, but many parapsychologists still do not have the several thousand dollars needed to buy the computer in the first place. Some low priced "ESP-testers" have appeared commercially from time to time, but it was never clear that such devices were adequately random, and I do not believe any are still on the market.

The PESP System:

This paper presents a software program that almost anyone can enter into a Hewlett-Packard model HP-41C programmable scientific calculator in less than 30 minutes. This program, PESP (Professional ESP), turns the calculator into an immediate feedback tester-trainer for clairvoyance. Accessories which Hewlett-Packard plans to market soon will allow a GESp version with a remote target indicator that would allow an agent to try telepathic sending. I will develop and describe a GESp program when the relevant accessories become available.

The HP-41C is probably the most sophisticated hand-held calculator currently available. It is more accurately described as a hand-held computer, although Hewlett-Packard prefers to call it a programmable scientific calculator for marketing purposes. It has a list price of \$195, but can often be found discounted to as low as \$165. The directions with the HP-41C are quite clear, and anyone can enter the program described below with only a small understanding about the HP-41C's operation. Once the program is entered it will be permanently stored for the approximately one-year life of the batteries, or for the life of the machine if you remember to change batteries quickly each year.

I should warn readers, however, that the HP-41C is a fascinating and habit-forming device, and you will soon want to use it for all sorts of other things! For those who need a calculator in their work anyway, the HP-41C is an extremely sophisticated and reliable machine. I use mine for everything from complex statistical analyses of data to automatically billing my car pool members for their pro-rata share of gas and oil each month.

The basic, bare-bones program was developed by Harold Puthoff and myself and described in a specialized calculator users' journal (Tart & Puthoff, 1981). That version was designed for self-testing: it could not be used for testing others unless the percipient were constantly supervised, otherwise cheating was possible. A person using it only for self-testing

would presumably not bother to cheat himself. The PESP program described here is a major revision of the original program. It can be used simply for self-testing. If used in conjunction with one of the printers Hewlett-Packard makes for it and if both the HP-41C and the printer are enclosed in a locked case that allows access only to the ON, $\Sigma+$, $1/x$, \sqrt{x} , R/S, and numbers 0 through 9 keys, the system may be impervious to fraud by typical unsupervised percipients. I haven't yet found a way to cheat on the system in that case without such cheating showing up on the printed record. I would like to hear from anyone who devises a way to cheat on this system.

The basic operation of the PESP program will be sketched here. The program and detailed notes on its operation will be presented in the final section. For the person who simply wants to have and use the PESP program, you need not try to understand the detailed program notes.

Loading the PESP Program:

Once you have read your HP-41C instruction manual, you may load the PESP program and be ready to run just by following the sequence below.

1. Turn the HP-41C on.
2. Press the PRGM switch. The display will show "PRGM" in small letters.
3. Press the yellow shift key, then the RCL key, then the period key twice.
4. Start keying in the PESP program step by step, as shown below¹. Step numbering occurs automatically. If an instruction doesn't appear in the display as is shown in the listing here, you haven't entered it correctly: consult the manual.
5. Put the END instruction in as the last step by repeating instruction 3 above.
6. Push the PRGM switch again so the PRGM display disappears. You are out of the program mode and back to the normal operate mode.
7. Assign the upper left hand key, $\Sigma+$, to PESP by pressing the yellow shift key and then the XEQ key just beside it. Then press the ALPHA switch. The "ALPHA" indicator will show on the display. Key in the letters PESP, then press the ALPHA switch again to shut off the alpha (letter) mode. Now press the $\Sigma+$ key. From now on, whenever the HP-41C is in the user mode (press USER switch, display shows "USER"), pressing the $\Sigma+$ key will start the PESP program.
8. In the same way as in the last step, assign the $1/x$ key to PASS.
9. In the same way, assign the \sqrt{x} key to RESULTS.
10. Press the XEQ button, then the ALPHA switch, then enter the letters SIZE, then press the ALPHA switch again. You will see three blank spaces in the display. Enter the number 008. (This allocates 8 registers in the HP-41C to computations, the rest to program.

You are ready to operate PESP.

1. The PESP program given here is slightly too long to fit in the memory of the standard HP-41C, although it will fit in the memory of the slightly more expensive HP-41CV, an HP-41C with five times as much memory, an option I strongly recommend. You can extend the memory of your HP-41C by buying a plug-in memory module. Or you can simply not enter steps 128 through 137 of the listed PESP program. The present step 138 will then become step 128. All you will lose by this will be an automatic calculation and display of the percentage of hits in each run, which you can easily calculate yourself.

Operation of the PESP Program:

Turn on the HP-41C and press the USER switch. The "USER" display will come on. Since the top left hand key ($\Sigma+$) has already been assigned to PESP, when you press it the program starts and the display prompts you with "MONTH?". Enter the number of the month (1 through 12) and then press R/S. R/S is the "RUN STOP" key: pressing it takes the date you have keyed into the display and enters it into the machine. You are then asked "DAY?". Enter the number of the day of the month, then R/S. Now you are asked "YEAR?". Enter the year and R/S. You are then prompted with "CHOICES?", Do you want a two-choice test (target 0 or 1), a five-choice (targets 0 through 4), etc.? Any number of choices can be used, but unless you're rather strongly psychic, it's going to be a long time before you get any rewards on a 1,000-choice test, so 10 is probably the maximum number of choices you want. Enter the number or choices and R/S.

You are now prompted for "RN LN?", the length of a run before automatic analysis. Any number may be entered, but you may not want to do more than 20 or 25 trials in a run, for psychological reasons. You are now asked if you want "FEEDBACK?". If you don't want feedback of individual target identity or of hits on this run, enter a zero and R/S. If you want feedback, just press R/S without entering anything.

The display now prompts you for the "TIME?". You should glance immediately at the second hand of your watch to get the exact seconds, then the hours and minutes. Enter the exact time with the seconds expressed as a decimal. For example, if at your glance it is 9:47 and 23 seconds, enter 947.23, then R/S.

As soon as you've done this, the HP-41C will sound two discrete beeps to get your attention and display "READY". The first target number has been chosen by PESP's pseudo-random number generator (PRNG) and is stored in the machine, awaiting your clairvoyant discernment.

If you've been using a Hewlett-Packard printer, all this entering of month, day, year, and time has given you a permanent record of these things.

2. The no feedback option is available for those who want to try pure clairvoyance experiments. You will enter your calls following the "READY", as explained in the text, but there will be no trial-by-trial feedback of target identity or whether you were correct or not. Only run scores will be given at the end. You may pass, but this will not provide feedback either. The processing time between trials is, to the naked eye, essentially the same on both hits and misses, differing, by my calculations, by around one one-hundredth of a second. The RESULTS subroutine assigned to the \sqrt{x} key is disabled so as to act as a PASS button also, otherwise feedback could be obtained as to correctness by reviewing results after every trial.

3. If you do regularly use a printer, and have more memory available than the stock HP-41C, as discussed in the previous footnote, you could add a prompt for the percipient's name to have it conveniently printed. After entering line 10 (SF 02), add the following program steps: 11 AON; 12 "NAME?"; 13 PROMPT; 14 AOFF. Subsequent lines will re-number themselves automatically.

But what's the point of it if you're not using a printer, just keeping a hand tally of your results? In this version of PESP, the exact values of day and year are part of the process of generating a seed value for the PRNG in a way that's largely unaffected by your conscious decisions. This will become clearer as we examine the vital PRNG part of the PESP program.

The Pseudo-Random Number Generator:

The PRNG subroutine is called LBL 05 in the program listing, specifically steps 39 through 50. A pseudo-random number generator takes some seed value and transforms it according to an algorithm, a repeated formula. If you know the seed (starting) value and the algorithm, you can predict the output of any PRNG. Further, PRNGs are often unsatisfactorily random, especially as you take more and more outputs from them. Since we need total unpredictability of targets for psi research, but we must use a PRNG with the HP-41C, how can we get a satisfactorily random output? Two steps have been taken in PESP to get satisfactory randomness.

First, the seed value that the PRNG subroutine uses must be beyond the user's conscious control. The steps to accomplish this began with collecting the day and the year: these two numbers are multiplied by each other as a start in getting a seed value. The absolute value of the natural logarithm of the time (entered to the nearest second) is then added to the product of day and year as a starting seed number.

This means that if you always enter the same day, year, and time values you will always get the same target sequence. If you are testing yourself you wouldn't do such a thing. If you are testing someone else as a percipient, you would not expect them to figure out that they could cheat by entering these same values every time. Since I don't recommend testing others without using a printer and having the whole system in a locked box, as discussed earlier, such cheating would be readily apparent when the day, year, and time values on the printout were inspected.

To generate its first target, then, the PRNG consults this stored seed number, adds pi (3.141592654) to it, raises this resulting number to the fifth power and then throws away the integer part of the result, keeping only the fractional part. This gives us a range of variation from .0000000000 to .999999999. This fractional output of the PRNG is then scaled into the number of choices originally set, so the final output is an integer number in the range chosen at the start of the run. The target number is stored and the display prompts "READY" ✓

As a second step to assure adequate randomness, at the start of each new run a new time seed is called for, so a given seed is only used for a single run. Changing the seed so frequently gives adequate randomness. Using a special test program (Tart, 1982), the PESP's PRNG was sampled for 1000 outputs, using a 5-choice output and putting in a new time seed every 25 trials, as would be typical in ESP testing. The output did not show statistically significant departures from randomness at either the singlet or doublet levels by Chi-square tests.

One further note on potential cheating problems with an unsupervised and sophisticated percipient. If they knew the exact form of this program and were able to use their own precision pocket calculator unobserved, they might be able to calculate the targets. This problem can be eliminated by making small changes in the program, and I will be happy to advise any researcher on this if they expect it to be a problem.

4. Hal Puthoff and I are indebted to Edwin May for the main part of the PRNG subroutine. I added the step of using the day and year as part of the initial seed gathering.

Responses, Feedback, and Scoring:

Returning to actual operation of PESP, we left it displaying "READY". A target number, in the range of choices you set up at the start of the run, is stored electronically in the machine. Now is the time to use your psi to discern it. When you have made your choice, enter the number by pressing the appropriate number key and then press R/S.

Assuming you have chosen to have feedback, if your call is wrong, the HP-41C will sound a low beep tone and then display the correct target T in the form "TARGET WAS T". If your call was correct, the machine will sound a little fanfare and display "CORRECT". It then will again sound the double alerting tone and display "READY", indicating it is ready with the next target. This sequence will repeat until you reach the end of the run, at which point a different alerting tone will sound, and for about three seconds each, the display will show the number of passes in that run ("NR PASSES = "), the number of hits ("NR HITS = "), the number of trials ("NR TRIALS = "), and, if you have not had to delete lines 128-137 for lack of memory, the percentage of hits ("%HITS = "). Indeed, you can review results to date at any time during a run by pressing the \sqrt{x} key (which has already been assigned to the RESULTS subroutine). You can then continue with trials until you come to the end of the run.

The PASS subroutine, available anytime by pressing the 1/x key, is quite important for my learning theory approach. On some trials you may not have the slightest idea as to what the target might be, there is no internal experience that you want to get feedback on, as it were. If you have to make a trial you probably add a (discouraging) miss to your score, or, at best, a hit that means nothing to you. By pressing the 1/x key to execute PASS, you receive feedback on the target identity, but it does not count as either a hit or a miss.

Wait for the alerting double beep and "READY" display before entering your next call. If you don't, and enter a call before this, then a R/S, it won't score correctly. If you enter a call number that is larger than your number of choices, it will always score as incorrect.

The PASS subroutine is automatically disabled after the results have been displayed at the end of a run. After this review of results, the HP-41C displays "END OF RUN". If you are not using a printer and did not have time to copy down the results, pressing the \sqrt{x} key will run through the results for this run again.

If you want to do another run with the same parameters of number of choices and run length, just press R/S and a beep will prompt you for a new time seed. Enter the current time to the nearest second, R/S, and you're off again. Entering the same time seed as a way of cheating, incidentally, will not work, as the internally stored time seed continually changes, so entering the same time no longer means the same thing as it did before.

If you want to have another run with different parameters, press the $\Sigma+$ key to start the PESP program from the beginning.

There we have it. All the usual psychological hints for enhancing psi apply here, but the main point is that you can try out anything you like and have immediate feedback on the results. Good learning!

The Program:

Following is a documented listing of the PESP program. The documentation is for the technically minded who want to know just how PESP works. For those who simply want to use the PESP program, ignore the documentation remarks and simply use it as a list of instructions to enter into your HP-41C. Most of the steps are entered by one or two keystrokes, a few (such as PROMPT) cannot be entered directly. As the HP-41C manual explains, such functions are entered by

pressing the XEQ (for execute) key, then turning on the ALPHA switch, entering the letters of the function, and then turning off the ALPHA switch.

References:

- Tart, C., Card guessing tests: Learning paradigm or extinction paradigm? J. Amer. Soc. Psych. Res., 1966, 60, 46-55.
- Tart, C., Learning to Use Extrasensory Perception. Chicago: University of Chicago Press, 1976.
- Tart, C., A randomness test program for pseudo-random number generator routines on the HP-41C. Submitted for presentation at the 25th Convention of the Parapsychological Association.
- Tart, C., & Puthoff, H., ESP testing and training. PPC Calculator J., 1981, 8, No. 6, 62-63.

01 LBL "PESP"

02 CF 00

03 FIX 0

04 0

05 STO 00

06 STO 03

07 STO 04

08 STO 05

09 STO 07

10 SF 02

0 is stored in registers 00, 03, 04, 05, and 07. Register assignments are listed below.

Register	Variable
00	Length of run
01	Number of choices
02	Time seed & its transformations
03	Number of trials to date
04	Number of hits to date
05	Number of passes to date
06	Current target
07	Number of misses to date

11 LBL 00

12 "MONTH?"

13 PROMPT

14 "DAY?"

15 PROMPT

16 STO 02

17 "YEAR?"

18 PROMPT

19 ST* 02

20 "CHOICES="

21 PROMPT

22 STO 01

23 "RN LN?"

24 PROMPT

25 STO 00

Record data collection, MONTH?, DAY? (numbers, not alpha), YEAR?, number of CHOICES?, and run length (RN LN?). The numerical value of the day is multiplied by the year and stored in register 02 to provide variation beyond that given by the time seed alone.

26 0

27 "FEEDBACK?"

28 PROMPT

29 X=Y?

30 SF 00

Choice of feedback or, if 0 is entered, no individual trial feedback. Entering 0 sets flag 00, which blocks individual trial target identity feedback and prevents review of results (which could provide target info) before end of run.

31 LBL 04

32 "TIME="

33 PROMPT

34 LN

35 ABS

36 ST+02

37 CF 01

38 CF 02

Time prompt subroutine. Enter time to nearest second, using decimal point to separate hours and minutes from seconds. If there has been a previous run completed flag 01 was set, disabling the PASS option, so flag 01 is now cleared. The absolute value of the LN of the time is added to the already stored product of day and year in register 02. Flag 02 is cleared, making the PASS and RESULTS options available.

39 LBL 05

40 PI

41 RCL 02

42 +

43 5

44 Y↑X

45 FRC

46 STO 02

47 RCL 01

48 *

49 INT

Pseudo-random number generator subroutine (PRNG).

50 STO 06

51 CLX

52 SF 11

Target stored in register 06 and cleared from X-register. Flag 11 set so if power is turned off program will automatically go to LBL 02 and print POWER OFF when turned on.

53	"READY"	
54	TONE 6	Prompt for response
55	TONE 6	
56	PROMPT	
<hr/>		
57	FC? 11	Test: has power been off? Note with printer if so, then
58	GTO 02	go on.
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59	RCL 06	
60	X=Y?	Test for hit.
61	GTO 06	Go to LBL 06 if hit.
62	GTO 03	Go to LBL 03 if miss.
<hr/>		
63	LBL 07	Trials counter subroutine. Increments trials counter
64	1	(register 03) by one and tests for end of run. If end
65	ST+ 03	of run (register 03 = register 00), goes to RSLT sub-
66	RCL 03	routine.
67	RCL 00	
68	X=Y?	
69	GTO "RSLT"	
70	GTO 05	
<hr/>		
71	LBL 03	Miss subroutine. Misses are counted in register 07 to
72	1	make timing routines almost the same (estimated .01 sec
73	ST+ 07	dif) as for hits, thus allowing pure clairvoyance test
		procedure.
<hr/>		
74	FS? 00	
75	GTO 07	In no feedback condition (flag 00 set), skips target
76	TONE 0	identity feedback subroutine (LBL 01).
77	XEQ 01	
78	GTO 07	Go to trials counter subroutine (LBL 07).
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79	LBL 06	Hit feedback subroutine. Increments hit counter
80	1	(register 04 by one).
81	ST+ 04	
82	FS? 00	Branch to trials counter in no feedback condition.
83	GTO 07	
84	SF 12	
85	BEEP	
86	" CORRECT"	Display CORRECT, sound musical beep tone.
	87 AVIEW	
	88 CF 12	
	89 PSE	
	90 GTO 07	Go to trials counter subroutine.
<hr/>		
91	LBL "PASS"	PASS subroutine.
	92 FS? 01	If end of run (flag 01 set), go to END OF RUN subroutine.
	93 GTO 08	
	94 FS? 02	If program has not progressed to getting time seed, cycle
	95 GTO 00	back to MONTH? prompt (LBL 00).
	96 1	
	97 ST+ 05	Increment PASS counter (register 05) by one.
	98 FS? 00	If no feedback condition, go to PRNG (LBL 05).
	99 GTO 05	
	100 XEQ 01	Go to target identity feedback, then to PRNG for next
	101 GTO 05	target.

102 LBL "RESULTS" RESULTS subroutine. Turns into a PASS if no feedback
103 FS? 00 condition (flag 00 set).
104 GTO "PASS"
105 FS? 02 If time seed has not yet been obtained, go to MONTH?
106 GTO 00

107 LBL "RSLT" RSLT subroutine. This is accessed directly if end of
108 TONE 3 run test has been passed, bypassing the conditionals
109 TONE 2 when entering by the RESULTS key.
110 RCL 05

111 "NR PASSES="

- 112 ARCL X
- 113 AVIEW
- 114 PSE
- 115 PSE
- 116 RCL 04

117 "NR HITS="

- 118 ARCL X
- 119 AVIEW
- 120 PSE
- 121 PSE
- 122 RCL 03

123 "NR TRIALS="

- 124 ARCL X
- 125 AVIEW
- 125 PSE
- 127 PSE
- 128 RCL 04
- 129 RCL 03
- 130 /
- 131 100
- 132 *
- 133 "%HITS="
- 134 ARCL X
- 135 AVIEW
- 136 PSE
- 137 PSE
- 138 RCL 03
- 139 RCL 00
- 140 X=Y?
- 141 GTO 08
- 142 GTO 05

If end of run (X=Y), go to END OF RUN subroutine.

If not end of run, go to PRNG for next trial.

143 LBL 01 Target identity feedback subroutine. If no feedback
144 FS? 00 condition (flag 00 set), branch to trials counter
145 GTO 07 subroutine (LBL 07).
146 "TARGET WAS"

- 147 ARCL 06
- 148 AVIEW
- 149 PSE
- 150 RTN

151 LBL 08 End of run subroutine. Flag 11 is cleared as a convenience in using the HP-41C for other purposes than PESP.
 152 CF 11 ience in using the HP-41C for other purposes than PESP.
 153 SF 01 END OF RUN is displayed. If R/S is pressed, 0s are
 154 "END OF RUN" stored in registers 03, 04, and 05 (trials, hits, and
 passes) and program branches to LBL 04, prompting for
 155 AVIEW a new time seed and allowing a new run of the same
 156 STOP length and number of target choices. Flag 01 is set to
 157 0 disable the PASS subroutine.
 158 STO 03
 159 STO 04
 160 STO 05
 161 ADV
 162 GTO 04

163 LBL 02
 164 "POWER OFF" POWER OFF subroutine. Prints POWER OFF if this has
 occurred, then branches to PRNG to select a new target
 165 AVIEW and trial.
 166 GTO 05
 167 END

FLAG FUNCTIONS:

Flag 00 sets if 0 (no feedback) is entered after the FEEDBACK? prompt. When set, pressing the RESULTS key executes a pass without giving any results feedback. When responses are entered, the target identity subroutine (feedback) does not give feedback, but passes on to incrementing the trials counter (LBL 07).

Flag 01 is automatically set when the END OF RUN subroutine (LBL 08) is reached. It disables the PASS subroutine, looping it back to END OF RUN, so trials beyond the designated end of a run can't be carried out. The PASS subroutine is enabled (flag 01 cleared) once a time seed has been entered in LBL 04.

Flag 02 is set at the beginning of the PESP program. It prevents pressing of the PASS or RESULTS key prematurely (before the first READY prompt) from starting trials before paradigmatic data and a time seed have been gathered. Pressing PASS or RESULTS before entering a time seed cycles back to the MONTH? prompt. This flag is cleared after the time seed is entered.