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WHY ARE COINCIDENCES SO IMPRESSIVE? [1]

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Summary.—We present evidence for an intuitive scaling rule by which people gauge the likelihood of coincidences. This rule is essentially linear in nature and becomes increasingly unreliable as the "outlandishness" of a coincidence grows, the latter being a demonstrably nonlinear phenomenon. We suggest that the existence of this linear scaling rule may help explain why so many people are inappropriately surprised by coincidences.

The inability of many people to reason probabilistically is well-established (Kahneman, Slovic, & Tversky, 1982) and is widely held to underpin belief in paranormal phenomena (e.g., Sutherland, 1992). Here we report the outcome of an experiment to assess intuitive expectations of coincidences which, we believe, provides new insight into these issues. It points towards the existence of a mental scaling law for assessing coincidences which becomes increasingly unreliable the more "outlandish" a coincidence appears to be.

The basis of the study is a generalisation of the "Birthday Paradox" in which subjects are asked to estimate the size of a random gathering of people, N, required to give even odds of at least two people sharing the same birthday. If the N people are equally likely to belong to one of G groups, then it can be shown that

$$N \geq 0.5 + 1.2\sqrt{G} \qquad [1]$$

where, for birthdays, $G=365$, so $N \geq 23$. One of us has speculated (Matthews, 1993) that the widespread failure of intuition concerning coincidences may stem from attempts to model this nonlinear dependence of N on G by a linear mental model for which $N_{ment} \sim$ (constant) $\cdot\ G$.

Defining α as the ratio of the predictions of the mental and correct models so that

$$\alpha \sim k \cdot \sqrt{G} \qquad [2]$$

it is clear that this "astonishment factor" grows with G, i.e., as the outlandishness of the coincidence increases. It was thus proposed that [2] may explain why people are so inappropriately impressed by coincidences.

We investigated this hypothesis by providing 124 subjects (25 men, 99 women whose mean age was 24.1 yr. and range 18 to 53) six questions based on the generalised Birthday Paradox. Each question effectively asked the subject to assess the size of N for a different value of G, ranging from $G=4$ to $G=5000$. The order of the questions was randomised to reduce the risk of a simple *pro rata* scaling law being used by subjects. All subjects were also asked to state their attitude towards paranormal phenomena; this was to test the hypothesis put forward by one of us (S.B.) that believers in the paranormal have poorer intuition about probabilistic events (Blackmore & Troscianko, 1985). To date, evidence for this so-called "Sheep and Goats" hypothesis has been equivocal (Blackmore & Troscianko, 1985; Brügger, Landis, & Regard, 1990).

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For each of the 106 questionnaires giving complete responses to all six questions, the six estimates of N were regressed against the corresponding value of G using a power law, so that for each subject we have $N_{ment} = A \cdot G^B$ and thus

$$\log_{10} N = \log_{10} A + B \cdot \log_{10} G \ . \qquad [3]$$

The average values of A and B for the whole sample were then calculated. If a linear mental model is being used, then we expect $B \sim 1$; the mathematically correct model, in contrast, has $B = 0.5$.

The average value of B for the 106 subjects was 0.934 ± 0.344; this value for B is not significantly different from the linear value ($t_{105} = 1.97$, ns) but is significantly different from the mathematically correct value of $B = 0.5$ ($t_{105} = 13.0$, $p < .001$). The average correlation coefficient was .863 ($t_{104} = 17.2$, $p < .001$), a high value indicating that the intuitive estimates of N are the result of application of a rationale rather than mindless guessing. Ordering of the questions had no significant effect.

It thus appears that the commonly experienced astonishment at coincidences may be the result of a linear mental model being used to approximate a nonlinear phenomenon. However, the value of B for believers in the paranormal ($N = 78$) was, at $.92 \pm 0.33$, not significantly different from the value of $.97 \pm 0.34$ for nonbelievers ($N = 23$; for difference in mean values $t_{99} = 0.70$, ns). This contradicts the prediction of the Sheep and Goats hypothesis and reduces the likelihood that belief in paranormal phenomena can be ascribed to differences in the ability to reason probabilistically. The possibility that nonbelievers are simply more aware of their inadequacies in probabilistic reasoning merits further research.

REFERENCES

Blackmore, S. J., & Troscianko, T. (1985) Belief in the paranormal: probability judgements, illusory control and the "chance baseline shift." *British Journal of Psychology*, 76, 459-468.

Brügger, P., Landis, T., & Regard, M. (1990) A sheep-goat effect in repetition avoidance: extrasensory perception as an effect of subjective probability. *British Journal of Psychology*, 81, 455-468.

Kahneman, D., Slovic, P., & Tversky, A. (Eds.) (1982) *Judgment under uncertainty: heuristics and biases*. Cambridge, UK: The University Press.

Matthews, R. A. J. (1993) The law of credulity. *Mathematics Gazette*, 77, 327-328.

Sutherland, S. (1992) *Irrationality: the enemy within*. London: Constable.

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