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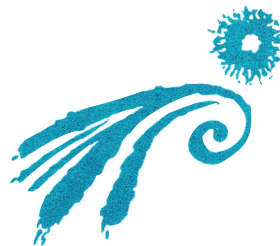
Random Robot Redux: Replications and Reflections

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ABSTRACT

A previous program of human/machine anomalies experiments utilizing a randomly driven mechanical robot has been extended with a sequence of new trials specifically addressing particular physical and subjective correlates. Despite the modest size of this database, acquired under less than ideal laboratory conditions, the absolute and statistical scales of the anomalous effects well exceed those typical of experiments of this class. Beyond gross replication of the earlier results, the new data display structural aspects that offer additional insights into the fundamental nature of such mind/matter phenomena in general, and suggest potential pragmatic applications in various technical practices.

I. Background

In earlier publications,^(1,2) we presented in some detail the intellectual motivation, empirical precedents, technical design, construction, operation, analysis, results, and interpretation of an extensive sequence of human/machine experiments that employed an autonomous robot driven by an onboard random event generator (REG) as a target for various volitional intentions of its operators. Explored were attempts to influence the azimuthal angle at which the robot exited its circular platform; the time period over which it remained on the platform; and the total stochastic distance it covered from its starting central position to its peripheral exit. Each of these protocols yielded overall data that clearly separated in accordance with the pre-stated operator intentions, with effect sizes and structural aberrations similar to those found in many other REG experiments. In an attempt to extend these prior studies for purposes of empirical replication, pilot exploration of revised protocols, investigation of individual interests, and furtherance of basic understanding of the underlying mind/matter interaction phenomena, a new sequence of such robot experiments has since been performed, as reported herein.

Figures 1 and 2 present photographs of the robot and its platform in the laboratory. All other details of its instrumentation and operation are the same as those described in References 1 and 2, but with the following caveats: It should be noted that these Phase II experiments were carried out over a five-month period during which necessary preparations for, and execution of, the closure of the PEAR laboratory were accomplished (January–May 2007), and that the associated environmental disturbances inescapably compromised the precision of equipment alignment and the comfort of the operators to an extent we would not normally have tolerated. For example, midway



Figure 1:
Close-up
of PEAR robot

through this period of experiments, we were obliged to abandon our computerized overhead optical tracking system, which had become prejudiced by repeated jostlings of its mountings and of the robot table itself, in favor of manual time and position observations, which nevertheless proved more than adequate to capture the essential performance characteristics with the accuracy we required. At a later point it even became necessary to transfer all of the experimental equipment to another room where it was reassembled and operated with no evident compromise in its behavior. Notwithstanding these distractions, the robustness of the anomalous effects displayed and the conservatism and simplicity of the analytical criteria applied reassure that the salient effects reported here prevailed over these disruptions. Indeed, their persistence through this background of operational noise may be an indicative hint of their underlying character.



Figure 2: PEAR robot on its operating platform

II. Protocol and Participants

For this round of experiments we chose to concentrate the operator efforts solely on the “time-of-flight” mode wherein were compared the residence times of the robot on the table for adjacent efforts to hasten its exit (t_S), or to prolong its excursion (t_L). Time differences ($t_L - t_S$) were compiled solely from successive long-intention and short-intention trials performed in a single period of operation, to minimize any effects of secular drift in the mechanical performance of the robot itself.

Only two operators contributed two relatively small bodies of data. The first (henceforth Op X) was an adult male member of the PEAR staff who had been involved with the construction and analysis of this experiment from its inception, and who expressed a particular affinity for the device and for his empirical experience with it,

especially in this time-of-flight mode. The second (Op Y) was an undergraduate male intern who became so intrigued with the experiment during his introductory apprenticeship that he voluntarily continued to generate data well beyond his normal academic residence requirement. Op X generated just one series of data (Series A), comprising 10 long/short sets performed over a period of a few days, primarily to signal requalification and resumption of the robot experiments into the laboratory agenda. Op Y generated three somewhat larger series (B, C, D), totaling 65 balanced sets, along with some calibration data, over a subsequent 3½-month period. Detailed listings of all of the data acquired are presented in the Appendix; a summary of the experimental and analytical results is reported in Table 1 below.

III. Results

Despite the small size of this Phase II database, several starkly anomalous effects are nonetheless evident within it:

- 1) Each of the four series departs significantly from the chance expectation for the number of trials processed. In Series A, for example, of the ten successive sets of alternating short-intention and long-intention trials, eight show separations of their times-of-flight in the desired direction. The total or mean times of the long-intention trials exceed those of the short-intention trials by a factor of 1.58. Elementary statistical analysis of the time-difference distribution returns a T -score against chance expectation of 2.50, an equivalent Z -score of 2.15, and a probability of chance occurrence of .02. The effect size, computed as Z_D/\sqrt{N} , is an order of magnitude larger than those achieved in most of the prior experiments.

Table 1: Phase II Random Robot Results Summary

| Op | Series | N | N_+ | μ_L | μ_S | μ_{LS} | μ_D | σ_L | σ_S | σ_{LS} | σ_D | T_D | p_T | Z_D | ε_D | T_{LS} |
|------|---------|-----|-------|---------|---------|------------|---------|------------|------------|---------------|------------|-------|-------|-------|-----------------|----------|
| X | A | 10 | 8 | 50.80 | 32.12 | 41.46 | 18.68 | 23.45 | 16.58 | 21.97 | 23.66 | 2.50 | .02 | 2.15 | .68 | 2.06 |
| Y | B | 15 | 10 | 64.27 | 43.16 | 53.72 | 21.11 | 42.91 | 22.27 | 35.26 | 46.98 | 1.74 | .05 | 1.64 | .42 | 1.69 |
| | C | 25 | 8 | 68.52 | 89.04 | 78.78 | -20.52 | 45.86 | 72.23 | 60.78 | 63.13 | -1.63 | .94 | -1.57 | -.31 | -1.20 |
| | D | 25 | 16 | 101.80 | 70.84 | 86.32 | 30.96 | 55.07 | 39.81 | 50.07 | 70.17 | 2.21 | .02 | 2.09 | .42 | 2.28 |
| | B+C+D | 65 | 34 | 80.34 | 71.45 | 75.90 | 8.89 | 51.22 | 54.48 | 52.86 | 66.23 | 1.08 | .14 | 1.07 | .13 | 0.97 |
| X, Y | A+B+C+D | 75 | 42 | 76.40 | 66.21 | 71.30 | 10.19 | 49.38 | 52.74 | 51.17 | 62.23 | 1.42 | .08 | 1.40 | .16 | 1.22 |
| Y | *Cal | 10 | 6 | 63.50 | 69.60 | 66.55 | -6.10 | 32.60 | 44.53 | 38.11 | 64.40 | -0.30 | .60 | -.29 | -.09 | -0.35 |

N = number of long/short paired sets of trials

N_+ = number of sets having positive time differences ($t_L - t_S$)

μ_L = mean time of long-intention trials

μ_S = mean time of short-intention trials

μ_{LS} = mean time of all trials

μ_D = mean time difference over all sets

T_D = statistical T -score of difference distribution = $(\mu_D/\sigma_D) \sqrt{N}$

p_T = probability of greater T -score (1-tailed)

Z_D = statistical Z -score of difference distribution computed *via* Rosenthal approximation:⁽³⁾ $Z = \{N \times \ln [1 + T^2/N] \times [1 - 1/2N]\}^{1/2}$

ε_D = effect size computed as Z_D/\sqrt{N}

T_{LS} = score of two-distribution T -test = $\mu_D \sqrt{N} / \sqrt{(\sigma_L)^2 + (\sigma_S)^2}$

*: For this calibration series, “long” and “short” values are arbitrarily assigned to odd- and even-numbered trials, respectively.

σ_L = standard deviation of distribution of times of long trials

σ_S = standard deviation of distribution of times of short trials

σ_{LS} = standard deviation of distribution of times of all trials

σ_D = standard deviation of distribution of time differences

- 2) Similar extra-chance behavior characterizes Op Y performance in each of his Series B, C, and D.
- 3) However, Op Y performance in Series C is starkly opposite to that achieved in his preceding and following series, actually reaching a significant “psi-miss” level on a one-tailed *T*-score basis, remarkably equivalent in magnitude and structure to his positive achievement on the preceding Series B and the following Series D.
- 4) While this reversal essentially cancels one or the other of his positive series achievements, rendering his three-series database and the overall four-series database less than significant, if one constructs chi-squared values over these groups of series,

$$(\chi^2 = \sum_B^D Z_i^2 = 9.56 \text{ on } 3 \text{ d.f.}), \quad (\chi^2 = \sum_A^D Z_i^2 = 14.18 \text{ on } 4 \text{ d.f.}),$$

the corresponding probabilities of these series-level structures occurring by chance are approximately 0.024 and 0.007, respectively. Otherwise stated, all four series of these two operators, if cast against the much larger database of the prior study, would stand as extreme outliers in that composite distribution of performances (*cf.* Table 2 of Refs. 1 and 2).

- 5) The calibration data taken in the course of these Phase II experiments, like those acquired throughout the earlier studies, fall well within chance expectation. (Clearly, it would have been preferable to collect a much larger body of local calibration data comparable in size to that of the experimental database, but the aforementioned laboratory constraints precluded this. Nonetheless, the similarity of this smaller sample to the calibrations obtained in the prior phase of experiments, and to the composite A, B, C, D empirical μ_{LS} and σ_{LS} values

obtained in this Phase II, reassure that this paucity could not substantially compromise the primary results.)

The most parsimonious interpretation of these empirical observations is that this experimental design has again fostered emergence of consciousness-correlated physical phenomena in the rather simple and direct context of an REG-driven mechanical robot, and that these two operators, for whatever reasons of environment, attitude, or strategy, have performed exceptionally well. Indeed, the anomalous effect sizes seen here are demonstrably larger than virtually all of those found with the more elaborate and precise automated facility used in the prior studies, and actually are comparable with those of our best other REG-based experiments of any genre, especially those employing fresh operators generating small exploratory databases on novel experimental designs.^(4,5,6) To this extent, some degree of specific and general replication may be claimed.

Other structural similarities of these data to those of prior studies can be noted:

- 6) The sharp reversal and recovery of Op Y performance over his series B, C, and D conform to a host of “series position effects” commonly encountered in many of our REG experiments, such as those reported in Reference 7.
- 7) Op Y’s superior performance in Series D was associated with an auditory environment of his favorite music, a tactic occasionally employed by some operators on other REG experiments.⁽⁸⁾
- 8) The stated emotional “resonance” of both operators with this particular experiment reinforces the importance of this subjective factor as postulated in several of our theoretical models,⁽⁹⁾ and affirmed in much anecdotal experience.

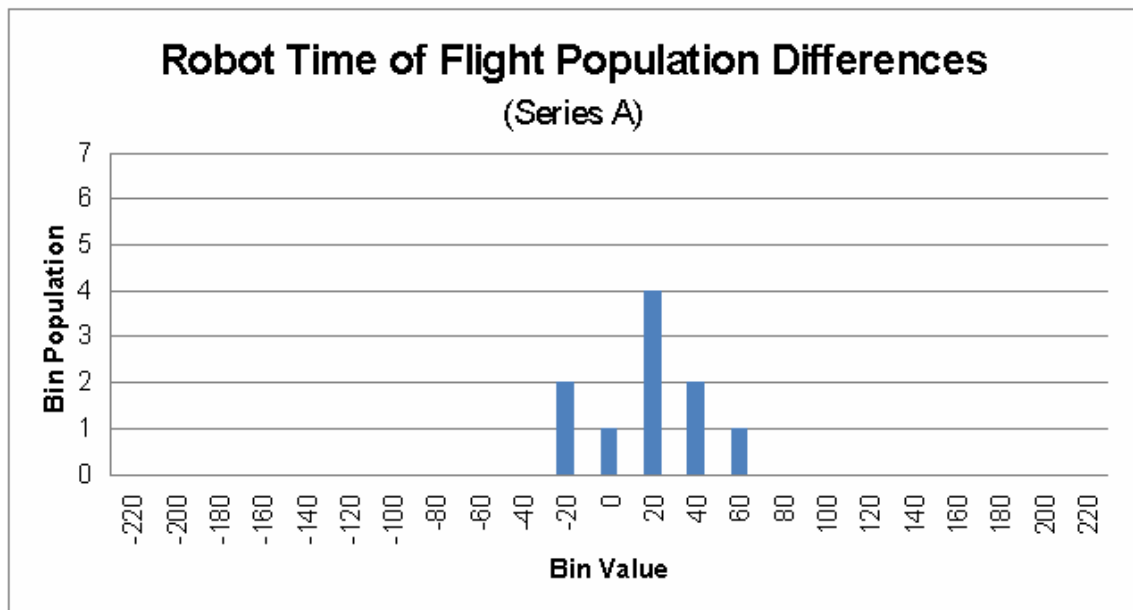
- 9) The hovering of the series scores in the vicinity of the conventional, but arbitrary, .05 chance probability criteria also is characteristic of much other REG experimental data, supporting the relevance of subjective teleological correlates for such anomalous phenomena.^(9,10)

In addition to the differential treatment of the data just described, one also could assemble separate distributions for all of the long-intention and short-intention trials and compare those statistically. For example, two-distribution *T*-tests applied to the individual long and short series and to the composite databases return the values listed as T_{LS} in the rightmost column of Table 1. The small differences of these from the corresponding differential values, T_D , are attributable to the disparities among the relevant standard deviations, σ_L , σ_S , σ_D , and the hybrid value $(\sigma_L^2 + \sigma_S^2)^{1/2}$ used in the *T* calculations, but these do not substantially alter the salient characteristics of the result patterns.

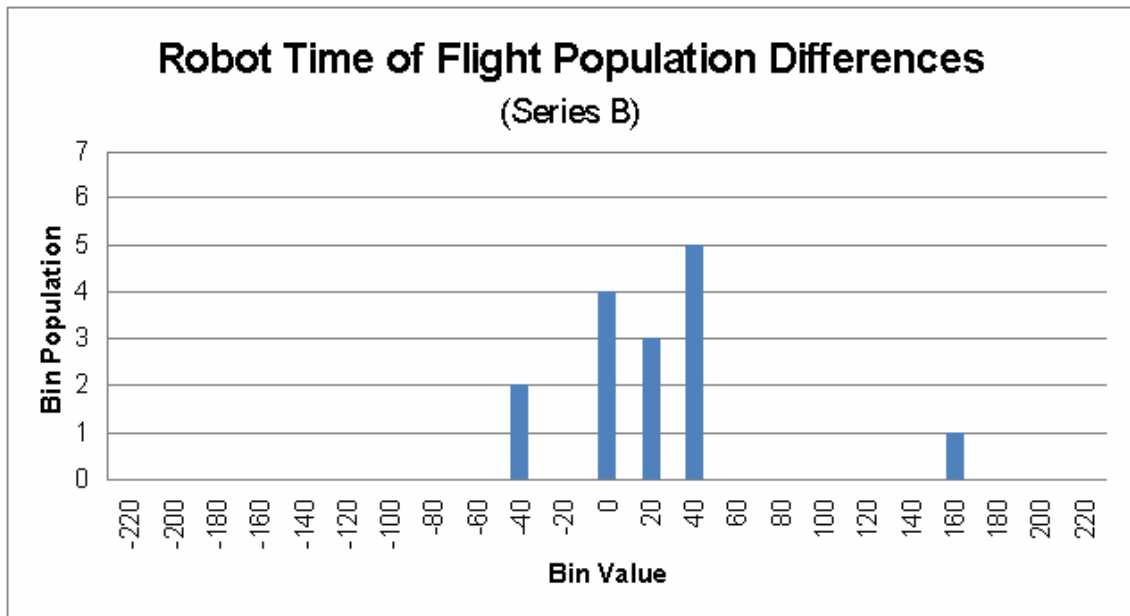
To aid visual conceptualization, Figures 3a–f display graphical representations of the distributions of the difference and calibration data. Figures 4a, b show the long and short data, *per se*. Clearly evident are the predominant skews of the long and short distributions, and some coupling of each variance value to its corresponding mean (also evident in Table 1). In this regard, we should take note of an apparent monotonic progression of the various μ and σ values as the experiments proceeded through their five-month operational period. These positive inclines may reflect some valid progression in the pattern of operator influence or they could be an artifact imposed by a gradual deterioration in the robot's mechanical performance, attributable to ageing of its onboard batteries, loss of traction of its wheels on the platform, or wearing of its motor

and gear works that caused it to propagate more slowly in executing the stochastic motion dictated by its onboard REG. Such tendencies have been noted over the entire experimental life of this device, and it is for this reason that we have preferred strictly differential protocols and analyses which minimize or essentially eliminate this confound. One could consider some sort of empirical compensation for this drift in performance, but it can be shown that this would not substantially change the *differential* results. It could, however, compact somewhat the separate long and short data distributions, depending on which portion of the secular protractions were assumed to be artefactual.

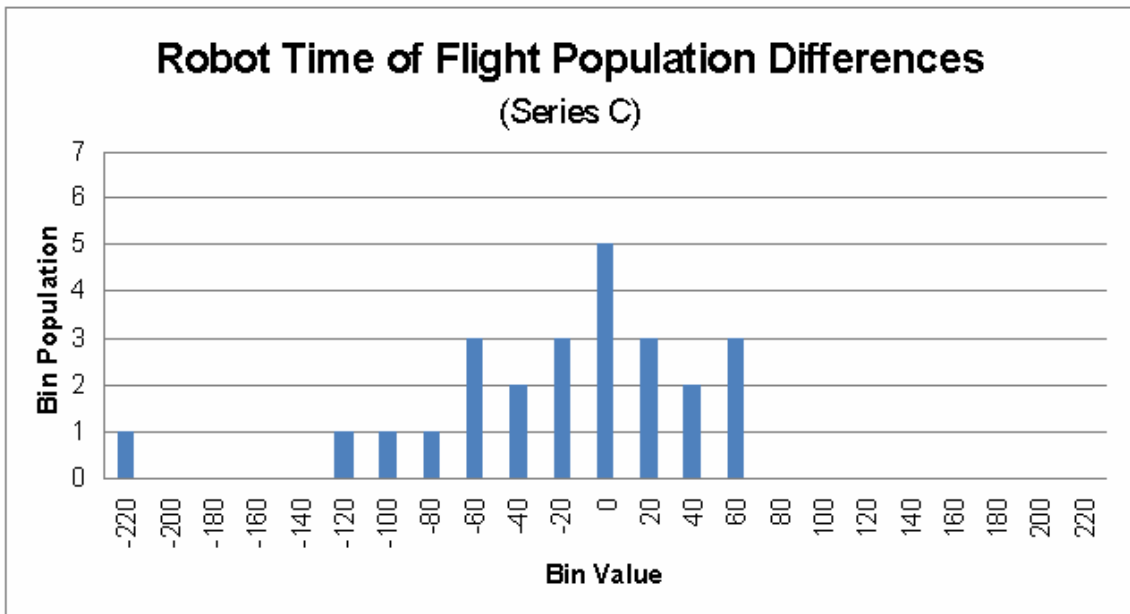
Figure 3: Binned Time-of-Flight Differences for Paired Sets of Long-Intention and Short-Intention Trials; Bins are 20 seconds wide, left exclusive, centered on the numbered values.



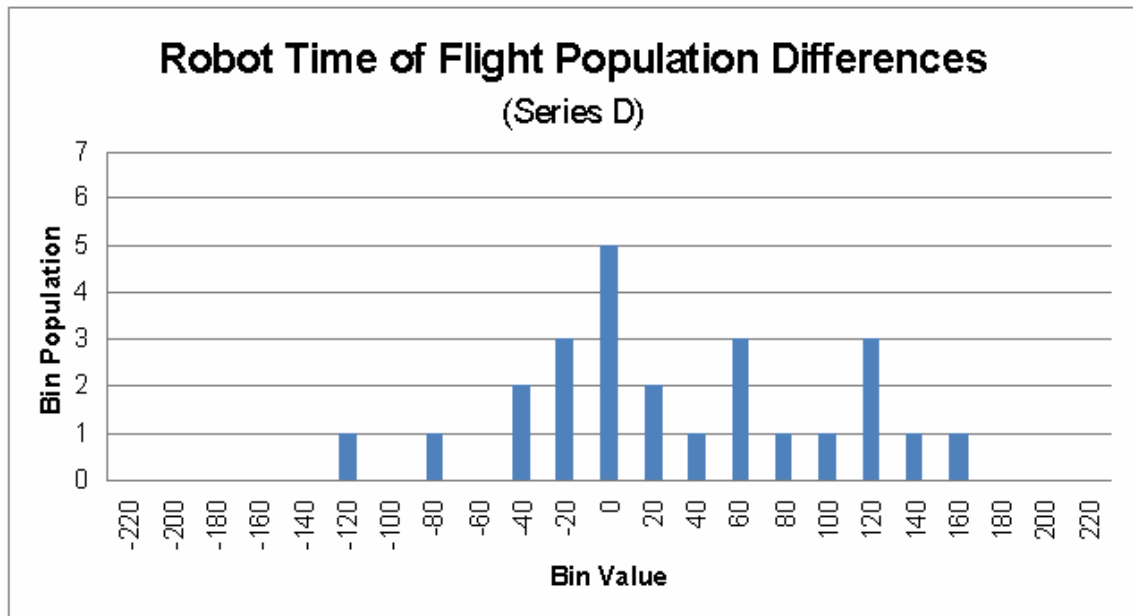
a) Series A, Op X



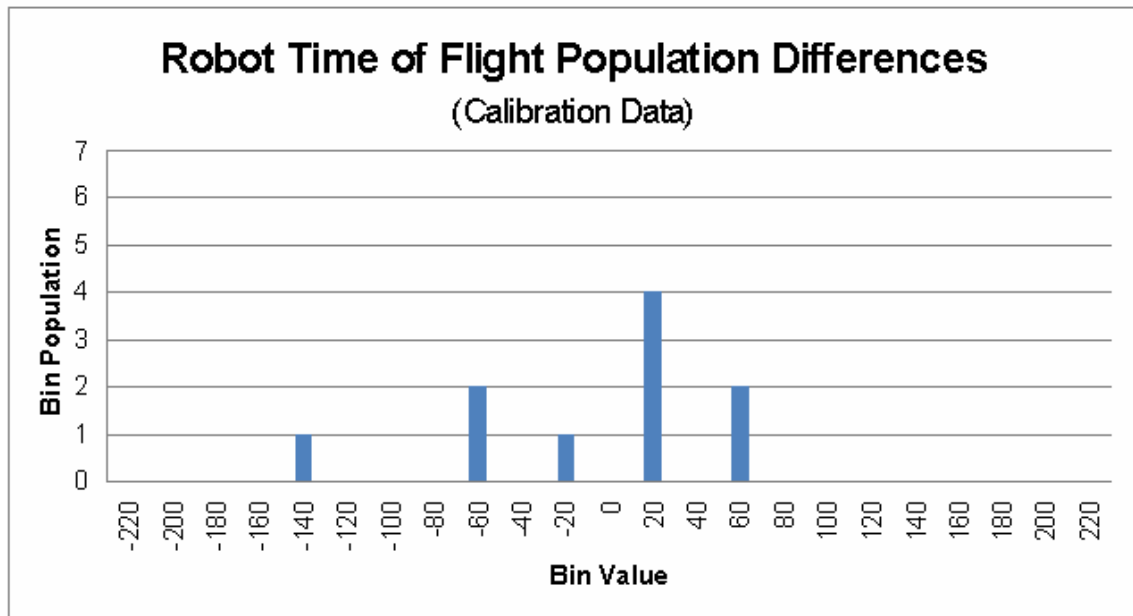
b) Series B, Op Y



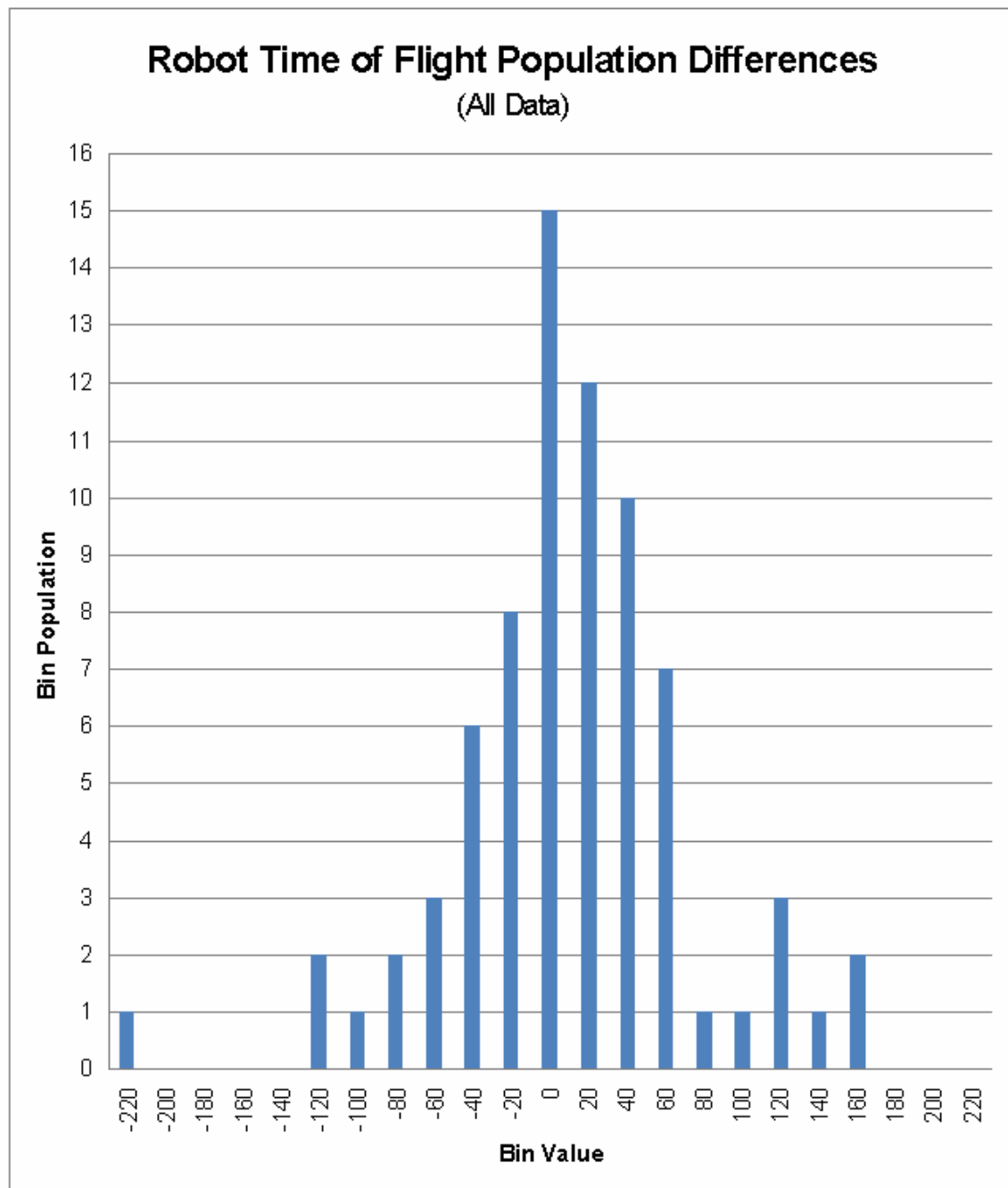
c) Series C, Op Y



d) Series D, Op Y

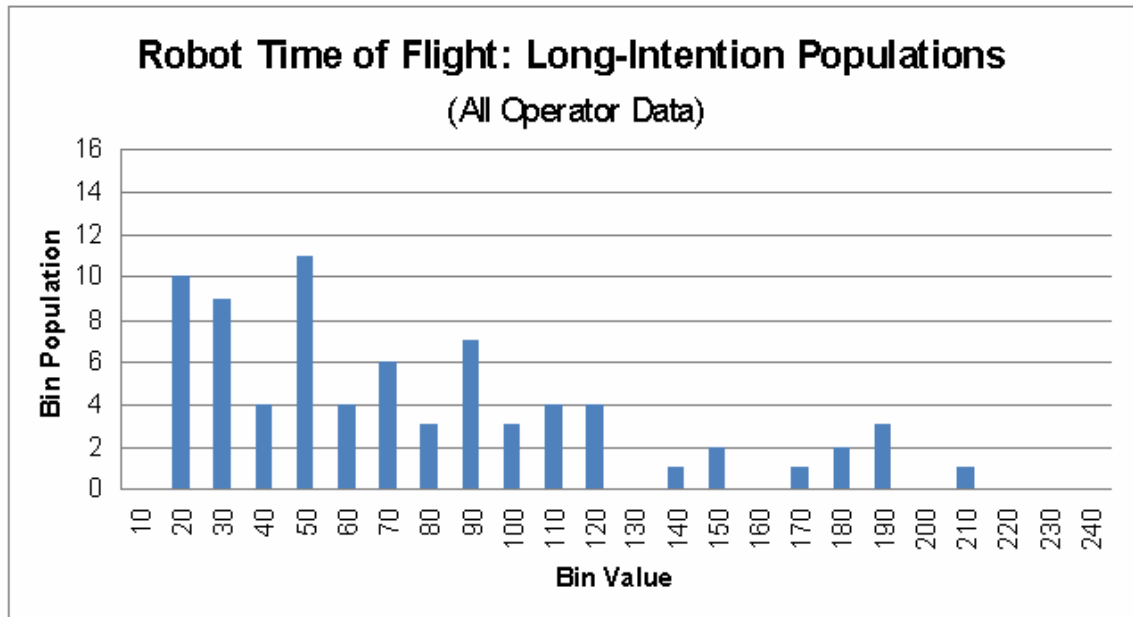


e) Calibration Data

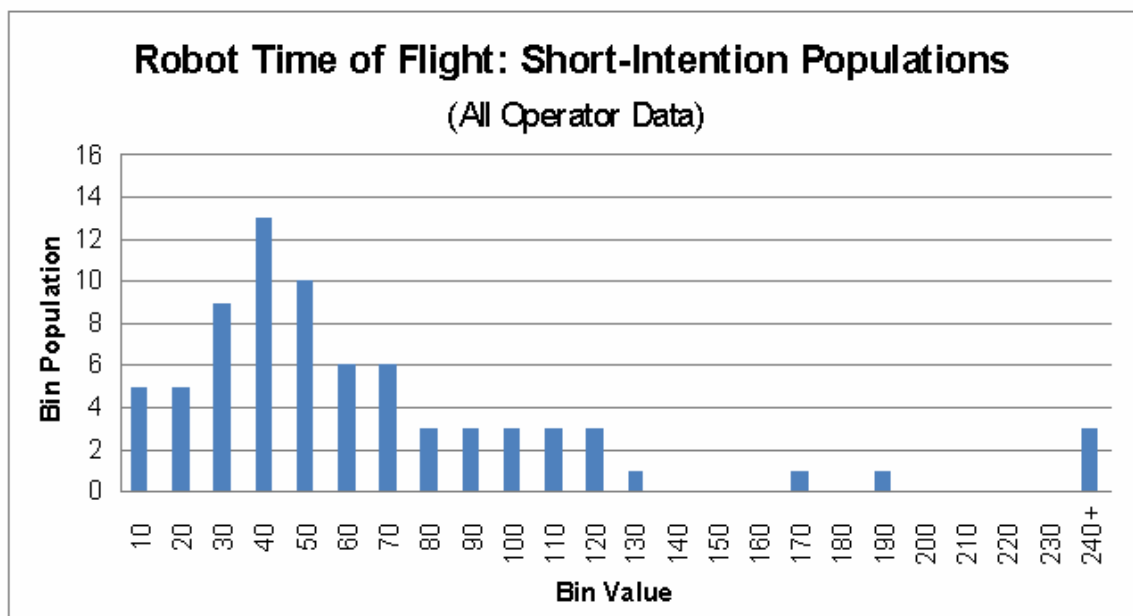


f) All Series Data Combined

Figure 4. Binned Combined Absolute Times of Flight; Bins are 10 sec wide, left exclusive, centered on the numbered values.



a) All Long-Intention Trials



b) All Short-Intention Trials (bin 240+ subsumes three outliers at 246, 248, and 274 sec)

IV. Reflections

Notwithstanding the gross replication and the structural similarities of these Phase II Robot anomalies to previous studies, and indeed to many other consciousness-correlated physical phenomena studied in this laboratory and elsewhere, a notable and possibly instructive fundamental distinction should be noted. Namely, whereas most traditional REG-based experimental data can be modeled as if the operator consciousness were simply altering the elemental binary probabilities of the digital bit strings comprising the output data combinatorial values,⁽¹¹⁾ such a parsimonious hypothesis becomes much more arcane to apply to the robot performance. While its onboard random processor indeed generates rapid sequences of binary digits, these must be rendered into quantitative translation and rotation instructions to the driving mechanism *via* a convoluted recipe of digital logic (*cf.* Ref. 1 Appendix). It would be extremely difficult to trace the effect of small changes in the REG binary probabilities through to their manifestations as alterations in the spectra of exit-times of the robot, especially in this polar-dynamic geometry, and it seems less than plausible that the operators could impose such a causal logic chain on the device to achieve their intended goals. Rather, a more complex system type of responsiveness seems to be in play in some less-deterministic, subjectively cast format, wherein the operator's consciousness becomes inextricably entangled with all of the components of said complex system, the composite behavior of which defies causal logic but nonetheless is teleologically responsive. To some extent, a similar entangled-complexity suspicion emerges from a few of our other more analog experiments, such as the Random Mechanical Cascade,⁽¹²⁾ Fountain,^(4,13) the Pendulum,⁽¹⁴⁾ and others, all of which obscure any strictly deterministic role for the

consciousness in realization of the physical phenomena. But at this point in our understanding we need further definitive empirical studies and aggressive models to pursue formulation of a productive “science of the subjective” approach to such mind/matter entanglements.^(9,10,15,16,17,18)

Possibly pertinent to better understanding of the vagaries of such consciousness-correlated physical phenomena might be further reflection on the curiously symmetrical inversion of anomalous effects in Op Y’s Series C efforts. It is almost as if the basic definition of “long” and “short” had been inverted throughout this series and indeed, if this implacable assumption were imposed, the structural character of these data would nestle very nicely with that of the other series, and the overall bottom-line significance of his three-series effort would escalate to $p_T \approx 10^{-4}$ (*cf.* the series-level χ^2 value computed above). Outrageous as such data treatment may appear, we should recall that over our large database of “FieldREG” experiments,^(19,20) where no explicit direction of attention is involved, both directions of anomalous data departure have been routinely observed, and a chi-squared criterion has had to be invoked. The provisional interpretation of these response patterns has simply been that once the requisite “resonance” of the participants and venue with the processor have been established, the direction of its reaction is more randomly incidental than teleological, and only the magnitude and duration of the output excursions are indicative.

V. Summary

The random robot thus once again has proven itself to be a particularly viable vehicle for demonstration and study of anomalous human/machine interactions, and

certainly invites continuation and expansion of similar experiments going forward. But subtler and more ambitious studies also now need to be undertaken. In the prior papers^(1,2) we alluded to the contemporary burgeoning development and deployment of robotic devices in many technological contexts. In the medical arena especially, it is inevitable that very small scale “micro-robots” and even “nano robots” will play increasingly important roles in a broad range of surgical and diagnostic procedures, and it is not too soon to consider and to explore systematically potential cross-talk between these information processors and the consciousness of their users. One could quarrel that such devices clearly will be hardened against all manner of random technical variability and thus should be impervious to any anomalous human/machine effects, but we are now well aware that complex and/or quantum-level systems by their nature entail intrinsic uncertainties in their information generation and utilization that may render them vulnerable to such subjectively based interference. And if this possibility is conceded, little more imagination is required to conceive more beneficial applications of mind/robot bonded systems whose capacities would exceed those of their individual partners. In any case, it may now be worthwhile to initiate another round of basic human/machine experiments utilizing miniaturized robotic devices, with special attention to the degree of control that the human mind can exercise over them.

All of this is for the future, but to conclude this present report, as Op Y wrote after the last trial entry in his experimental logbook:

“END, for now...”

Acknowledgments

As mentioned in more detail in the prior papers,^(1,2) the PEAR robot program was originally stimulated by the seminal research of René Peoc'h who had deployed robotic devices invented by two of his French collaborators in experiments involving young chicks and rabbits.^(21,22) Implementation of our own studies was enabled by the technical efforts of many of our PEAR colleagues including John Bradish, who expended many months of effort in designing, constructing, modifying, and servicing several generations of robot vehicles and their operating platforms; York Dobyms who assisted in configuring the numerical/mechanical logic to drive the device; Roger Nelson who helped design the original experimental and calibration protocols and the analysis of the pilot data; Greg Nelson who arranged the electronic camera system that tracked the robot motion; and Michael Ibison who wrote the software to render its output into useful data. All of the work reported here has traded heavily on these earlier efforts, and on the ongoing supervision of operator experiments by our Laboratory Manager, Brenda Dunne.

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Appendix:
Trial-Level Difference Data
and Statistical Analyses

Table 2: Trial-Level Data, Op X, Series A
(Inclusive Dates 1/4/07 – 1/9/07)

| Trial | Intention | Time to exit (sec) | $D = t_L - t_S$ |
|-------|-----------|--------------------|------------------|
| 1 | <i>S</i> | 10.3 | 15.0 |
| 2 | <i>L</i> | 25.3 | |
| 3 | <i>S</i> | 14.0 | 58.3 |
| 4 | <i>L</i> | 72.3 | |
| 5 | <i>S</i> | 41.3 | 18.3 |
| 6 | <i>L</i> | 59.6 | |
| 7 | <i>S</i> | 40.2 | -11.3 |
| 8 | <i>L</i> | 28.9 | |
| 9 | <i>S</i> | 47.0 | 40.3 |
| 10 | <i>L</i> | 87.3 | |
| 11 | <i>S</i> | 56.6 | 23.4 |
| 12 | <i>L</i> | 80.0 | |
| 13 | <i>S</i> | 41.6 | -18.6 |
| 14 | <i>L</i> | 23.0 | |
| 15 | <i>S</i> | 14.6 | 39.4 |
| 16 | <i>L</i> | 54.0 | |
| 17 | <i>S</i> | 39.3 | 3.0 |
| 18 | <i>L</i> | 42.3 | |
| 19 | <i>S</i> | 16.3 | 19.0 |
| 20 | <i>L</i> | 35.3 | |
| | | | $\Sigma = 186.8$ |

Statistical Summary

$$\mu_D = 18.68$$

$$\sigma_D = 23.66$$

$$\sqrt{N} = 3.16$$

$$T_D = 2.50$$

$$Z_D = 2.15$$

$$p_T \approx p_Z \approx .02$$

$$N_+/N = 8/10$$

$$\varepsilon_D = .68$$

Key:

Intention *L*: keep robot on table as long as possible (t_L)

Intention *S*: exit table as soon as possible (t_S)

$$D = t_L - t_S$$

$$\mu_D = \text{empirical mean of } D \text{ distribution over series} = \sum_i D_i / N$$

$$\sigma_D = \text{empirical standard deviation of series} = \left\{ \sum_i \frac{(D_i - \mu_D)^2}{N - 1} \right\}^{1/2}$$

$$T_D = \frac{\mu_D}{\sigma_D} \sqrt{N}$$

$$Z_D = \{N \times \ln [1 + T^2/N] \times [1 - 1/2N]\}^{1/2} \text{ (Rosenthal approximation)}$$

p_T = chance probability of T_D ; p_Z = chance probability of Z_D (tabulated values)

N = number of sets in series; N_+ = number of sets having $D > 0$

$$\varepsilon_D = \text{effect size computed as } Z_D / \sqrt{N}$$

Table 3: Trial-Level Data, Op Y, Series B
(Inclusive Dates 3/19/07 – 3/22/07)

| Trial | Intention | Time to exit (sec) | $D = t_L - t_S$ |
|-------|-----------|--------------------------------------|------------------|
| 1 | L | 61.6 | 43.3 |
| 2 | S | 18.3 | |
| 3 | L | 32.9 | -2.7 |
| 4 | S | 35.6 | |
| 5 | L | 19.0 | -36.0 |
| 6 | S | 55.0 | |
| 7 | L | 34.3 | -2.3 |
| 8 | S | 36.6 | |
| 9 | L | 184.0 | 157.7 |
| 10 | S | 26.3 | |
| 11 | L | 70.0 | 16.7 |
| 12 | S | 53.3 | |
| 13 | L | 113.3 | 49.3 |
| 14 | S | 64.0 | |
| 15 | L | 54.0 | 30.1 |
| 16 | S | 23.9 | |
| 17 | L | discard; no S to complete this set | |
| 18 | L | 49.6 | -47.7 |
| 19 | S | 97.3 | |
| 20 | L | 50.9 | 18.3 |
| 22 | S | 32.6 | |
| 21 | L | 117.3 | 44.3 |
| 23 | S | 73.0 | |
| 24 | L | 47.3 | 31.0 |
| 25 | S | 16.3 | |
| 26 | L | 53.0 | 15.4 |
| 27 | S | 37.6 | |
| 28 | L | 39.0 | -9.0 |
| 29 | S | 48.0 | |
| 30 | L | 37.9 | 8.3 |
| 31 | S | 29.6 | |
| 32 | L | discard; no S to complete this set | |
| | | | $\Sigma = 316.7$ |

Statistical Summary

$$\mu_D = 21.11$$

$$\sigma_D = 46.98$$

$$\sqrt{N} = 3.87$$

$$T_D = 1.74$$

$$Z_D = 1.64$$

$$p_T \approx p_Z \approx .05$$

$$N_+/N = 10/15$$

$$\varepsilon_D = .42$$

Trials 21, 22 placed in reverse order to preserve long/short alternation

Key: See Table 2.

Table 4: Trial-Level Data, Op Y, Series C
(Inclusive Dates 4/25/07 – 5/21/07)

| Trial | Intention | Time to exit (sec) | $D = t_L - t_S$ |
|-------|-----------|--------------------|-----------------|
| 1 | <i>S</i> | 17.0 | 18.0 |
| 2 | <i>L</i> | 35.0 | |
| 3 | <i>S</i> | 111.0 | -60.0 |
| 4 | <i>L</i> | 51.0 | |
| 5 | <i>S</i> | 68 | -13 |
| 6 | <i>L</i> | 55 | |
| 7 | <i>S</i> | 34 | -15 |
| 8 | <i>L</i> | 19 | |
| 9 | <i>S</i> | 61 | -45 |
| 10 | <i>L</i> | 16 | |
| 11 | <i>S</i> | 37 | -2 |
| 12 | <i>L</i> | 35 | |
| 13 | <i>S</i> | 69 | 50 |
| 14 | <i>L</i> | 119 | |
| 15 | <i>S</i> | 35 | 60 |
| 16 | <i>L</i> | 95 | |
| 17 | <i>S</i> | 77 | 0 |
| 18 | <i>L</i> | 77 | |
| 19 | <i>S</i> | 248 | -53 |
| 20 | <i>L</i> | 195 | |
| 21 | <i>S</i> | 87 | -35 |
| 22 | <i>L</i> | 52 | |
| 23 | <i>S</i> | 168 | -111 |
| 24 | <i>L</i> | 57 | |
| 25 | <i>S</i> | 40 | -8 |
| 26 | <i>L</i> | 32 | |
| 27 | <i>S</i> | 274 | -105 |
| 28 | <i>L</i> | 169 | |
| 29 | <i>S</i> | 32 | -8 |
| 30 | <i>L</i> | 24 | |
| 31 | <i>S</i> | 58 | -7 |
| 32 | <i>L</i> | 51 | |
| 33 | <i>S</i> | 60 | 39 |
| 34 | <i>L</i> | 99 | |

| Trial | Intention | Time to exit (sec) | $D = t_L - t_S$ |
|-------|-----------|--------------------|-----------------|
| 35 | <i>S</i> | 29 | 65 |
| 36 | <i>L</i> | 94 | |
| 37 | <i>S</i> | 246 | -211 |
| 38 | <i>L</i> | 35 | |
| 39 | <i>S</i> | 88 | 24 |
| 40 | <i>L</i> | 112 | |
| 41 | <i>S</i> | 44 | 53 |
| 42 | <i>L</i> | 97 | |
| 43 | <i>S</i> | 48 | -25 |
| 44 | <i>L</i> | 23 | |
| 45 | <i>S</i> | 50 | 25 |
| 46 | <i>L</i> | 75 | |
| 47 | <i>S</i> | 133 | -66 |
| 48 | <i>L</i> | 67 | |
| 49 | <i>S</i> | 112 | -83 |
| 50 | <i>L</i> | 29 | |
| | | | $\Sigma = -513$ |

Statistical Summary

$$\mu_D = -20.52$$

$$\sigma_D = 63.13$$

$$\sqrt{N} = 5.00$$

$$T_D = -1.63$$

$$Z_D = -1.57$$

$$p_T \approx p_Z \approx .94$$

$$N_+/N = 8/25$$

$$\varepsilon_D = -.31$$

Key: See Table 2.

Table 5: Trial-Level Data, Op Y, Series D
(Date 5/31/07)

| Trial | Intention | Time to exit (sec) | $D = t_L - t_S$ |
|-------|-----------|--------------------|-----------------|
| 1 | <i>S</i> | 50 | 57 |
| 2 | <i>L</i> | 107 | |
| 3 | <i>S</i> | 43 | 7 |
| 4 | <i>L</i> | 50 | |
| 5 | <i>S</i> | 75 | 113 |
| 6 | <i>L</i> | 188 | |
| 7 | <i>S</i> | 57 | 8 |
| 8 | <i>L</i> | 65 | |
| 9 | <i>S</i> | 47 | 100 |
| 10 | <i>L</i> | 147 | |
| 11 | <i>S</i> | 98 | -76 |
| 12 | <i>L</i> | 22 | |
| 13 | <i>S</i> | 117 | -25 |
| 14 | <i>L</i> | 92 | |
| 15 | <i>S</i> | 67 | 146 |
| 16 | <i>L</i> | 213 | |
| 17 | <i>S</i> | 186 | -114 |
| 18 | <i>L</i> | 72 | |
| 19 | <i>S</i> | 95 | 24 |
| 20 | <i>L</i> | 119 | |
| 21 | <i>S</i> | 49 | -31 |
| 22 | <i>L</i> | 18 | |
| 23 | <i>S</i> | 45 | -23 |
| 24 | <i>L</i> | 22 | |
| 25 | <i>S</i> | 117 | 25 |
| 26 | <i>L</i> | 142 | |
| 27 | <i>S</i> | 76 | 111 |
| 28 | <i>L</i> | 187 | |
| 29 | <i>S</i> | 45 | 55 |
| 30 | <i>L</i> | 100 | |
| 31 | <i>S</i> | 100 | -7 |
| 32 | <i>L</i> | 93 | |
| 33 | <i>S</i> | 110 | -2 |
| 34 | <i>L</i> | 108 | |

| Trial | Intention | Time to exit (sec) | $D = t_L - t_S$ |
|-------|-----------|--------------------|-----------------|
| 35 | <i>S</i> | 81 | 6 |
| 36 | <i>L</i> | 87 | |
| 37 | <i>S</i> | 15 | 163 |
| 38 | <i>L</i> | 178 | |
| 39 | <i>S</i> | 47 | 35 |
| 40 | <i>L</i> | 82 | |
| 41 | <i>S</i> | 28 | 126 |
| 42 | <i>L</i> | 154 | |
| 43 | <i>S</i> | 67 | -43 |
| 44 | <i>L</i> | 24 | |
| 45 | <i>S</i> | 28 | 90 |
| 46 | <i>L</i> | 118 | |
| 47 | <i>S</i> | 116 | -25 |
| 48 | <i>L</i> | 91 | |
| 49 | <i>S</i> | 12 | 54 |
| 50 | <i>L</i> | 66 | |
| | | | $\Sigma = 774$ |

Statistical Summary

$$\mu_D = 30.96$$

$$\sigma_D = 70.17$$

$$\sqrt{N} = 5.00$$

$$T_D = 2.21$$

$$Z_D = 2.09$$

$$p_T \approx p_Z \approx .02$$

$$N_+/N = 16/25$$

$$\varepsilon_D = .42$$

Key: See Table 2.

Table 6: Trial-Level Data, Calibration
(Date 5/31/07)

| Trial | Intention | Time to exit (sec) | $D = t_L - t_S$ |
|-------|-----------|--------------------|-----------------|
| 1 | <i>L</i> | 39 | 13 |
| 2 | <i>S</i> | 26 | |
| 3 | <i>L</i> | 50 | -69 |
| 4 | <i>S</i> | 119 | |
| 5 | <i>L</i> | 104 | 69 |
| 6 | <i>S</i> | 35 | |
| 7 | <i>L</i> | 59 | 22 |
| 8 | <i>S</i> | 37 | |
| 9 | <i>L</i> | 41 | -13 |
| 10 | <i>S</i> | 54 | |
| 11 | <i>L</i> | 58 | -66 |
| 12 | <i>S</i> | 124 | |
| 13 | <i>L</i> | 75 | 28 |
| 14 | <i>S</i> | 47 | |
| 15 | <i>L</i> | 63 | 26 |
| 16 | <i>S</i> | 37 | |
| 17 | <i>L</i> | 17 | -133 |
| 18 | <i>S</i> | 150 | |
| 19 | <i>L</i> | 129 | 62 |
| 20 | <i>S</i> | 67 | |
| | | | $\Sigma = -61$ |

Statistical Summary

$$\mu_D = -6.10$$

$$\sigma_D = 64.40$$

$$\sqrt{N} = 3.16$$

$$T_D = -0.30$$

$$Z_D = -.29$$

$$p_T \approx p_Z \approx .60$$

$$N_+/N = 6/10$$

$$\varepsilon_D = -.09$$

Key: See Table 2.

“Long”, “short” arbitrarily assigned to odd and even trials, respectively.