Probability of Deliberate Meeting

If the probability of finding a very compact meeting of ELSs (good compactness value) of a given set of key words is small in a monkey text, then this implies that the conditional probability is high that the meeting was deliberately placed given the good compactness value.

The probability argument goes like this. Let us suppose we reason as an open-minded skeptic. The open-minded skeptic says there are two possibilities. Either a monkey M typed the text, meaning the compact meeting was a chance meeting or a monkey did not type the text meaning that the compact meeting was placed deliberately. The open-minded skeptic says both are equally likely. So, before seeing the evidence of the meeting, which is the compactness value, both possibilities have an *a priori* probability of .5.

$$P(M) = .5$$
$$P(D) = .5$$

Now we let the skeptic see the evidence which consists of an experiment in which the probability of as compact a meeting occuring in a monkey text is .001, one chance out of a thousand. Here what is important is not the compactness value, but the relative compactness value. The relative compactness value is the probability of as a compact meeting occuring in a monkey text. Given the evidence, E, what is probability that the meeting was placed deliberately? That is, what is $P(D|E)$?

From the definitions of conditional probability, we always have,

$$P(D|E) = \frac{P(E|D)P(D)}{P(E|M)P(M) + P(E|D)P(D)}$$

And when the prior probabilities $P(D) = P(M) = .5$ and the conditional probability of the compact meeting given that the meeting is found in a monkey text is small, say, $P(E|M) = .001$, then

$$P(D|E) = \frac{P(E|D)}{.001 + P(E|D)}$$

So if $P(E|D)$, the conditional probability of observing the evidence E given that the meeting is placed deliberately, is .1, then $P(D|E) = .99$, a very high probability. On the other hand if $P(E|M) = 1.$, meaning that it is certain that the result would be found in a monkey's text, then

$$P(D|E) = \frac{P(E|D)}{1. + P(E|D}$$

Since the highest value of $P(E|D)$ is 1, it follows that $P(D|E) < .5$ which implies that $P(M|E) > .5$. If it is certain that it can be found in a monkey's text, then the probability that a monkey wrote the text is greater than .5.

In general, the smaller $P(E|M)$ is, the larger the expected value of $P(D|E)$ will be. And since we do not have a model for $P(E|D)$ as a skeptic we can say that each possible value of $P(E|D)$ is equally likely. And in this case, we have (leaving out the technical details) that the expected value or average value of $P(D|E)$ is

$$1 - P(E|M) log(1 + P(E|M)/P(E|M))$$

showing that even under the most uncertain of all models, if $P(E|M)$ is smaller than .02, then $P(G|M) > .92$.