SG1I

ANALYSIS OF SERIES PRODUCED BY ESP EXPERIMENTS

[redacted]

Typical ESP experiments involve the comparison of guesses with external states presumably both uncontrolable and unperceivable by the percipient by normal sensory means. The following note points out statistical variables available for analysis in these experiments and their possible interpretation in terms of ESP effects. The SRI experiments with the 4-state random number generator are experiments of this type. In the following, for simplicity, a 2-state or binary choice device is assumed, but by obvious extension the ideas may be applied to an analysis of 4-state data as well.

Denoting the two states of the machine by $+1$ and -1 the series produced by the machine during the test is a time-ordered series (m_i) where m_i takes the value of $+1$ or -1, and i denotes the position in the series $i = 1,2,\cdots$ N(total number of states in test). The corresponding guesses made by the percipient form another series (g_i) where g_i is either $+1$ or -1, and again i indexes the guess. Yet another time-ordered series is that produced by the machine during a calibration run with no percipient which we denote (c_i) and assume $i = 1,2,\cdots$ N as before with the same value of N.

There are thus three time-ordered series to be analysed and compared.

1. (m_i) the series produced by the machine during the test
2. (g_i) the series of guesses of the percipient
3. (c_i) the calibration series of the machine

The statistical properties of each series separately is described by a heirarchy of correlation functions:

$$< m > = \frac{1}{N} \sum_i m_i$$ Mean value (average properties)

$$C_{mm}(j) \sim \sum_i m_i m_{i+j}$$ 2nd order autocorrelation (j is displacement within series)

$$C_{mmm}(j,k) \sim \sum_i m_i m_{i+j} m_{i+k}$$ 3rd order autocorrelation

$$\vdots$$ Higher order correlations

If randomness is at issue it can be determined from the measured values of these functions compared with the probable values they would have for a truly random series. For most purposes it is deemed sufficient to use no higher than 2nd order correlations. A further simplification is to restrict attention to transition probabilities, i.e. $C_{mm}(j)$ with $j = \pm 1$ only. The cut-off point in the analysis is dictated by practical considerations of sample size (magnitude of N), or convenience of computation. In **principle**, however, the entire heirarchy is required for a complete analysis.

In addition to the autocorrelations, the cross-correlations of the series with each other may be computed. There are three(3) 2nd order cross-correlation functions among the three series above.

$$C_{mg}(j) \sim \sum_i m_i g_{i+j}$$ machine test- percipient test

$$C_{mc}(j) \sim \sum_i m_i c_{i+j}$$ machine test- machine calibration

$$C_{cg}(j) \sim \sum_i c_i g_{i+j}$$ machine calibration-percipient test

The essential point of this note is that a <u>proper description of an ESP experiment requires a computation of these correlation functions together with a statistical analysis of their likelyhood of occurrence by chance.</u> They embody the very information sought in the experiment.

The significance of the various functions is as follows:

1. Averages and autocorrelations

Determine whether each of the series is random, and especially

$\langle g \rangle$ and $C_{gg}(\tau)$ determine whether other than random strategy is used by percipient.

$\langle m \rangle$ and $C_{mm}(\tau)$ compared with $\langle c \rangle$ and $C_{cc}(\tau)$ determine whether statistics of machine alters between calibration and actual test.

(An indicator of psychokinetic, or other effects)

2. Cross-correlations

$C_{mg}(\tau)$ compares two simultaneous time series.

for	$\tau = 0$	measures correspondence of guess and machine state
for	$\tau < 0$	measures correspondence between guess and future machine state
for	$\tau > 0$	measures correspondence between guess and past machine state

$C_{mc}(\tau)$ compares two non-simultaneous series so likely of no interest, but could indicate statistically significant regularities in the series produced by the machine for different runs.

$C_{cg}(\tau)$ compares two non-simultaneous series so perhaps not significant, but indicates whether guessing sequence is related to calibration performance of machine.