Bible Codes, Marilyn, & El Niño

The Bible Codes

Human beings have always searched for hidden meaning within the fabric of life. Frequently, remarkable claims are made about the significance of such things as the strange patterns found in the deserts of Peru (see Erich von Daniken's *Chariots of the Gods*), crop circles, and so forth. The latest such example to receive worldwide attention is the assertion that the Bible contains secret messages that predicted then-future events, of which many have since come to pass.

The past several months have seen Michael Drosnin's *The Bible Codes* rapidly reach best seller lists throughout the United States and Europe; Jeffrey Satinover's *Cracking the Bible Codes* has also been highly successful. The possibility of Bible codes (also called Torah codes) was first revealed in a 1994 article in the scholarly journal *Statistical Science*. In it three Israeli's, Witzum, Rips (a mathematics professor) and Rosenberg (WRR), report on the following experiment: The names of 34 famous Rabbis, born long after Genesis was written, were chosen from an encyclopedia of famous Rabbis. For each Rabbi, a set of names and titles that would identify the Rabbi and a set of dates that represented his date of birth or death were chosen.

WRR then considered a Hebrew version of Genesis as a string of 78,064 letters with no spaces. They defined an equi-letter-skip word as a word whose letters occur in this string of letters of Genesis, separated by sequences of letters of equal length. If you try this concept on the paragraph you are currently reading for example, ignoring all spaces, punctuation and numbers, you will find the French word *savoir* beginning with the eleventh letter and skipping every sixth letter after that (savior certainly would have been better!). The word *secret* can also be unearthed by using every tenth letter beginning with letter number 162.

An elementary probability calculation shows that we can expect just by chance that most of the names and dates of the Rabbis will occur somewhere in Genesis as equi-letter-skip words. However, WRR defined a rather technical notion of distance between two equi-letter-skip words and hypothesized that the names and dates of the Rabbis would be closer together than would normally occur by chance alone. Astonishingly, the authors found through their statistical analysis a degree of closeness that would normally occur less than once in fifty thousand times in a search of such length in comparable Hebrew text, thereby suggesting a divine origin for Genesis.

Tests using 90 other Rabbis suggested by the journal's referees again produced highly significant results. Then WRR did an analysis using the first 78,064 letters of the Hebrew translation of Tolstoi's *War and Peace*. The Rabbis' names and dates again appear as equi-letter-skip words but the degree of closeness of their names and dates was not out of the ordinary. Since *War and Peace* was written in the nineteenth century and does not involve religion it serves as an effective control, and the failure to find statistically significant connections in this work supports the contention that the patterns found in the Bible are not an artifact due merely to chance.

While there is no shortage of believers, neither is there any shortage of skeptics. Although the experiments of WRR may appear sound, other scientists have found plenty of opportunity for criticism of their study and for further mathematical analyses. Recent experiments carried out by mathematician Dror Bar-Natan and computer scientist Brendan McKay (BNMK) in fact cast considerable doubt on the validity of WRR's work. WRR claim that they did not make the choices of which Rabbi names and dates to use, but rather they were made by other historical scholars for them. BNMK showed that whoever made them made a significant number of rather arbitrary choices—especially for the names of the Rabbis.

BNMK then set out to see if they could find a significant result in *War and Peace* if they were allowed to make judicious choices to help their cause. BNMK considered the second list of Rabbis used by WRR. They kept the same dates but dropped 20 of the 90 names used by WRR and added 30 new ones that they claim could equally well have been chosen by WRR. With these changes, BNMK found the same kind of significant results in *War and Peace* that WRR found in Genesis.

Drosnin, the author of *The Bible Codes*, has defended the existence of Bible codes by stating "When my critics find a message about the assassination of a prime minister en-

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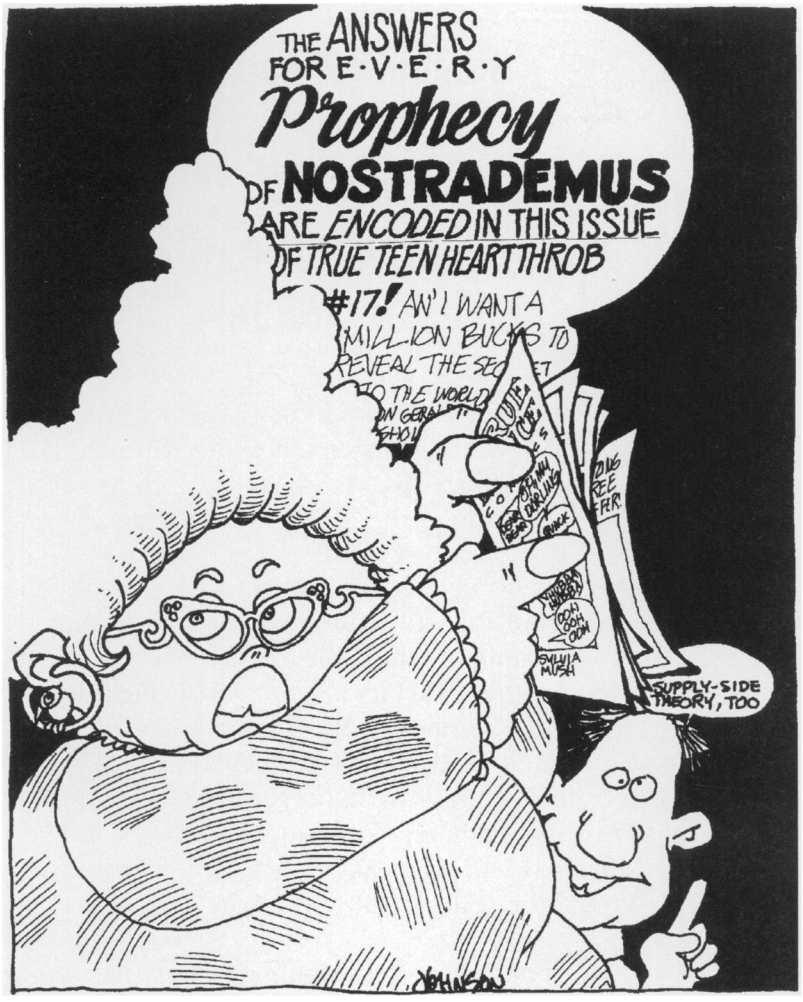

Illustration by John Johnson of Teapot Graphics

crypted in *Moby Dick,* I'll believe them." (*Newsweek,* June 9, 1997.) Responding to the challenge, McKay has managed to find "Lincoln" near "killed", "Trotsky" near "executed", "Ghandi" near "the bloody deed", "Kennedy" near "shoot", "M L King" near "to be killed by them", and "Princess Di" near "mortal in the jaws of death"!

Ask Marilyn

Perhaps you are familiar with the weekly columns written by Marilyn vos Savant in *Parade Magazine,* an insert in many Sunday newspapers. (Ms. vos Savant is listed in the Guiness Book of World Records in the category "Highest IQ".) Each week Marilyn poses a brain teaser to her readers, often mathematical in nature. In a recent column she offers the following problem: A woman and a man (unrelated) each have two children. At least one of the woman's children is a boy, and the man's older child is a boy. Do the chances that the woman has two boys equal the chances that the man has two boys? If you have not seen this problem before, you may wish to work out a solution before reading on. A warning however: most people, including quite a few professional mathematicians, get it wrong!

Marilyn answered that the probability was 1/2 for the man and 1/3 for the woman. A reader stated flatly "I will send $1,000 to your favorite charity if you can prove me wrong. The chances of both the woman and the man having two boys are equal." Ms. vos Savant took this individual up on his bet and asked her readers to help her settle the issue by a survey, asking anyone who had exactly two children (no more), with at least one of them being a boy, to respond and report the sex of both children. She received 17,946 responses, of which 35.9% wrote that they had two boys. Marilyn claims this is close enough to 1/3 so she wins the bet.

Does this data basically prove Ms. vos Savant correct? Certainly the large sample size is impressive. However, one must keep in mind that these results arose not from a random sample, but from a voluntary response sample, and as such it is not possible to make scientific statements about the accuracy of the 35.9% figure as an estimate of the conditional probability that both children are boys given that at least one of them is.

Fortunately Marilyn does not stop there. She also presents a letter from an employee of the Center for Health Data who writes: "The U.S. Census Bureau interviews a random sample of families each year for the National Interview Survey. From 1987 to 1993, it interviewed 342,018 households, including 42,888 families with exactly two children. Of these, 9523 had two girls, leaving 33,365 with at least one boy: 11,118 with boy-girl, 10,913 with girl-boy and 11,334 with boy-boy. Thus 22,031 of the 33,365 (at least one boy group) had a child of each sex (66%), while 11,334 of the 33,365 (at least one-boy group) had two boys (34%). Close enough I'd say...."

Although this data does seem to substantiate Ms. vos Savant's correct answer of 1/3, there are some interesting anomalies in this data. The most striking is that only 22.2% of the 42,888 families with exactly two children had exactly two girls. Even taking into account the fact that girl births are slightly less common than boy births, this figure is too low. Using the U.S. 1993 sex ratio of 1.050 boys born for every girl and assuming the sexes of the two children are independent (hence neglecting the possibility of identical twins), we would expect the proportion of two child families having two girls to be 23.8% (check this!). Including identical twins would only increase this figure. Can you suggest a possible reason for this lower than expected incidence of two-girl families? A likely explanation is given below. [1]

Every Probability is 50/50

On Oct. 13, 1997 on "Nightline", newsman Ted Koppell was discussing the various natural disasters that were being

predicted due to El Niño. Here's part of his conversation with Dr. Richard Andrews, director of the California Office of Emergency Services:

Ted Koppel: "Dr. Andrews, I'm sure you have heard such cautionary advice before so on what basis is the assumption being made that this is the one that's going to have the kind of impact on Southern California in particular that's being predicted?"

Richard Andrews: "Well, in the business that I'm in and that local government and state government is in, which is to protect lives and property, we have to take these forecasts very seriously. We have a lot of forecasts about natural hazards in California and we have a lot of natural events here that remind us that we need to take these forecasts seriously. I listen to earth scientists talk about earthquake probabilities a lot and in my mind every probability is 50-50, either it will happen or it won't happen...."

Hmmm, maybe playing the lottery isn't such a bad idea after all...!

Here are two interesting problems suggested by the foregoing discussion. Assume for both that the sex of the offspring are independent from birth to birth, with the same probability of a boy on each birth:

1. Of all the couples in the United States whose first two children are girls, estimate from the Census Bureau data the proportion that decide to have another child in hopes of obtaining one of the opposite sex. Do the same for the case when the first two children are boys. Use a model that assumes that P(Boy) and P(Girl) are determined from the sex ratio given above.

2. Suppose that all parents have children until precisely one boy (or girl, if you prefer) is born. Assume that no child dies before reaching adulthood and bearing children themselves, and that no one is infertile. Would world population grow, decline or become stable? Vary the problem by assuming in turn that (a) there is some upper limit, of your choice, on the number of children a couple could bear; (b) there is no such upper limit. Also try the case when P(Boy) = P(Girl) = 1/2.

Endnotes

[1] In many third world countries couples hope to have at least one son, in part because of the presumed economic value to the family of a future male worker. If every couple who had only female offspring continued to have children until a boy was born, there would be no families with just two girls. While this child-bearing strategy is clearly not prevalent in the United States, there may well be a tendency for at least some parents who have had two girls to bear at least one additional child in the hopes of obtaining a boy. There may likewise be a propensity to try for a girl if the first two children are both boys, however the Census Bureau data suggests that this occurs with much less frequency.