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The Effects of genetically healthy and weakened *Caenorhabditis elegans* on a field Random Event Generator (REG).

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Introduction:

At this point a significant amount of data has accumulated that point towards the fact that random events can be influenced by human conscious intention (Jahn & Dunne, 1997). These interactions have been studied by numerous labs, most thoroughly by the Princeton Engineering Anomalies Research Laboratory (Radin & Nelson, 1989). The basic experimental setup used to study these mind/machine interactions involves a human participant and a random system that can range from a computer microchip to larger scale systems such as the random mechanical cascade device. In numerous studies, these random devices, which comprise a noisy system, exhibit an orderliness, which is correlated with the intention of the operator. These results suggest that the conscious intention of a human operator interacts with the physical world in some non-ordinary way, and that mental events can have an effect on the physical world.

These studies were also expanded to study a phenomenon known as field consciousness to examine situations in which a number of people share a common intention. Again, for events in which there appears to be coherence in the mental events of a large number of people random systems become less noisy (Nelson et al., 1998). It should be noted that these experiments were tested under conditions in which subjects were not specifically intending to influence the REG. These studies suggest that random events are also influenced by the similar intentions of a group of people, or their resonance as a group.

One question that remains is the extent to which these random events can be manipulated by the presence of organisms other than humans, begging the question, is there something unique about the consciousness of the human participant in these mind/machine interactions. Some work investigating the extent to which non-humans can influence REGs has shown that a randomly moving robot carrying a lighted candle tends to move towards chicks that have imprinted on it more often than would be expected by chance (Peoc'h, 1995). While it has also been shown that intention can influence remote biological systems, the effect that these biological systems have on a random system is not well understood (Braud and Schlitz, 1991).

The current experiment was undertaken to explore the role that mutation accumulation lines of *C. elegans* might have on the output of a random event generator (REG). *C. elegans* is a soil nematode from Bristol England. The line used for the present experiment has been allowed to undergo accumulation of spontaneous mutations (SDM)s

in an experiment to investigate the whole genome mutation effects in the Vassilieva Lab (University of Utah, 2003). We hypothesized that this mutated line would have an effect on the REG when compared to a non-mutated line. We also included a control condition without *C. elegans* to have a baseline for comparison to the other conditions.

Materials and Methods:

Previous research has shown that accumulation of spontaneous mutations under relaxed natural selection leads to weakening of the lines, to deterioration of their health, fitness, and behavior (Vassilieva & Lynch, 1999).

Preparation of lines: Line 87 and the N_2 (control line that did not undergo mutation-accumulation) were taken from the -80°C, and allowed to recover from the frozen stage and then bleached to synchronize the worm's age as only the eggs survive the bleaching. Thus the developmental stages were the same in all experimental groups. The *C. elegans* were grown on NGM agar under the standard techniques of Sulston & Hodgkin (1988) at 20°C and maintained on 60x15mm seeded (~80-90µl *E. coli* OP50 strain added to plates and grown at room temperature for 2 days for food source) petri plates (Vassilieva & Lynch, 1999). In 2.3 days after bleaching all hatched worms reached Larva4 (L4), ***or*** the last larva stage before *C. elegans* reaches adulthood is this stage. This stage is the easiest to distinguish, because L4 worms have a characteristic black spot in the area of vulva development. The worms of this stage were studied.

Protocol for running: REG data were collected for 3 conditions: a mutated line (87) which underwent mutation accumulation (MA) for 421 generations (Vassilieva & Lynch, 1999), the original non-mutated line (N_2) line, ancestral to line 87 (Vassilieva & Lynch, 1999), and a control condition without *C. elegans*. The data for each condition were collected over 6 one-hour sessions on three subsequent days under which the worms were placed in the vicinity of the REG. The temperature in the room was 23°C. For the analysis, each condition contained 6 data points representing the mean and standard deviation of the REG output over each hour of the recording. We were interested in investigating overall differences between conditions, and specifically the difference between the effects of the mutated line 87 and the other two conditions.

Results:

There was no significant difference between the means of the conditions ($p>.05$). An omnibus ANOVA revealed a suggestive trend for differences between the standard deviations between conditions ($F_{2,15} = 2.873$, $p=.088$). A contrast of the mutated line vs. the non-mutated line and the control conditions revealed a significant difference ($t= 2.391$, $p=.03$). Specifically the standard deviation of the output of the REG in the presence of the mutated line was significantly lower than the other two conditions. The standard deviations of the three conditions are as follows: mutation (7.05), non-mutation (7.15), control (7.14) whereas the expected standard deviation of the calibrated REG is

7.07. This would indicate that the source of the deviations in the expected output of the REG is in the variance of the non-mutation and control conditions rather than for the mutation condition.

Discussion

The results from this experiment show a difference between the mutation line and the non-mutated line and control condition, such that there is less variance associated with the output of the REG in the presence of the mutated line. While these differences did emerge between the mutated line condition and the other two groups, it was expected that the effect of mutation accumulation would be to alter the output of the REG compared not only to the other conditions, but to the calibrated values of the REG as well. As evidenced by the values described in the results section, the mutation condition's standard deviation was closer to the expected standard deviation compared to the non-mutation and control conditions, which had higher standard deviations. In fact, a t-test revealed a highly significant difference between the expected standard deviations and the standard deviations of the non-mutation and control line ($t=4.038$, $p=.002$). So these results also suggest the possibility that the anomalous effects were present in the control condition and non-mutated line, such that there was greater variance in the output of the REG for these conditions as compared to the expected value for the REG

One factor that is important to consider when interpreting these results is the effect of the human experimenter. It should be noted that the experimenters were aware of the conditions under which the REG output was recorded, thus while this experiment was designed to investigate the influence of mutation accumulation on REG data the possibility remains that our own conscious/unconscious intention played a role in the results. This is a problem that a number of REG applications have to contend with as well as in the field of mind-matter interactions in general.

While this work is not conclusive as far as the effects of mutation accumulation in a biological system on REG output, significant deviations were revealed in the REG output. Taking into consideration what has been learned from this study, some suggestions are made for future research into this area. First, it would be important that the experimenters are unaware of the conditions that are being run until after the data are analyzed**.** This would help to minimize the effect of experimenter intention. Second, future work could investigate the link between genomic expression, which has already been obtained for 87 vs. control N_2 line, fitness, which has already been estimated, and these REG data.

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