Journal of Scientific Exploration, Vol. 6, No. 4, pp. 311–332, 1992
0892-3310/92

Experiments in Remote Human/Machine Interaction

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Abstract—Several extensive experimental studies of human/machine interactions wherein the human operators and the target machines are separated by distances of up to several thousand miles yield anomalous results comparable in scale and character to those produced under conditions of physical proximity. The output distributions of random binary events produced by a variety of microelectronic random and pseudorandom generators, as well as by a macroscopic random mechanical cascade, display small but replicable and statistically significant mean shifts correlated with the remote operators' pre-stated intentions, and feature cumulative achievement patterns similar to those of the corresponding local experiments. Individual operator effect sizes distribute normally, with the majority of participants contributing to the overall effect. Patterns of specific count populations are also similar to those found in the corresponding local experiments. The insensitivity of the size and details of these results to intervening distance and time adds credence to a large database of precognitive remote perception experiments, and suggests that these two forms of anomaly may draw from similar mechanisms of information exchange between human consciousness and random physical processes.

Introduction

Since its inception in 1979, the Princeton Engineering Anomalies Research (PEAR) program has investigated two categories of anomalous phenomena: 1) the effect of human intention on the performance of engineering devices that involve various random and pseudo-random physical processes; and 2) the non-sensory perception of information about remote geographical targets. Both of these experimental programs were originally designed as replications and extensions of studies reported by other laboratories (Puthoff & Targ, 1976; Puthoff & Targ, 1977; Schmidt, 1970; Schmidt, 1973, Radin & Nelson, 1989), and both have produced results that confirm the ability of human consciousness to interact with the tangible world in ways that are inexplicable by known physical mechanisms (Dunne, Dobyns, & Intner, 1989; Dunne, Jahn, & Nelson, 1983; Dunne, Nelson, & Jahn, 1988; Jahn & Dunne, 1987; Jahn, Dunne, & Nelson, 1987; Nelson, Dunne, & Jahn, 1984; Nelson, Dunne, & Jahn, 1988a/1988b).

The benchmark human/machine experiments have utilized a sophisticated microelectronic random event generator (REG) based on a reverse-biased solid state noise diode (Nelson, Dunne, & Jahn, 1984). Human operators, sitting within a few feet of the experimental apparatus, attempt to shift the mean of its output distribution of random binaries to higher or lower values, or to take a baseline, in accordance with pre-recorded intentions. The first several years of such experimentation consistently yielded statistically significant correlations between those intentions and the performance of the machines. For example, the initial experimental data base, consisting of over a quarter million trials per intention of 200 binary samples each, generated by 33 individual operators, displayed a statistically significant difference between the high- and low-intention output distributions with a composite z-score of 3.614, $p=2 \times 10^{-4}$ (Jahn & Dunne, 1987; Jahn, Dunne, & Nelson, 1987). A similar experiment employing a macroscopic random mechanical cascade (RMC) device, comprising 1131 runs per intention each tantamount to 9000 trials or approximately 387,000 binary equivalents, generated by 25 individuals, produced an overall difference z-score of 3.891, $p=5 \times 10^{-5}$ (Dunne, Nelson, & Jahn, 1988; Nelson, Dunne, & Jahn, 1988a/1988b).

The remote perception class of experiments requires participants to describe their impressions of unknown sites where another individual is, has been, or will be situated at a specified time. Details of the methodology, analyses, and results of these investigations have been reported in Dunne, Dobyns, & Intner, 1989; and Dunne, Jahn, & Nelson, 1983. In brief, a data base of some 336 trials yielded highly significant statistical evidence of extra-chance information acquisition ($z=6.355$, $p=10^{-10}$), for percipients generating descriptions of targets ranging from less than a mile to more than 5,000 miles from their own location, over temporal intervals ranging from several days before to several days after their partner's visit to the target site. In the majority of the precognitive efforts, the descriptions were recorded before the target was even selected. No significant reduction of the anomalous effect with increased distance or time separation was found over the ranges tested.

Remote REG Experiments

The demonstrated space and time insensitivity of the remote perception results prompted investigation of whether the human/machine experiments might also be successfully conducted by operators spatially and temporally remote from the apparatus. Accordingly, a protocol was implemented wherein the REG was set to generate automatically runs of 1000 trials, each of 14 minutes duration, as opposed to the 50-trial runs that constituted the original local data base. For these experiments, termed REMREG, the standard experimental unit, or "series", was defined as 3000 trials, or three runs, generated under each of the three intentions—high, low, and baseline. Since this modification altered four different variables—run length, feedback, operator location, and time—attempts were made to isolate these parameters under four separate sub-protocols termed A, B, C and D:

Run Length

This protocol was identical to that of the benchmark local experiments, except for the longer run length and the resultant increase in series length from the original 2500 trials per intention to 3000 trials per intention. Operators sat proximate to the REG during data generation and received on-line feedback via LED displays indicating the current trial number and count, as well as the cumulating mean of each run. Data for each series were accumulated in three one-hour sessions, each consisting of one 1000-trial run under each of the three intentions.

Feedback

The effects of eliminating on-line feedback were explored by having the operator initiate each run, but sit in an adjacent room during its actual generation. At the end of each run, the operator returned to the REG room to observe and record the results. (In all experiments in our laboratory, data are automatically recorded on-line in a computer file, as well as on an independently generated hard copy record; log books provide a third data record that also permits operators to report in writing any subjective observations or other relevant information pertaining to the experiment.)

Location

In these remote experiments the operator was situated at some distant location, having arranged in advance for members of the laboratory staff to initiate the three runs of each session at regular 20-minute intervals, commencing at a specified time. Laboratory personnel took turns initiating and recording the runs, and no one was present in the REG room while the data were being generated. No staff member had knowledge of the operator's intentions until after the runs were completed and recorded. At that time, the operator communicated the sequence of the high, low, and baseline intentions, usually by phone but occasionally by mail, before receiving any feedback about the outcome.

Time

This remote condition was identical to C, except that the operator performed his or her efforts at times before or after the actual machine operation.

During the period from October 1984 through November 1987, a total of 182 REMREG series were generated by 31 operators on our microelectronic diode-based REG. Of these, 106 series, or 318,000 trials, were produced by 22 operators under the remote conditions, 86 series in the C sub-protocol, and 20 in the D. A small database of 7 remote series was also generated by one operator on a shift register-based pseudorandom generator (Nelson, Dunne, & Jahn, 1984) under the C condition. The results of the local A and B protocol experiments have been incorporated within a comprehensive ANOVA study of all REG data (Nelson & Dobyns, 1991), and will not be discussed further here.

Beginning in November 1987, a third variation of the REG protocol was implemented to explore individual operator responses to a broader range of secondary variables, among them distance and time. In this protocol, termed THOUREG, the size of an experimental series was reduced to 1000 trials per intention to permit its completion in a single session and to encourage operators to produce larger and more varied databases. The THOUREG experiment, which concluded in January, 1991, included a total of 78 remote series, 51 in the C condition and 27 in the D, generated by 10 operators. One operator also generated 10 remote D series under this protocol on the shift register-based pseudorandom device. The THOUREG protocol was also used for a body of experiments employing a software algorithm-based pseudoREG, operating on an IBM-PC/AT computer in a program called ATPseudo (Nelson & Dobyns, 1991). Nine operators generated a total of 64 remote series on this device, 61 in the C condition and 3 in the D.

In total, some 265 remote REG series, comprising 491,000 trials per intention, were generated by 30 different operators on three different machines over a six year period. These represent approximately 20% of the total PEAR REG database as of January 1991, and include trials generated from Kenya, India, New Zealand, Hawaii, Brazil, Russia, Hungary, Germany, and England, as well as from various places in Canada and the continental U.S. In approximately 20% of these remote experiments (60 series, or 100,000 trials) the operator efforts were at times other than those during which the machines were running, the temporal differences ranging from several days before to several days after the time of machine operation.

Results

The composite results of the entire remote REG database, distinguished by C and D conditions, are summarized in Table 1. Figure 1 displays the combined data in the form of a cumulative deviation graph. Further breakdown of the data by device and experiment is provided in Table 2. Operator-specific tabulations are available in Dunne & Jahn (1991). In all formats, these results show strong evidence for anomalous correlation between remote operator intention and the performance of three different random event generators for the high efforts, ($z = 3.185$, $p = 7 \times 10^{-4}$), while the low efforts are statistically indistinguishable from chance. High/low separations are consistently in the intended direction, with the single exception of the small REM-Pseudo subset, and the magnitude of the split between these directions of intention is unlikely by chance at a z-score of 2.227 ($p = .013$). Despite the large differences in the sizes of the various device and experiment subsets, the positive yield of the high-going efforts is consistent, with the sole exception of the C condition Diode-THOU data. The low and baseline efforts, in contrast, stay within chance in the majority of subsets.

The striking asymmetry between high- and low-intention yields clearly observable in the traces of Fig. 1 has also been found, to a lesser degree, in the composite results of the local REG experiments on these same three devices, as displayed in Fig. 2. This substantially larger local database consists of 968 series, comprising well over 1.3 million trials per intention, and was generated by 95 different operators. Table 3 compares the bottom line results of the remote and local databases by intention. Standard t-test comparisons indicate that the two populations are statistically indistinguishable for each of the three intentions, as well as for the high/low shifts.

TABLE 1
Remote REG Data Summary

Condition	Intention	Mean	z-score	Prob.[1,2]	Propor. srs. p < .05[3]	Propor. int. dir.[3]
C						
205 series	Baseline	100.004	0.389	.348	.059 (.039)	.522
391,000 trials	High	100.027	2.348	.009*	.059 (.034)	.590*
per intention	Low	100.005	0.462	.322	.059 (.039)	.478
29 operators	Hi/Lo Diff.	.022	1.333	.091	.063 (.034)	.541
D						
60 series	Baseline	100.016	0.731	.232	.117* (0)*	.450
100,000 trials	High	100.054	2.416	.008*	.050 (.017)	.650*
per intention	Low	99.981	−0.834	.202	.067 (.033)	.483
10 operators	Hi/Lo Diff.	.073	2.298	.011*	.083 (0)*	.633*
All Remote						
265 series	Baseline	100.007	0.678	.249	.072 (.030)	.506
491,000 trials	High	100.032	3.185	7×10^{-4}*	.057 (.030)	.604*
per intention	Low	100.000	0.036	(.486)	.060 (.038)	.479
30 operators	Hi/Lo Diff.	.032	2.227	.013*	.068 (.026)*	.562*

[1] Numbers in parentheses ( ) indicate effects opposite to intention.
[2] Counts marked with * are unlikely by chance at p < .05 (1-tailed).
[3] For Baselines, proportion of series with mean >100.

It should be noted that the higher z-scores of the local results are attributable to the size of that database, which is three times larger than that of the remote experiments. For this reason it is important also to consider the effect sizes or, equivalently, the average mean shifts, in assessing the relative yields of the various data sets. For example, while the z-scores for the high efforts are of comparable magnitude (3.185 for the remote and 3.308 for the local) the remote data have a mean of

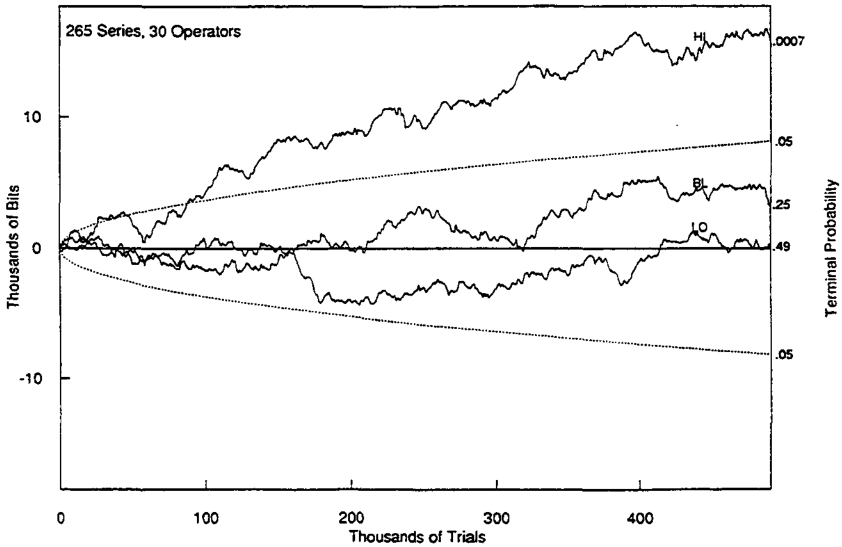

Fig. 1. All REG remote data.

TABLE 2
Remote REG Data Summary by Device and Experiment

					Mean z-score			
Expt.	Cond.	#Srs.	#Trials/int.	#Ops.	Baseline	High	Low	Hi/Lo Diff
Diode								
REM	C	86	258,000	22	*100.011*	*100.020*	*99.999*	*.021*
					0.777	1.456	−0.021	1.044
	D	20	60,000	5	*100.001*	*100.032*	*99.970*	*.062*
					0.025	1.122	−1.053	1.538
	All	106	318,000	22	*100.009*	*100.023*	*99.994*	*.029*
					0.711	1.799*	−0.476	1.608
THOU	C	51	51,000	8	*100.034*	*99.986*	*99.962*	*.024*
					1.076	−0.455	−1.218	0.539
	D	27	27,000	6	*100.022*	*100.086*	*99.991*	*.095*
					0.514	2.007*	−0.215	1.571
	All	78	78,000	10	*100.030*	*100.021*	*99.972*	*.049*
					1.172	0.813	−1.111	1.361
All	C	137	309,000	26	*100.015*	*100.015*	*99.993*	*.022*
					1.147	1.145	−0.514	1.173
	D	47	87,000	9	*100.007*	*100.049*	*99.976*	*.073*
					0.307	2.050*	−0.994	2.153
	All	184	396,000	27	*100.013*	*100.022*	*99.990*	*.032*
					1.157	1.973*	−0.920	2.045*
Pseudo								
REM	C	7	21,000	1	*99.896*	*100.052*	*100.064*	*−.012*
					−2.123(*)	1.058	1.302	−0.173
THOU	D	10	10,000	1	*100.057*	*100.055*	*99.983*	*.072*
					0.806	0.771	−0.242	0.716
All	All	17	31,000	2	*99.948*	*100.053*	*100.038*	*.015*
					−1.289	1.308	0.934	0.265
ATPseudo								
THOU	C	61	61,000	9	*99.990*	*100.079*	*100.045*	*.034*
					−0.350	2.745*	1.562	0.836
	D	3	3,000	2	*100.142*	*100.194*	*100.127*	*.067*
					1.097	1.503	0.981	0.369
	All	64	64,000	9	*99.997*	*100.084*	*100.049*	*.035*
					−0.105	3.005*	1.737*	0.897

* p < .05 in direction of intention (mean > 100 for baselines).
(*) p < .05 in direction of opposite intention (mean < 100 for baselines).

100.032 compared to the local mean of 100.020. If the remote effect size were to be sustained over a database similar in size to the local, a z-score of well over 5.0 would result, with an associated probability on the order of 10^{-8}. This point is also relevant in interpreting the statistical significance of the proportions of series with $p < .05$, or of those conforming to the intended direction.

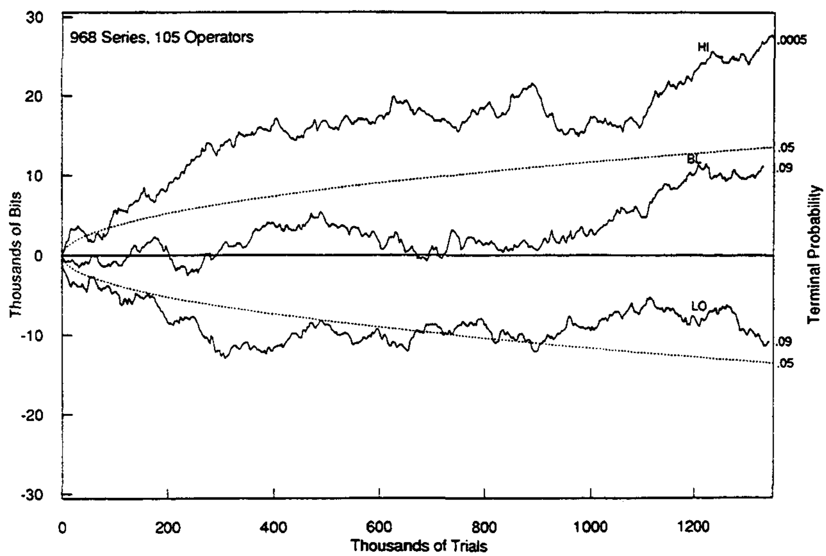

Fig. 2. All REG local data.

Distance and Time Comparisons

Any attempt to postulate a mechanism for these remote effects would benefit from some knowledge of their quantitative dependence on distance and time. The precognitive remote perception data which stimulated these studies revealed no significant dependencies on these parameters, and the same appears to hold for the human/machine results as well. In Fig. 3, the series z-scores of all the remote high efforts (both C and D) are plotted as a function of the distance between operator and device, over distances ranging from less than one to nearly 9,000 miles. The only significant term in a standard regression analysis is a constant displacement from the chance value, which lies well within the 95% confidence intervals for the linear slope. In other words, none of the higher order terms statistically support attenuation of the effect with increasing distance.

The high-intention off-time (D) data can be similarly arrayed as a function of the time difference between machine operation and operator effort (Fig. 4). The positive numbers on the x-axis indicate efforts up to 73 hours prior to machine operation, and the negative numbers efforts up to 336 hours after the scheduled session. Again, there is no significant correlation between time of effort and size of effect, over the range studied.

The apparent insensitivity of the magnitude of these effects to the intervening distance or time suggests that the phenomenon may well be akin to that observed in the PRP experiments. It may also be worth noting that, although comparison between the C and D subsets proves statistically non-significant ($t = 1.074$), the off-time D efforts produce consistently larger effect sizes across the various high and high/low difference subsets of Tables 1 and 2. The lack of significance of this difference is primarily attributable to the relatively small amount of D data; if the ob-

TABLE 3
REG Remote vs Local Comparisons

	Remote (C & D)			Local (A)	
Baseline					
# of Trials/intention	491,000			1,330,250	
# of Series	265			957	
Mean	100.007			100.008	
z-score	0.678			1.279	
Probability[1]	.249			.100	
Proportion Series $p < .05$[2]	.072	(.030)		.060	(.046)
Proportion Series mean > 100	.506			.513	
t-score of remote-local differences			0.085		
High					
# of Trials/intention	491,000			1,351,900	
# of Series	265			968	
Mean	100.032			100.020	
z-score	3.185			3.308	
Probability	7×10^{-4}*			5×10^{-4}*	
Proportion Series $p < .05$	.057	(.030)		.068*	(.043)
Proportion Series intended direction	.604*			.517	
t-score of remote-local differences			1.018		
Low					
# of Trials/intention	491,000			1,343,550	
# of Series	265			968	
Mean	100.000			99.992	
z-score	0.036			−1.316	
Probability	.486			.094	
Proportion Series $p < .05$	.060	(.038)		.059	(.055)
Proportion Series intended direction	.479			.523	
t-score of remote-local differences			0.678		
Hi/Lo Differences					
# of Trials/intention	982,000			2,695,450	
# of Series	265			968	
Mean Diff.	.032			.028	
z-score	2.227			3.272	
Probability	.013*			5×10^{-4}*	
Proportion Series $p < .05$	.068	(.026)*		.060	(.051)
Proportion Series intended direction	.562*			.541*	
t-score of remote-local differences			0.240		

[1] All probabilities 1-tailed.

[2] ( ) denotes proportion of series where $p < .05$ in direction opposite to intention, or mean < 100 in baselines.

* $p < .05$.

served score differences were to persist through larger databases, we would need to confront the possibility that off-time effort may actually enhance the effect.

Trial Count Populations

Hypothetically, the anomalous mean shifts of the REG experimental outputs could be produced by a variety of distortions of the trial count distributions. By examining the individual count populations, i.e., the number of trials conforming to

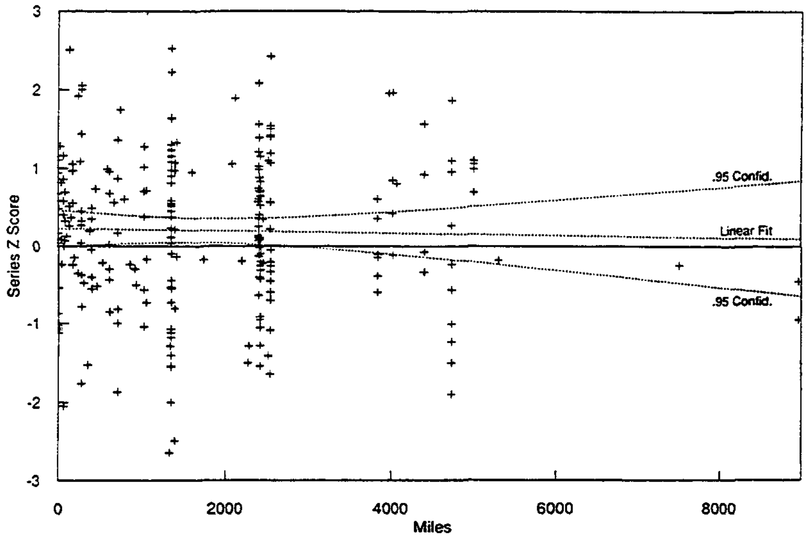

Fig. 3. All REG remote data vs distance.

each integer count, . . . 98, 99, 100, 101, 102, etc. . . . , it is possible to determine whether the mean shifts result from an excess or deficiency of counts near the mean or in the tails of the distribution, or from some random or regularly distributed pattern of count differences across the entire distribution. Fig. 5 shows the distribution of trial count deviations from expected values, Δn, for all high- and low-intention remote REG data. In the high data, where there is a significant shift of the mean in the direction of effort, a majority of counts above 100 show a clear excess, while most of the lower numbered counts display a nearly consistent

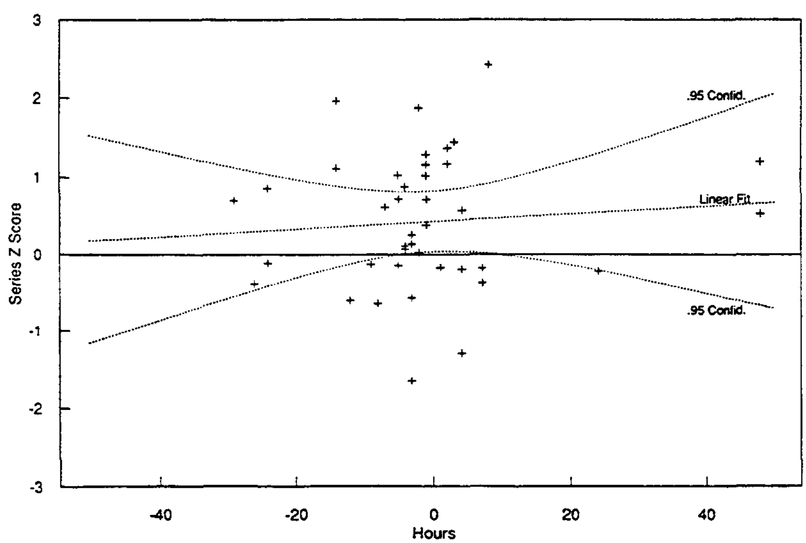

Fig. 4. All REG off-time remote data vs time difference.

deficit. In the low data, where there is no overall effect, the count distributions show no regular patterns. The baseline and calibration data, like those of the low data efforts, also display random arrays of count excesses and deficits. These patterns are consistent with those found in the local experiments: namely, when an anomalous mean shift occurs, the burden of the deviation is borne by a majority of the trial count values on both sides of the mean, rather than by just a few extreme values; when there is no significant mean shift, the count populations are random (Jahn, Dobyns, & Dunne, 1991).

In both local and remote data, the proportional changes in the count populations from their chance expectations, $\Delta n/n$, are found to scale linearly with the difference between the particular count number and the mean count number, 100. Fig. 6 compares the high-intention remote and local data re-plotted as such proportional count deviations, fitted by their appropriate linear regressions. In both instances, the proportional deviations display significant z-scores only for the first order (linear) trends (Z1); the quadratic trends (Z2) are quite insignificant. This can be shown analytically to be tantamount to simple translations of the theoretical chance Gaussian distribution without any selective enhancement of any particular count populations, or equivalently to specific changes in the elemental binary probability underlying the original random distributions. Again, the close quantitative similarity between the remote and local data in this respect strongly suggests that both experiments are dealing in the same basic phenomenon.

Individual Operator Contributions

Throughout all our local REG studies, characteristic differences in individual operator performance and in their sensitivities to secondary experimental parameters have added important dimensions to the credibility and interpretation of the local human/machine data (Dunne, Nelson, Dobyns, & Jahn, 1988; Jahn & Dunne, 1987; Jahn, Dunne, & Nelson, 1987; Nelson & Dobyns, 1991).

A similar spectrum of individual performance is found in the remote experiments, as well. Table 4 summarizes the effects obtained by each of the 30 participating operators; more detailed breakdowns are provided in Appendix A of Dunne & Jahn, 1991. Briefly, 21 operators, or 70%, succeed in producing positive results in the high direction of effort, compared with the 15 expected by chance. Of these, four, or 13%, have databases with probabilities of less than .05, compared to the one or two expected by chance.

Several of the smaller operator databases, although technically non- significant, display effect sizes that are of comparable magnitude to the significant larger ones. In contrast, the distributions of the low and baseline results are consistent with chance expectations; in fact, the baseline results are evenly divided, with 50% of the operators producing baselines above 100 and 50% below. Twenty operators, or 67%, split the high and low efforts in the direction of intention, although this is primarily attributable to the high-intention yield.

The upper graph of Fig. 7 displays the distribution of individual operator effect sizes for the high remote efforts, confirming graphically the contribution to the

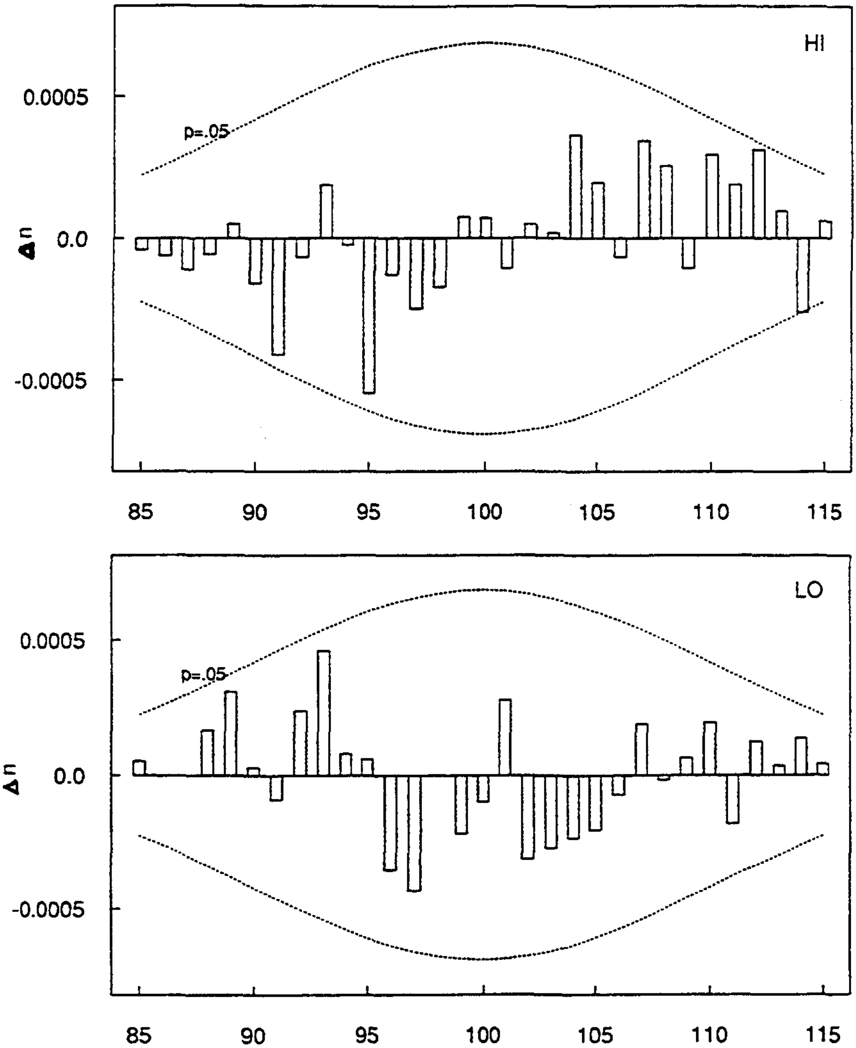

Fig. 5. Remote REG count frequency deviations.

overall yield by a majority of the operators. In this figure, the solid curve indicates the distribution of operator effect sizes that would be expected by chance, while the dashed curve traces the same theoretical distribution consistent with a mean shift of the observed magnitude. The close approximation of the latter to the actual operator distribution emphasizes the uniformity of operator contributions, in contrast to an effect driven solely by the data of a few exceptional operators. The lower graph provides a similar representation of the local high-intention data (Dunne, Nelson, Dobyns, & Jahn, 1988), which again shows a strong resemblance to the pattern of operator contributions in the remote experiments.

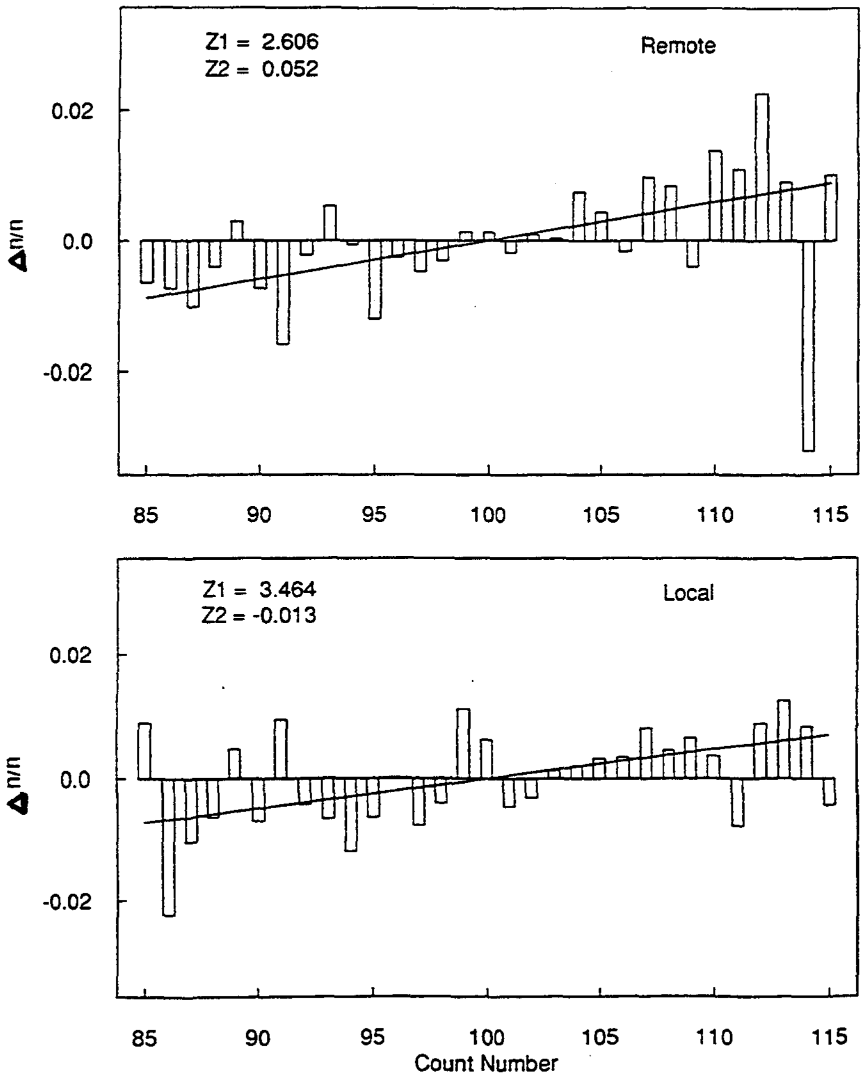

Fig. 6. REG proportional count deviations (High Intention).

Remote Random Mechanical Cascade Experiments

We have long operated a substantially different human/machine facility that also lends itself well to remote experiments, a macroscopic "Random Mechanical Cascade" (RMC), details of whose design, protocol, analysis, and results have been reported in Dunne, Nelson, & Jahn, 1988; Jahn & Dunne, 1987; Jahn, Dunne, & Nelson, 1987; Nelson, Dunne, & Jahn, 1988a/1988b. The basic experiment requires an operator to attempt to influence the mean of a distribution of 9000 3/4″ polystyrene balls dropped through a maze of 336 nylon pegs into 19 collecting

TABLE 4
Remote REG Data Summary by Operator

Opr.	# Series C	# Series D	Total # Trials/Int.	Baseline Mean	High Mean	Low Mean	Hi/Lo Mean Diff.	z Diff.
10	24	1	45,000	100.010	100.087*	100.006	.081	1.739*
14	4	—	12,000	99.993	100.039	100.006	.033	0.365
16	42	—	66,000	99.981	100.049*	100.009	.040	1.029
18	4	—	12,000	100.077	99.996	99.940	.056	0.620
20	1	—	3,000	99.769	99.999	99.974	.025	0.139
21	9	—	9,000	100.006	99.978	99.999	−.021	−0.203
22	4	—	4,000	99.974	100.224*	99.977	.247	1.562
27	3	—	3,000	100.005	100.017	99.919	.098	0.533
30	3	—	9,000	100.075	100.002	99.922	.080	0.758
36	12	7	19,000	100.055	99.957	99.858*	.099	1.368
37	1	—	3,000	99.835	100.166	100.099	.067	0.365
39	5	—	15,000	99.953	100.048	99.951	.097	1.182
41	4	15	31,000	100.060	100.062	100.017	.045	0.789
42	4	—	12,000	100.096	99.909	100.001	−.092	−1.011
45	2	—	6,000	100.067	100.021	100.056	−.035	−0.269
48	1	—	3,000	99.881	99.833	100.080	−.247	−1.351
49	8	8	48,000	99.954	100.048	99.997	.051	1.110
55	1	—	3,000	100.096	100.063	100.055	.008	0.047
57	5	5	20,000	99.990	100.130*	100.035	.095	1.334
68	3	—	9,000	100.107	99.920	100.039	−.119	−1.133
70	11	4	25,000	100.050	100.013	100.020	−.007	−0.113
78	16	9	25,000	100.042	100.045	99.986	.059	0.940
80	1	—	3,000	99.998	100.067	99.792	.275	1.504
81	2	—	6,000	100.169	100.106	99.948	.158	1.228
84	—	4	4,000	100.051	100.087	100.210(*)	−.123	−0.773
86	1	—	3,000	99.891	100.088	100.182	−.094	−0.519
93	18	6	68,000	99.993	99.994	100.024	−.030	−0.779
94	4	—	12,000	100.022	100.008	99.968	.040	0.444
114	3	—	3,000	99.936	100.050	100.248(*)	−.198	−1.084
130	9	1	10,000	99.886	99.950	99.949	.001	0.004

* $p < .05$ in direction of intention (mean > 100 for baselines).
(*) $p < .05$ in direction opposite to intention (mean < 100 for baselines).

bins, wherein they accumulate in a good approximation of a Gaussian distribution. In the local experiments, the operator sits on a sofa approximately eight feet from the device and observes this 10′ × 6′ machine in operation over a 12-minute run. Data are generated in sets of three runs, each distinguished only by the operator's pre-recorded intentions to shift the mean of the ball distributions to the right, to the left, or to produce a baseline, and a typical experimental series consists of ten such sets. Because of the susceptibility of the device to long term drifts associated with wear or temperature and humidity variations, and in the absence of any theoretical expectation of the mean, statistical analysis of the data is based on paired t-test comparisons of runs within each local set. Even by this conservative measure, the overall yield of 87 local series generated by 25 different operators (a total of 1,131 runs in each of the three intentions) has proven statistically significant at $t=3.891$, $p=5 \times 10^{-5}$ (Dunne, Nelson, & Jahn, 1988; Jahn & Dunne, 1987; Nelson, Dunne, & Jahn, 1988a/1988b).

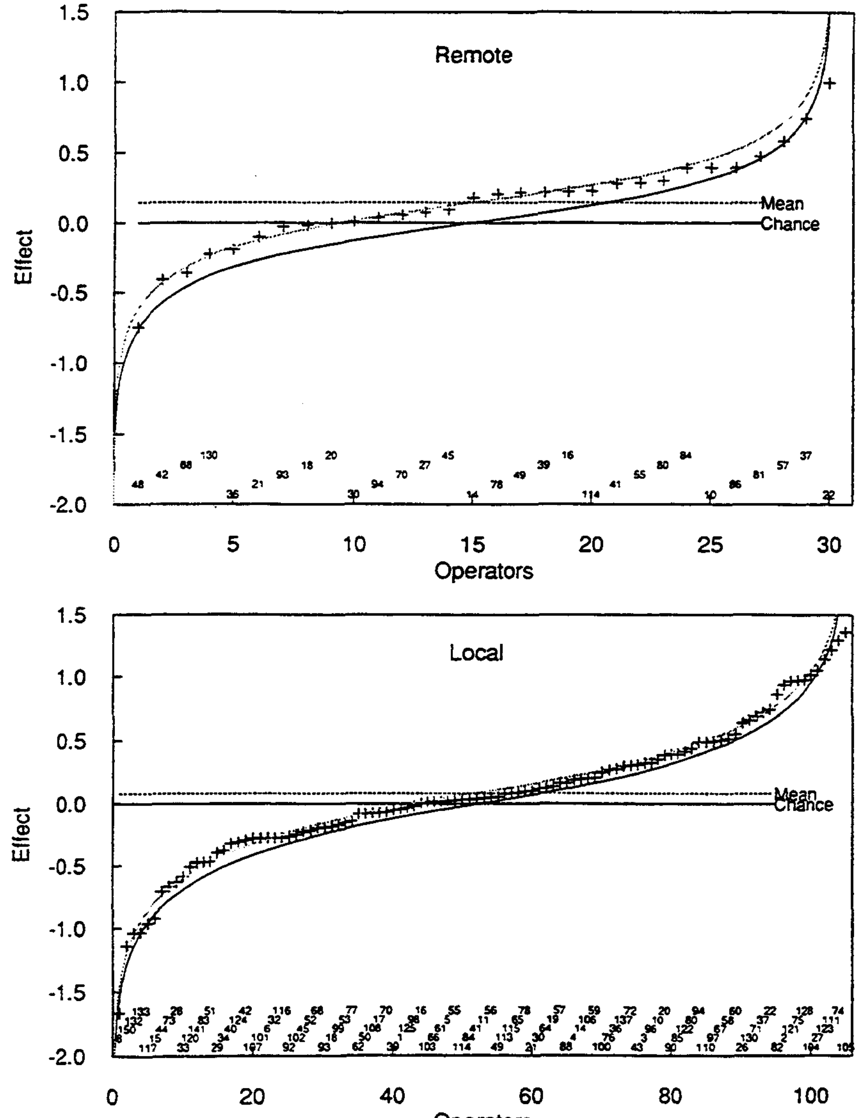

Fig. 7. REG operator effect sizes.

Little modification of the RMC protocol for remote operation is required, since the local protocol is already similar to that employed for the remote REG experiments. At a nominal time agreed upon with the operator, and at subsequent intervals of 20 minutes, members of the laboratory staff, who are blind to the remote operator's intentions, turn on the machine and record the data, only after which the operator reveals the order of the three intentions by phone or mail. Ten operators have completed a total of 26 such remote series of ten tripolar sets each, from dis-

TABLE 5
Remote RMC Data Summary by Operator

Opr.	# Srs.	Baseline Mean	Right Mean	Left Mean	t-score Rt-Lt	Prob.	# Srs. p < .05	# Srs. p < .50
10	6	10.0159	10.0171	10.0126	0.651	.259	—	4
12	1	9.9956	10.0020	9.9808	1.100	.152	—	1
16	7	10.0013	10.0047	9.9981	1.070	.144	2	4
41	1	10.0290	10.0150	10.0126	0.288	.390	—	1
49	3	10.0078	10.0076	9.9934	1.991	.028*	1	3
68	2	10.0100	9.9994	10.0108	−1.326	(.100)	—(1)	—
69	1	10.0488	10.0318	10.0429	−0.691	(.255)	—	—
78	1	9.9797	10.0163	9.9944	1.538	.079	—	1
93	2	10.0109	10.0258	10.0139	1.000	.165	—	2
94	2	9.9984	10.0075	10.0000	0.890	.192	1	1
All	26	10.0084	10.0111	10.0047	2.139	.017*	4* (1)	17*

* $p < .05$ in direction of intention.

tances similar to those involved in the remote REG experiments. None of these were conducted at displaced times.

Although this remote RMC database is substantially smaller than that of the REG, the results once again show a statistically significant correlation with operator intention (Table 5). While only one operator individually achieved a significant overall split between the right and left intentions, eight of the ten produced results in the intended directions, compounding to a composite t-score of 2.14 ($p = .017$) for the right-left split. The overall difference between the means of the right- and left-going efforts, .0064 bins, is consistent with, and indeed somewhat larger than, that of the much larger local RMC data base, where the difference is .0057. Similar comparisons can be made between the proportion of significant series (15.4% of the remote data base vs. 14.9% of the local), and the proportion of series showing a split in the intended direction (65.4% of the remote series vs. 63.2% of the local).

From Fig. 8, which displays the remote and local results in the form of cumulative deviations of the differences, it is evident that the remote database, like the remote REG, also entails some asymmetry over a large portion of the data traces, in this case toward the left or low numbered bins. This left-going asymmetry also dominates the local RMC results, and while there is little parametric correlation or theoretical explication of this feature, its consistent appearance in both data sets further strengthens their commonality.

Finally, as with the REG data, a majority of both the local and remote RMC individual bin count populations develop orderly displacements in the direction of intention. Fig. 9 compares the right-left bin population differences of the remote and local RMC data in proportional $\Delta n/n$ formats, fit by the appropriate linear regressions. As in the local and remote REG databases, the first order terms dominate the fits, again suggesting specific alterations of the elementary binary probability, even though the fundamental definition of this probability for the RMC process is somewhat less explicit.

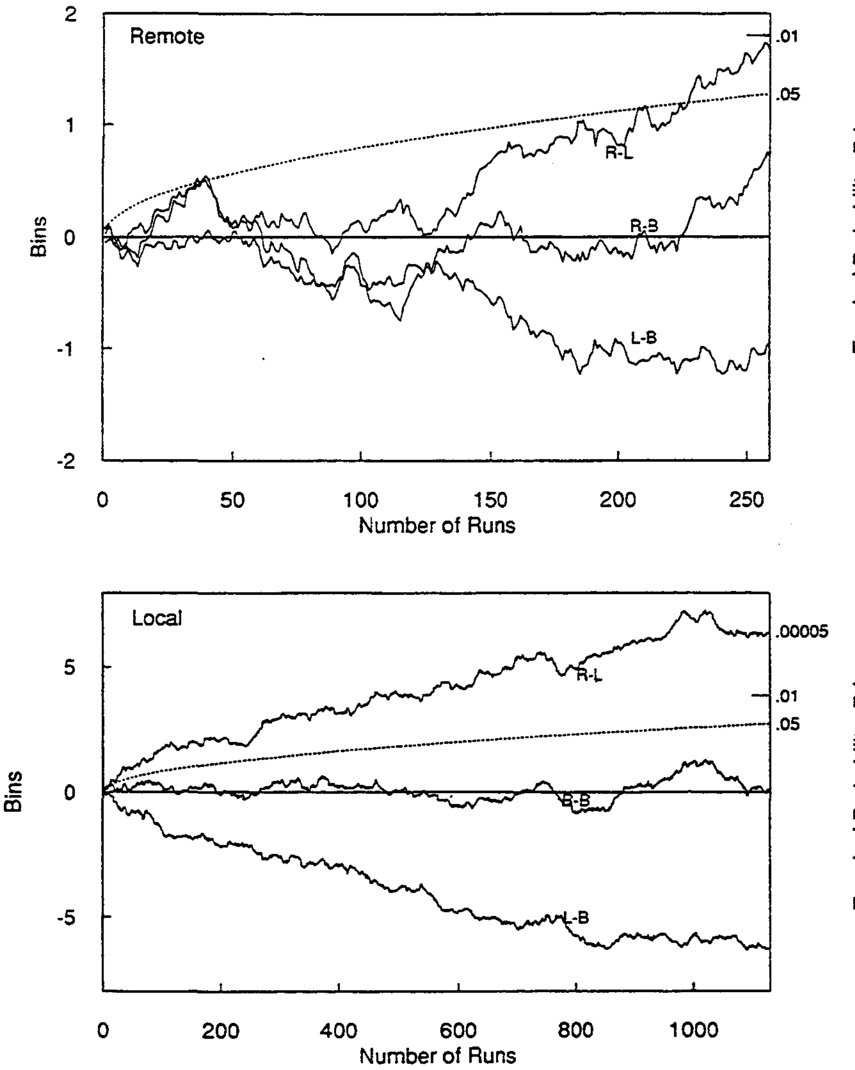

Fig. 8. All RMC cumulative deviations.

Precognitive Remote Perception (PRP)

As noted earlier, these experiments in remote human/machine interaction were originally prompted by the findings of our remote perception experiments, where the anomalous acquisition of information appears to be insensitive to intervening distance or time. It is now worth returning briefly to the PRP results to determine whether other instructive similarities between the yields of these two superficially disparate experimental programs may be found. For example, in the PRP data

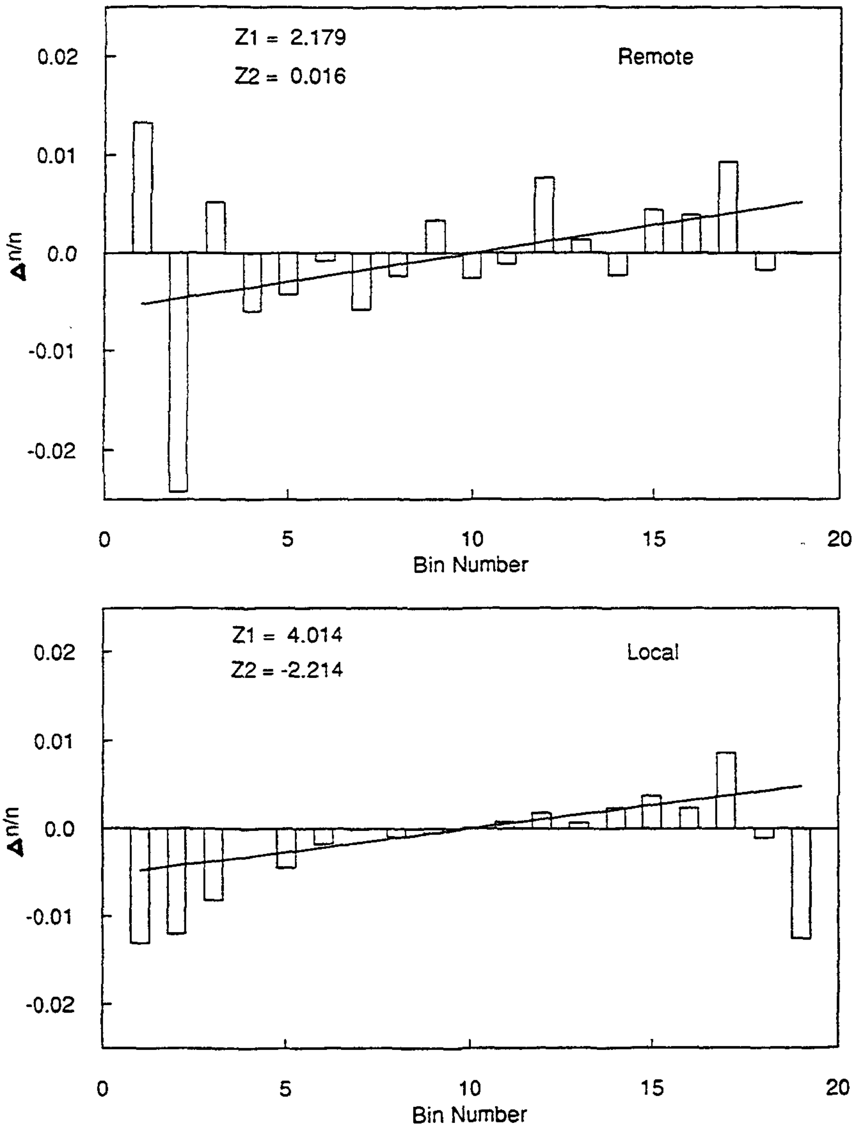

Fig. 9. RMC proportional count deviations (Right−Left).

shown in Fig. 10, we see the same type of small, incremental deviations in the individual trial scores compounding to significant shifts of the experimental score distributions relative to the empirical "chance" distributions of deliberately mismatched scores. The arrays of discrete PRP score increments also display the same Δn/n linear regularities as the human/machine data. Fig. 11 shows such treatment of 277 formal PRP trials, encoded ab initio by the participants (Dunne, Dobyns, & Intner, 1989; Dunne, Jahn, & Nelson, 1983; Jahn & Dunne, 1987), where the reg-

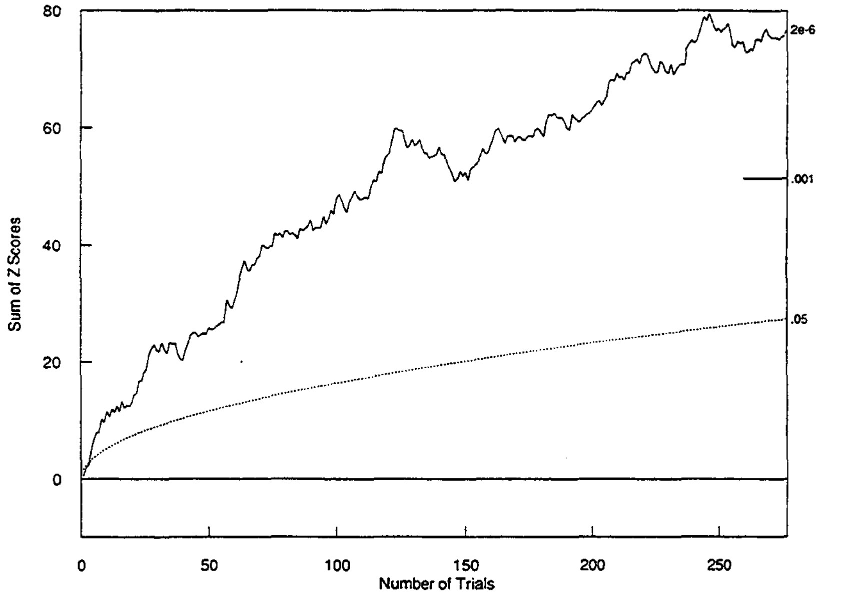

Fig. 10. PRP cumulative deviations (277 Ab Initio Trials).

ular linear pattern, akin to those observed in the human/machine data, suggests a uniform slight improvement in the statistical likelihood of percipients' proper identification of the target descriptors. Comparison of the scores achieved by those 28 percipients who generated at least five trials with the chance pattern and with the theoretical distribution of effects appropriate to a mean shift of the observed magnitude (Fig. 12) again indicates a uniformity of percipient contributions to the data base, rather than a disproportionate yield from just a few individuals (Dunne, Nelson, Dobyns, & Jahn, 1988). All of these indications thus support a fundamental commonality among the REG, RMC, and PRP phenomena.

Summary and Discussion

The experiments described in this paper present persuasive evidence that the anomalous correlations of operator intention with the performance of several substantially different types of random physical device, as originally found in local experiments, can also be obtained with the operators separated from the machines by distances up to several thousand miles. Indeed, these remote efforts appear to produce slightly larger effect sizes than those obtained under local conditions. The anomalous effects are also found to persist, perhaps even to be somewhat enhanced, when the time of operator effort is displaced from the time of machine operation, within the limits tested (cf Fig. 13).

The credibility of all these remote results is buttressed by a number of internal features that mimic those seen in local experiments. For example, the directional asymmetries of achievement observed in the benchmark REG and RMC studies are repeated in the remote experiments. Since the calibration data of these devices

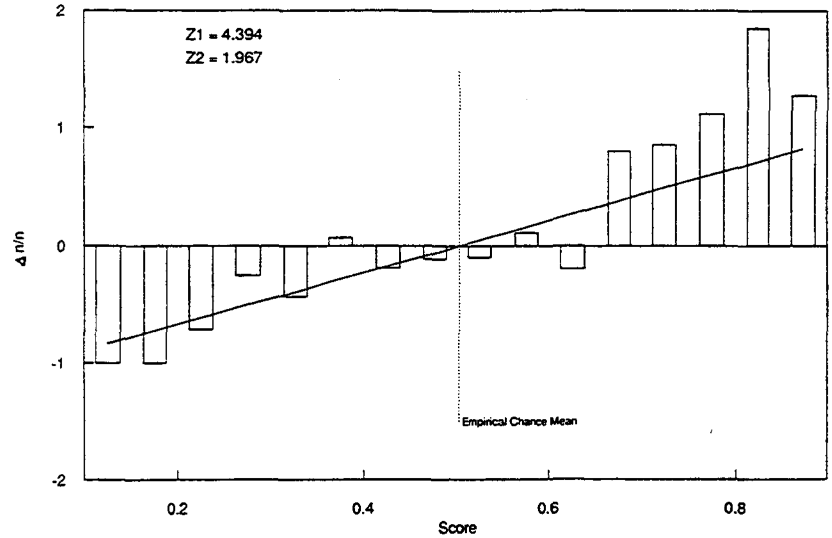

Fig. 11. PRP proportional score deviations (227 Ab Initio trials).

display no such biases, this effect must be related to some subtle psychological characteristics of the operator-machine interactions that manifest in substantial directional preferences, regardless of the physical proximity of the operator to the machine.

Likewise, the interior count structures of the anomalous remote output distributions are similar to those produced under local conditions. In both cases, the trial (or bin) count populations indicate effects that are diffused across the entire distribution in a manner consistent with a slight shift of the elemental binary probabili-

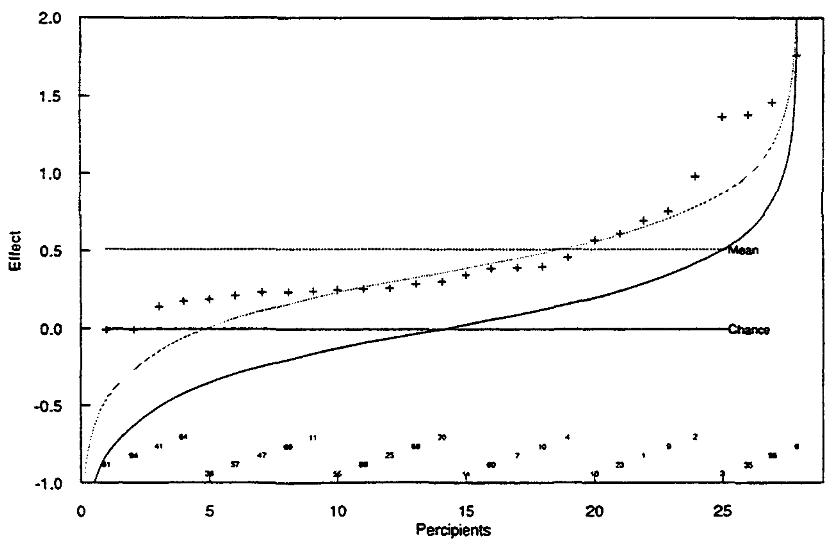

Fig. 12. PRP percipient effect sizes.

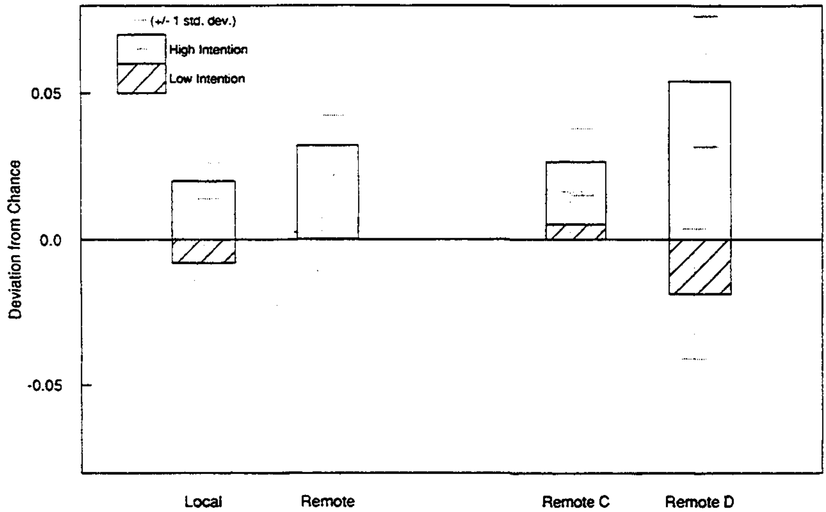

Fig. 13. Comparisons of REG effect sizes.

ties from their theoretical expectation, rather than attributable to an excess of extreme counts. As discussed in Jahn, Dobyns, & Dunne, 1991, such patterns suggest that the operator's consciousness is inserting order, or information, into the output data string in the most parsimonious fashion to achieve its pre-stated purpose.

Examination of the individual operator effect sizes indicates, in both remote and local efforts, that the majority of the participants are generating effects in the preferred direction of intention, and that these are distributed over a spectrum consisent with the theoretical distribution that would be expected for a mean shift of the observed scale. This consistency is again consonant with the hypothesis of an anomalous alteration of the probabilities underlying the physical process itself.

Finally, in their incremental extra-chance yields, insensitivity to distance and time, similarity of internal structure, and regularity of operator contributions, the results of these remote human/machine experiments bear strong resemblance to those of our remote perception experiments. Thus, beyond lending mutual credence to one another, they strongly suggest a common underlying mechanism that is capable of both acquisition and insertion of information in correlation with conscious intention. Any formal distinction between the fundamental processes of "psychokinesis" and "precognition" thereby becomes somewhat moot. Whatever theoretical implications may devolve from these results, one important empirical consequence is worth noting. Much of the criticism of experimentation in this field has focused on the inadequacy of shielding of the equipment from inadvertent or deliberate spurious disturbance by the operator, e.g. via vibrational, acoustical, electromagnetic, chemical, or thermal means. For this reason, most laboratories take considerable care to preclude such artifacts via various noise suppression, vibration isolation, and electromagnetic shielding techniques. In a real sense, the demonstration of equivalent patterns of results correlated with the intentions of operators who are thousands of miles away from the equipment may be regarded as the ultimate defense against such suspicions of artifactual disturbance, since by any reasonable criterion, these must be strongly enabled by the operator's proximity. The only remanent sources then must involve the laboratory staff or local physical environment, and these of course are totally disarmed by the double-blind, tripolar protocols employed.

Returning to the theoretical issues, while there have been many attempts to interpret consciousness-related anomalous phenomena in terms of some physical form of information transmission, virtually all of these have explicitly or implicitly presumed a space/time reference matrix. The demonstration of negligible attenuation of the empirical effects with distance, along with their precognitive and retrocognitive capacities, would seem to call this presumption into question, and specifically to preclude their attribution to any known form of field radiation, be it electromagnetic, geophysical, or even subtler physical vectors. Rather, some more radical proposition seems unavoidable.

Elsewhere we have suggested that such phenomena may derive from a fundamental resonance or bond between the operator and machine, or between the remote perception participants, that facilitates a shared state of knowledge extending over both space and time, and that appears to produce anomalous effects when forced into a causal paradigm (Jahn & Dunne, 1986; Jahn & Dunne, 1987). For example, we have outlined a quantum wave-mechanical model wherein these human/machine resonances are compared with covalent molecular bonds whose exchange energies derive from the sacrifice of information discriminating their atomic components. In support of this concept, our operators' informal subjective reports of their experimental experiences repeatedly refer to some identification or resonance with the experimental devices, and it may be that this bonding process is somehow enhanced as the logical improbability of their task increases, e.g. by spatial and temporal separation from the equipment. It could then follow from this model that the loss of direct information, such as the visible and audible characteristics of the machines, transcribes into the slightly enhanced ordering of the random statistical outputs that they generate.

At the least, we must acknowledge that the empirical anomalies emerging from these systematic human/machine experiments continue to compound and to deepen.

Acknowledgements

The Princeton Engineering Anomalies Research program is supported by grants from the John E. Fetzer Institute, the McDonnell Foundation, Mr. George Ohrstrom, Mr. Laurance S. Rockefeller, and Mr. Donald C. Webster. Special thanks are extended to the members of our laboratory staff who contributed to the design, conduct, and analysis of these experiments and the preparation of this report, and to the many volunteer operators who have so generously given of their time and energy to the generation of the data presented herein.

References

Bell, J. S. (1964). On the Einstein-Podolsky-Rosen paradox. *Physics, 1,* 195-200.

Dunne, B. J., Dobyns, Y. H., & Intner, S. M. (1989). Precognitive Remote Perception III: Complete Binary Data Base with Analytical Refinements. (Technical Note PEAR 89002). Princeton Engineering Anomalies Research, Princeton University, School of Engineering/Applied Science.

Dunne, B. J. & Jahn, R. G. (1991). Experiments in Remote Human/Machine Interaction. (Technical Note PEAR 91003). Princeton Engineering Anomalies Research, Princeton University, School of Engineering/Applied Science.

Dunne, B. J., Jahn, R. G., & Nelson, R. D. (1983). Precognitive Remote Perception. (Technical Note PEAR 83003). Princeton Engineering Anomalies Research, Princeton University, School of Engineering/Applied Science.

Dunne, B. J., Nelson, R. D., Dobyns, Y. H., & Jahn, R. G. (1988). Individual Operator Contributions in Large Data Base Anomalies Experiments. (Technical Note PEAR 88002). Princeton Engineering Anomalies Research, Princeton University, School of Engineering/Applied Science.

Dunne, B. J., Nelson, R. D., & Jahn, R. G. (1988). Operator-related anomalies in a random mechanical cascade. *Journal of Scientific Exploration, 2,* 155-179.

Jahn, R. G., Dobyns, Y. H., & Dunne, B. J. (1991). Count Population Profiles in Engineering Anomalies Experiments. (Technical Note PEAR 91001). Princeton Engineering Anomalies Research, Princeton University, School of Engineering/Applied Science.

Jahn, R. G. & Dunne, B. J. (1986). On the quantum mechanics of consciousness, with application to anomalous phenomena. *Foundations of Physics,* 16, 721-772.

Jahn, R. G., & Dunne, B. J. (1987). *Margins of Reality: The Role of Consciousness in the Physical World.* New York: Harcourt Brace Jovanovich.

Jahn, R. G., Dunne, B. J., & Nelson, R. D. (1987). Engineering anomalies research. *Journal of Scientific Exploration, 1,* 21-50.

Nelson, R. D., & Dobyns, Y. H. (1991). Analysis of Variance of Random Event Generator Experiments: Operator Intention, Secondary Parameters, Database Structure. (Technical Note PEAR 91004). Princeton Engineering Anomalies Research, Princeton University, School of Engineering/Applied Science.

Nelson, R. D., Dunne, B. J., & Jahn, R. G. (1984). An REG Experiment with Large Database Capability, III: Operator Related Anomalies (Technical Note PEAR 84003). Princeton Engineering Anomalies Research, Princeton University, School of Engineering/Applied Science.

Nelson, R. D., Dunne, B. J., & Jahn, R. G. (1988a). Operator Related Anomalies in a Random Mechanical Cascade Experiment (Technical Note PEAR 88001), and (1988b). Operator Related Anomalies in a Mechanical Cascade Experiment: Supplement, Individual Operator Series and Concatenations (Technical Note PEAR 88001.S). Princeton Engineering Anomalies Research, Princeton University, School of Engineering/Applied Science.

Puthoff, H. E., & Targ, R. (1976). A perceptual channel for information transfer over kilometer distances: Historical perspective and recent research. *Proceedings IEEE, 64,* 329-54.

Puthoff, H. E., & Targ, R. (1977). *Mind Reach.* New York: Delacorte Press.

Radin, D. I., & Nelson, R. D. (1989). Evidence for consciousness-related anomalies in random physical systems. *Foundation of Physics, 19,* 1499-1514.

Schmidt, H. (1970). A PK test with electronic equipment. *Journal of Parapsychology, 34,* 175-181.

Schmidt, H. (1973). PK tests with a high-speed random number generator. *Journal of Parapsychology, 37,* 105-118.