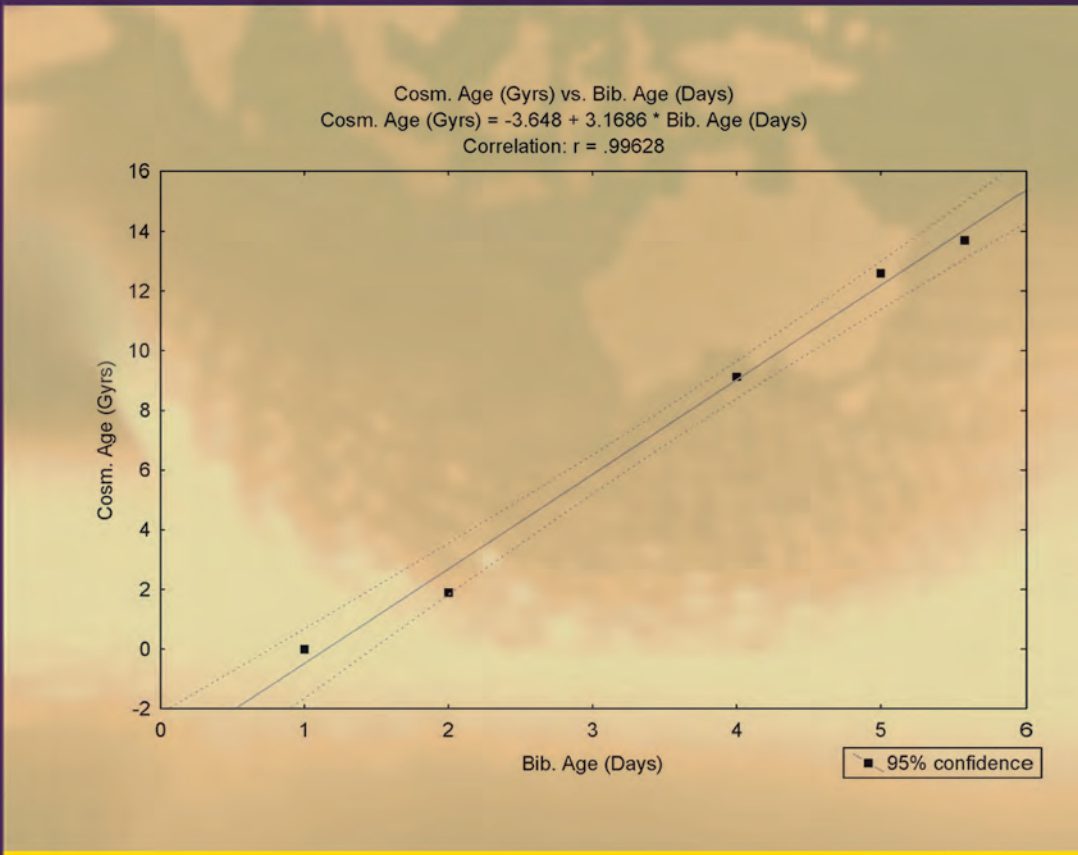
Haim Shore

Coincidences in the Bible and in Biblical Hebrew



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Also by the Author (English)

Radday, Y. T., Shore, H. *Genesis: An Authorship Study in Computer-Assisted Statistical Linguistics.* Analecta Biblica, 103. Series. Rome: Romae E Pontificio Instituto Biblico (Rome Biblical Institute Press), 1985.

Shore, H. *Response Modeling Methodology: Empirical Modeling for Engineering and Science*. Singapore: World Scientific Publishing Co. Pte Ltd., 2005.

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Preface to Second Edition

On December, 4, 2009, the Israeli daily, the Jerusalem Post, published an interview with me about the findings of this book. The interview was posted on the Internet and translated to other languages. Following this interview, numerous communications were received and articles about the methodology used in the book published in various local newspapers. Some writers provided me with findings of their own. Concurrently, I continued with my own research and found some new relationships (not yet made public). In this second edition there are two new chapters: Chapter 21, which replaces the previous chapter and introduces a new methodology to statistically analyze some of the "Coincidences" in this book, and Chapter 23, which expounds the new findings. Indeed, the latter introduces the reader, in non-technical terms, to the methodology of analysis pursued throughout this book. Since this chapter may be read as standalone (as most other chapters in this book), the reader is advised to read this chapter prior to (or after) reading the introductory Chapters 1 and 2. Some minor corrections have been applied to other chapters of the book.

As with the first edition, I will be happy to receive feedback and comments to the findings of this book.

Haim Shore
November, 2012

Preface

This book is about coincidences in the Bible and in the biblical Hebrew language. The nature of these coincidences, what they are and what they are not, and the structure of this book will be expounded in the introductory chapter that follows this preface. For now, suffice it to say that the coincidences addressed here are those that I have become acquainted with from my long-standing familiarity with written Jewish sources, or coincidences that I have detected by personal observation over the many years since these coincidences first intrigued my curiosity.

From a personal perspective, I was reluctant to author this book. I am a tenured professor in an engineering department at an Israeli university, and coincidences are outside the reach of my area of expertise. Furthermore, writing about coincidences may not add points to my international academic standing. Yet for quite a few years now, I have observed peculiar coincidences in the Bible and in biblical Hebrew that were indeed troubling. As these amazing coincidences grew in number over time, a growing sense of uneasiness left me sleepless at night. I felt that my integrity as an academic researcher—whose mission in life, as I perceive it, it is to tell the truth—was starting to be undermined. I realized that the sheer number of these coincidences had reached a critical mass, where not making the coincidences public would compromise my personal ethical values. Furthermore, it would be incompatible with my values as a scientist and with the very scientific method, which I have applied throughout my academic career as a researcher. So I decided to put these coincidences in writing.

As the process of authoring this book progressed, I gradually have come to realize that my expertise in statistics may be useful in establishing in a more rigorous manner the true nature of some of the coincidences addressed in this book. Therefore, statistical analysis has been applied to some of the coincidences to ascertain whether they might be rightfully perceived as conveying concrete information. This endeavor brought forth about a dozen and a half statistical analyses, scattered throughout this book, where certain amazing relationships are explored, depicted, and statistically tested to establish their validity. These

analyses, which can be traced by the list of figures given adjacent to the table of contents, are meaningful even as stand-alones. However, the analyses combined have implications that extend far beyond. In my judgment, the statistical analyses in this book compel one to perceive the other coincidences, which can not be subjected to statistical analysis, in a more serious fashion than would otherwise be justified—that is, if the statistical analyses were nonexistent.

We do hope that this book is, on the one hand, fun to read, and on the other hand be a trigger for further exploration of coincidences that the Bible and biblical Hebrew seem to have in store in abundance. Such explorations are expected to identify further amazing coincidences, not unlike the ones given in this book, that may, once found, be subjected to similar rigorous statistical analysis in order to remove their alleged coincidental nature.

Personal conclusions that one may derive from the coincidences displayed in this book are open for anyone to deliberate and shape up. These are considered by us to reside beyond the boundaries of the present composition.

HAIM SHORE
Beer-Sheva
October 2006

CHAPTER 21

How probable are the results? —A simulation study

Nineteen statistical analyses were introduced in earlier chapters and results displayed with respect to nine subjects:

- Diameters of the three celestial objects: the moon, Earth and the sun (M, E, S), chapter 8;
- Diameters of the planets, chapter 8;
- Water specific heat capacity (SHC) for the three phases of water: ice, liquid, and steam, chapter 9;
- Light wave frequencies, perceived by receptors in the human eye, chapter 10;
- Color wave frequencies, chapter 12;
- Time-period frequencies, chapter 12;
- Various cyclic phenomena frequencies, chapter 12;
- Transition metals' atomic weights, chapter 13;
- Other materials' atomic weights, chapter 13.

Each of the nine separate categories of analysis was based on different and statistically independent samples of observations. Each resulted in statistically significant results (one was bordering significance). For all nineteen analyses F-ratio values, significance values (p values) and scatter plots, together with the fitted linear regression lines, were provided.

While statistical significance had been achieved for almost all analyses, one may claim that the small sample size used in many of these analyses (three data points) undermines any attempt to attribute meaning to them. One way to circumvent this criticism is to ask: How probable are these results? Put differently:

What is the probability of three data points, as defined in the various analyses, aligning themselves on a straight line (or thereabout) by chance alone?

To examine this question we display in this chapter results from a simulation study, where data points, similar in a certain way to the data points used in the various analyses, are generated randomly by the computer. While values of the physical property, used in a certain analysis, remain the same (as in the original analysis), "Hebrew words" that represent the various objects are generated randomly by the computer, and the experiment is repeated many times. The central question posed with respect to the results of the simulation is: What percentage of the trios of "Hebrew words", generated artificially by the computer, align themselves on a straight line or thereabouts (as in the original trio of biblical Hebrew words)?

In the next section 21.1 we expound in detail a single example, related to the relationship between values of Hebrew biblical words for colors and their respective wave frequencies. In section 21.2 we display results related to all nine categories of analysis, as described above.

21.1 A detailed example: Colors wave frequencies (WF)

In Table 12.1 the seven elementary colors of the human visible spectrum were enumerated with their wavelength and frequency intervals. In section 12.3.2 we have identified four elementary colors which "were deemed as having clear non-debatable Hebrew meanings" in the Bible: Red, yellow, green and blue. Each of these has its own interval of wave frequency (WF), and in Table 12.3 we have selected (somewhat arbitrarily) the mid-point to represent the WF of the respective color. This may be justified for the last three colors (namely, yellow, green and blue), whose WF intervals lie within the human visible spectrum. It is different for "red", which lie at the lower boundary of the visible spectrum (infra-red is by definition non-visible). Furthermore, color "orange" (one of the seven elementary colors; refer to Tables 12.1 or 12.3) is not recognized in the Bible. Finally, the human receptor for "red" achieves its maximum sensitivity at WF=517.2 (Section 10.3.3), far from the formal definition of the WF for red as an elementary color (Tables 12.1 and 12.3). We take this value (517.2) as the WF for red in the pursuing analysis.

Taking account of these considerations, the analysis in this section proceeds in two stages as expounded below.

Stage I: Using the two data points associated with yellow and blue, an equation of a line is derived, which expresses the WF of a color in terms of the color numerical value (CNV) of the respective biblical Hebrew name. To examine how well the

model predicts the WF of colors not partaking in its mathematical derivation, we then introduce into this equation CNVs associated with biblical names of three other colors: elementary colors "red" and "green", and the non-elementary color magenta (*argaman* in Hebrew). The latter is produced by equal proportions of red and blue and it has an *equivalent* WF of 546.5THz (find details in Comment 2 of section 12.3.3).

For yellow and blue:

- Yellow: CNV= 97; WF = 520 THz;
- Blue: CNV=850; WF=650.

Introducing these two data points into the equation of a line: $WF=\beta_0 + \beta_1(CNV)$, we obtain: $\beta_0 = 503.2$; $\beta_1 = 0.1726$ (these values are close to the values obtained by linear regression applied to all four colors in the basic set; find details in Analysis III of section 12.3.3).

Introducing into this equation CNV values of the other colors, we obtain:

- Green (CNV=366, actual WF=**565**): WF (predicted from the model) = **566.4**;
- Red (CNV=51, actual WF=**517.2**): WF (predicted) = **512.1**;
- Magenta (*argaman*; CNV=294, actual WF=**546.5**): WF (predicted) = **554.0.**

Actual data-points for (yellow, green, blue) are displayed in Table 21.1 (Example 4) and in Figure 21.4.

Stage II: At this stage we use computer simulation to generate artificially trios of three-letter "biblical Hebrew" words in order to examine the likelihood of their alignment on a straight line, similarly to the configuration observed for the original true Hebrew words (refer, for example, to Figure 12.7). To guarantee both randomness and adherence to the natural structure of biblical Hebrew words, three-letter words are first generated randomly, where each letter is selected with probability equal to its actual appearance in the Hebrew Bible. Thus, the second letter in the Hebrew alphabet, the letter *bet*, appears 5.448% of the times and therefore it is selected randomly with this probability (or sampling weight). Also, generated words with same *three* letters are discarded as well as trios having any two words with identical numerical values. The last rejection criterion was pursued assuming that two Hebrew words representing two different objects (like Earth and sun) do not share same numerical values. Also, all generated words had *three* letters, even when actual (true) trios of words occasionally included four-letter

words. For example, the Hebrew for blue, *Tchelet*, is a four-letter word. We have assumed that integrating this particular information would bias the results and therefore all computer-generated trios comprised only three-letter words (as do the majority of actual Hebrew words taking part in this analysis).

The response variable (the metric subjected to statistical analysis) is the ratio of the slopes (SR) of the two lines that connect two adjacent points, namely:

$$SR = \frac{SR_{23}}{SR_{12}} = \frac{(Y_3 - Y_2)/(X_3 - X_2)}{(Y_2 - Y_1)/(X_2 - X_1)},$$

where Y_j (j=1,2,3) is the value on the vertical axis (the physical property) of the j-th point, Xj is the respective value on the horizontal axis (Hebrew numerical value) and the words in the trio are sorted (for the analysis) according to values of the physical property (the Y values). Obviously for three points that are arranged exactly on a single line (whether the line has positive or negative slope) we expect (ideally) SR=1. For three-point sets that are arranged near a straight line we expect SR values around 1.

Continuing with same example as in Stage I, it can be easily established from Table 1.1 and Table 21.1 that for the set {yellow, green, blue}, the SR values are (refer to section 12.3.2):

SR_{12} = 0.1673; SR_{23} = 0.1756; SR = (0.1756) / (0.1673) = 1.0498.

Simulating by the computer N=50000 trios of words and randomly selecting from that body of data a sample of n=5000 trios, a value of SR was calculated for each. The sample of 5000 SR values delivered mean and standard deviation equal to, respectively (Example 4 in Table 21.1):

$$\mu_{SR} = -1.35;\ \sigma_{SR} = 42.9.$$

Using these estimates and assuming normality of SR values (refer to Figure 21.4), we may calculate the probability of SR randomly falling in the interval ±5% around SR=1 (as happened with the actual trio of words):

$$\Pr[0.95 < SR \le 1.05] = 0.00093.$$

We realize that there is extremely small probability for SR to occur so near 1. Figure 21.4 shows a histogram of the artificially generated SR values. The figure

clearly shows that the simulated SR values are indeed normally distributed and that they have a large span of variation.

21.2 The complete simulation study

To learn whether the implausibility, found in the previous section, for a trio of biblical Hebrew words to align themselves in a linear configuration (or near to one) extends to other examples the analysis above was implemented to nine more examples (some of which are enumerated at the beginning of this chapter). Actual data-points and other relevant information are given in Table 21.1. Table 21.2 displays actual SR values, means and standard deviations obtained from the simulation experiments and the respective probability values (rightmost column).

Table 21.1. Examples of trios of biblical Hebrew words bound by a common physical property. HNV-Hebrew numerical value; MU-measurement unit (MU) on original scale; PP= Value of physical property used in analysis; "Figure" relates to relevant figures in this book. All examples are also shown in Figs. 21.1-21.10.

Ex.	Trio of words (HNV)	Physical property (MU) (PP)	Figure	*Relevant book section*
1	{moon, Earth, sun}	Log-diameter (km)	8.2	8.3.2
	(218, 291, 640)	(8.153, 9.454, 14.145)		
2	{Earth, Jupiter, Sun}	Log-diameter (km)	8.5	8.3.5
	(291, 508, 640)	(9.454, 11.848, 14.145)		
3	{ice, water, steam}	Specific heat capacity	9.1	9.4
	(308, 90, 319)	(2050, 4181, 1970)		
4	{yellow, green, blue}	Wave frequency (THz)	12.3	12.3.3
	(97, 366, 850)	(520, 565, 650)		
5	{day, month, year}	Log-frequency (Hz)	12.6	12.4.1
	(56, 218, 355)	(-11.37, -14.75, -17.24)		
6	{day, sound, light}	Log-frequency (Hz)	21.6	12.4.2
	(56, 130, 207)	(-11.37, 5.991, 33.97)		
7	{day, thunder, lightening}	Log-frequency (Hz)	12.7	12.4.2
	(56, 310, 800)	(-11.367, 5.9915, 33.968)		
8	{ standstill, sound, ,light}	Log-velocity (km/sec.)	21.8	23.3
	(89, 130, 207)	(0, 5.840, 19.52)		
9	{silence, thunder, lightening}	Log-velocity (km/sec.)	21.9	23.3
	(89, 310, 800)	(0, 5.840, 19.52)		
10	{gold, silver, copper}	Recip. atomic weight	13.2	13.4.1
	(14, 160, 363)	(5.077E-3, 9.270E-3, 15.74E-3)		

Table 21.2. Examples of trios of Hebrew words bound by a common physical trait (Table 21.1) and their probability to be aligned by chance on a straight line (or thereabouts) (n=5000 three-letter trios of "Hebrew words" sampled from a body of artificially generated N=50,000 trios). SR - Slopes ratio;

STD—Standard deviation

Ex.	trio of Hebrew words	Physical property	Relevant Figure	$SR_{ac.}$ (Actual SR)	{Mean, STD} (of SR)	Probability of (1-Δ<SR<1+Δ) Δ = | $SR_{ac.}$-1|
1	{moon, Earth, sun}	Log-diameter	8.2	0.755	{-.775, 98.3}	0.00203
2	{Earth,Jupiter, Sun}	Log-diameter	21.3	1.58	{.188, 23.0}	0.0208
3	{ice, water, steam}	Specific heat capacity (SHC)	9.1	0.744	{-.020, 1.06}	0.118
4	{yellow, green, blue}	Wave frequency (WF, THz)	21.1	1.05	{-1.35, 42.9}	0.000927
5	{day, month, year}	Log-frequency (freq. in Hz)	12.6	0.868	{-.553, 23.2}	0.00514
6	{ day, sound, light}	Log-frequency (freq. in Hz)	12.7	1.55	{-.703, 43.1}	0.0102
7	{day, thunder, lightening}	Log-frequency (freq. in Hz)	21.7	0.835	{-.575, 38.2}	0.00333
8	{ standstill, sound, ,light}	Log-velocity	21.8	1.25	{-3.26, 56.9}	0.00769
9	{ silence, thunder, lightening}	Log-velocity	21.9	1.05	{-1.28, 61.2}	0.000781
10	{gold, silver, copper}	Reciprocal atomic weight	13.2	1.11	{-1.36, 47.8}	0.00167

The latter clearly indicate that it is highly unlikely for a trio of Hebrew words to be aligned along a straight line by chance, irrespective of the values of the physical property described on the vertical axis. Figures 21.1-21.10 display plots of actual data points and histograms of the artificially generated SR values.

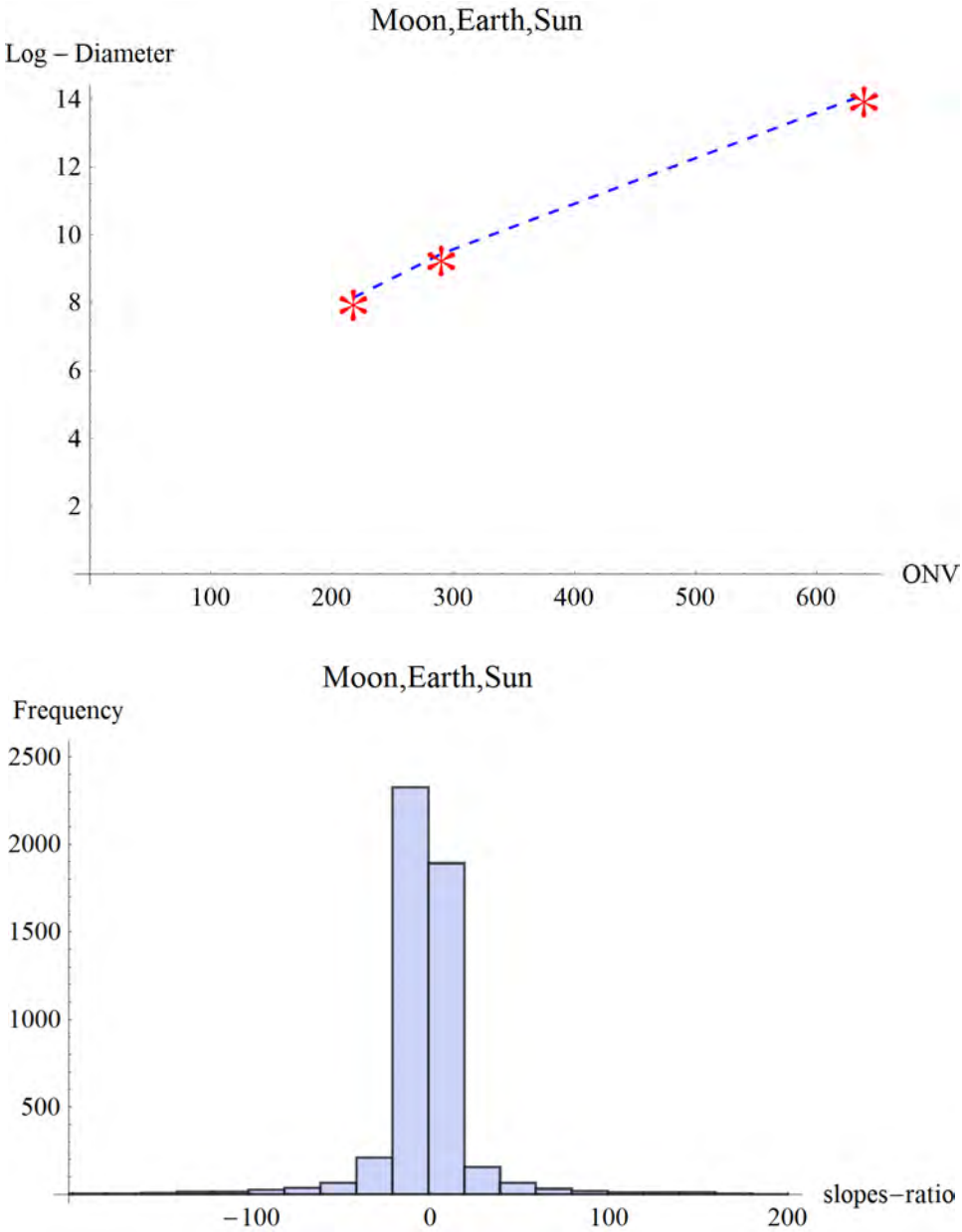

Figure 21.1. Example 1: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. Celestial ONV (Object numerical value) is numerical value of the Hebrew word.

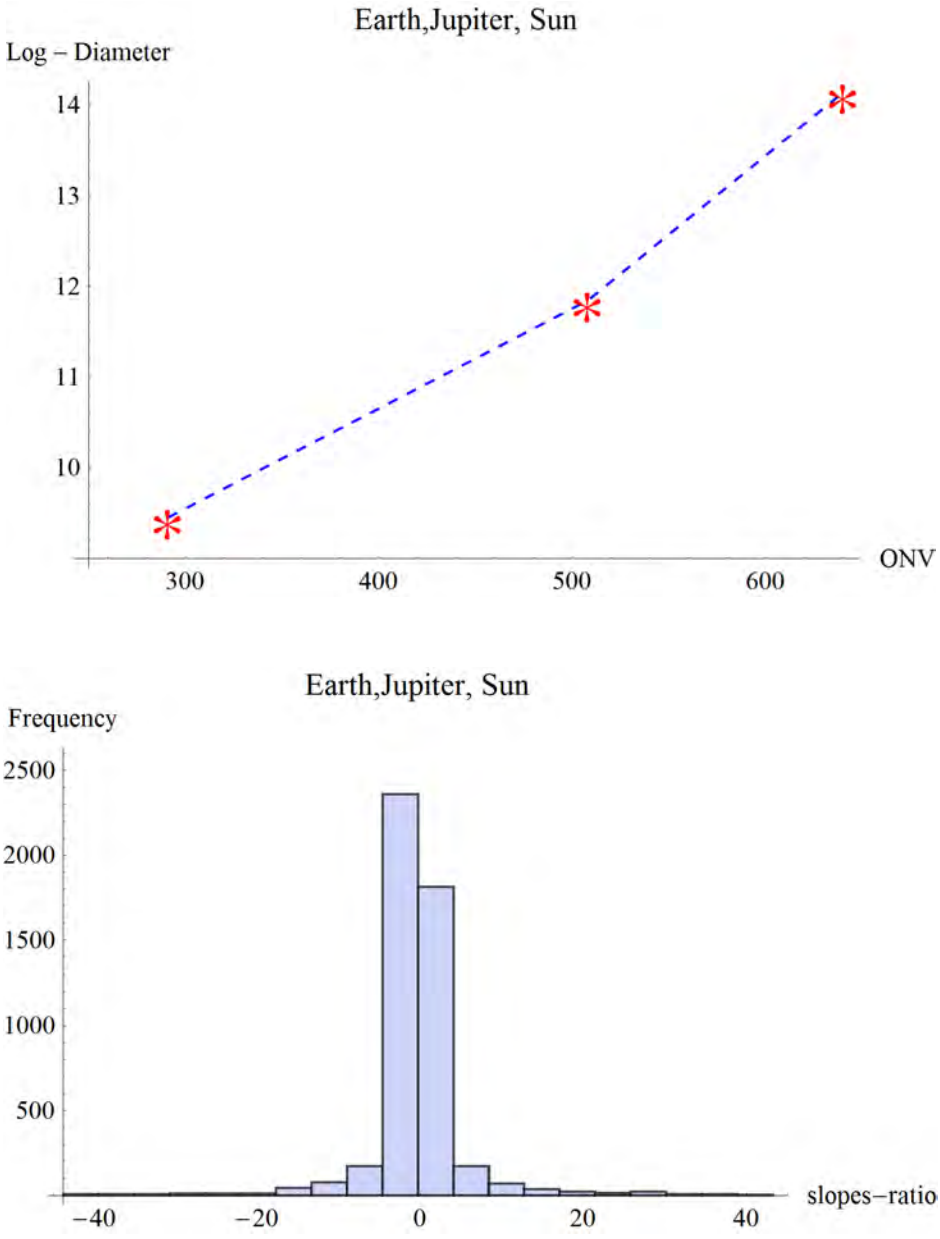

Figure 21.2. Example 2: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. Celestial ONV (Object numerical value) is numerical value of the Hebrew word.

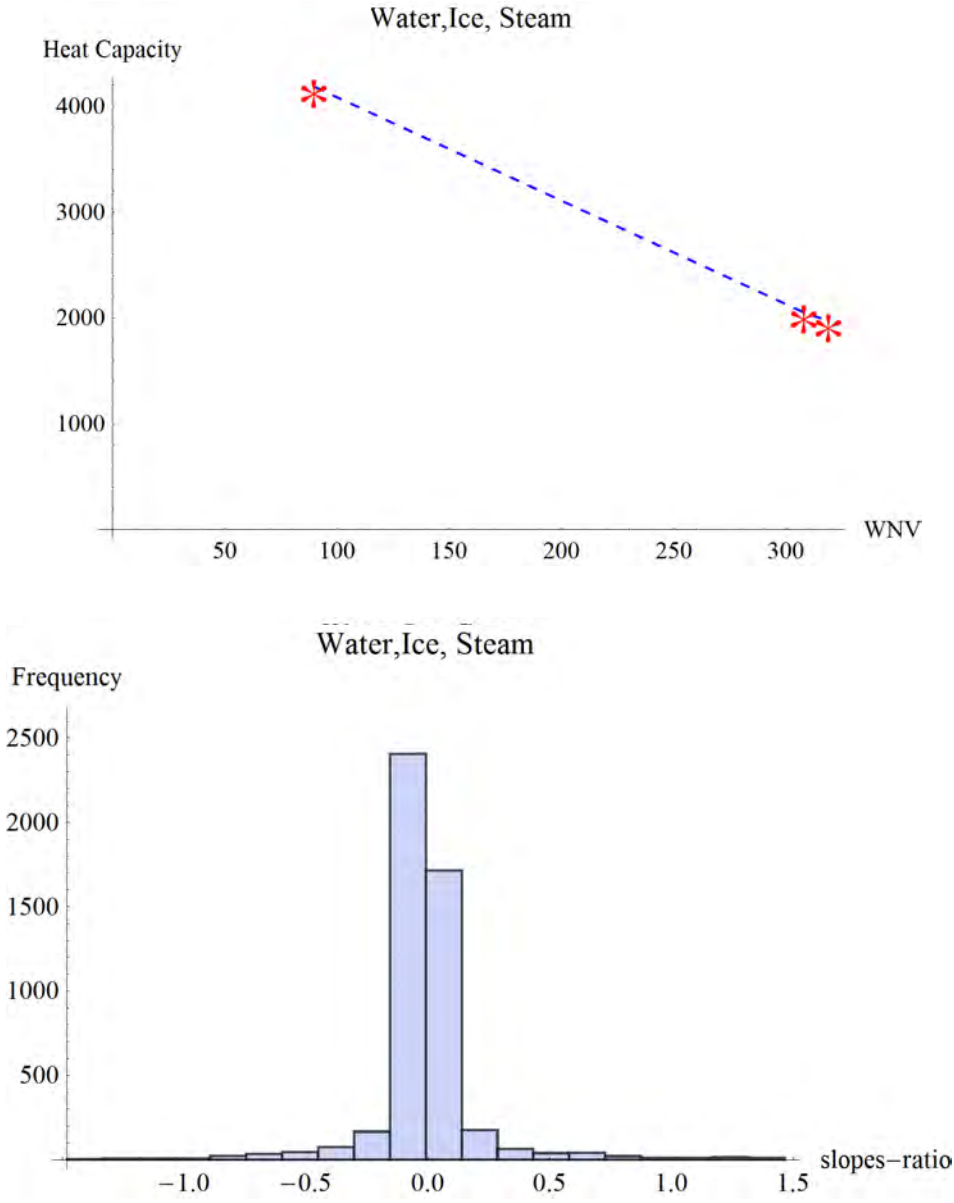

Figure 21.3. Example 3: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. WNV (Water numerical value) is numerical value of the Hebrew word.

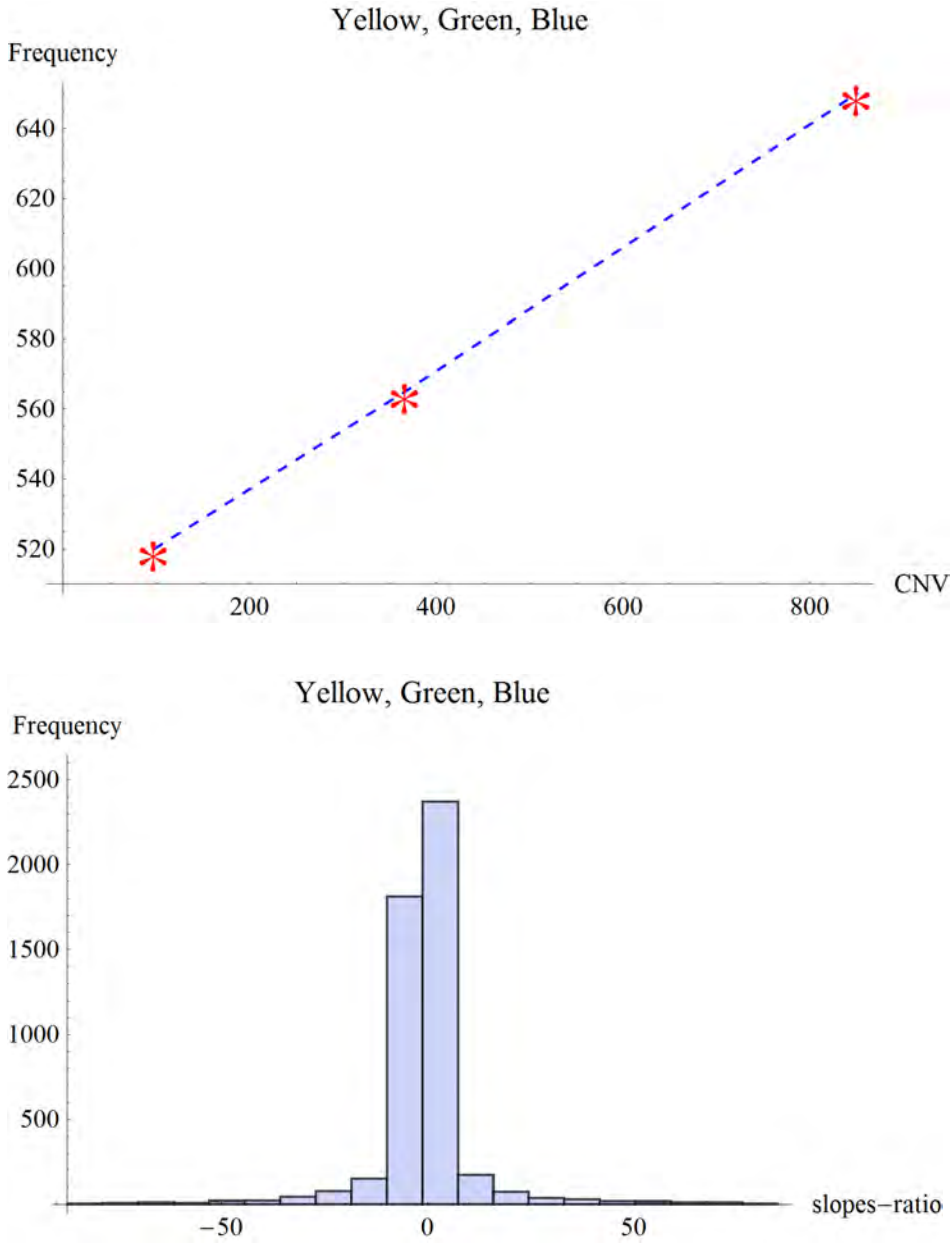

Figure 21.4. Example 4: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. CNV (Color numerical value) is numerical value of the Hebrew word.

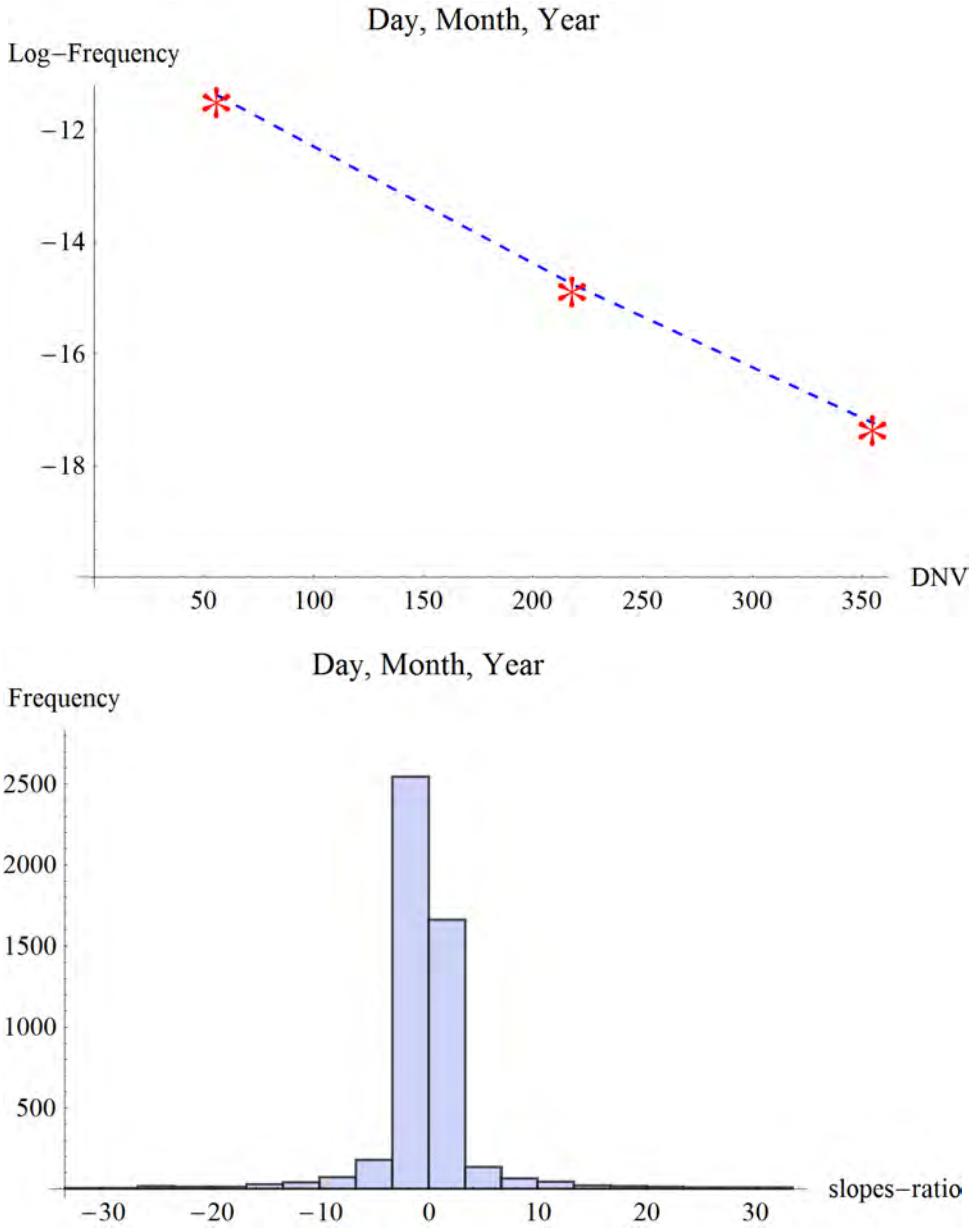

Figure 21.5. Example 5: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. DNV (Duration numerical value) is numerical value of the Hebrew word.

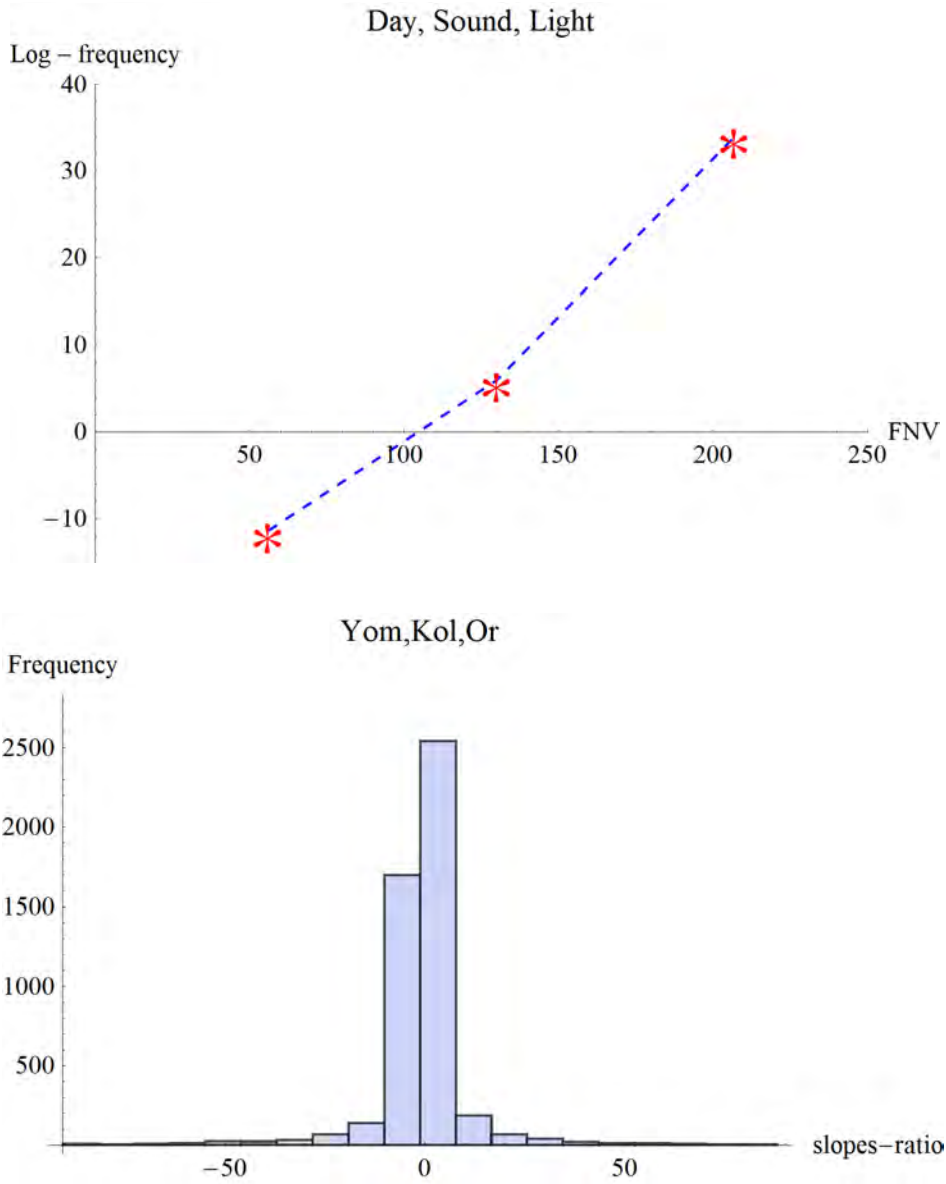

Figure 21.6. Example 6: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. FNV (Frequency numerical value) is numerical value of the Hebrew word.

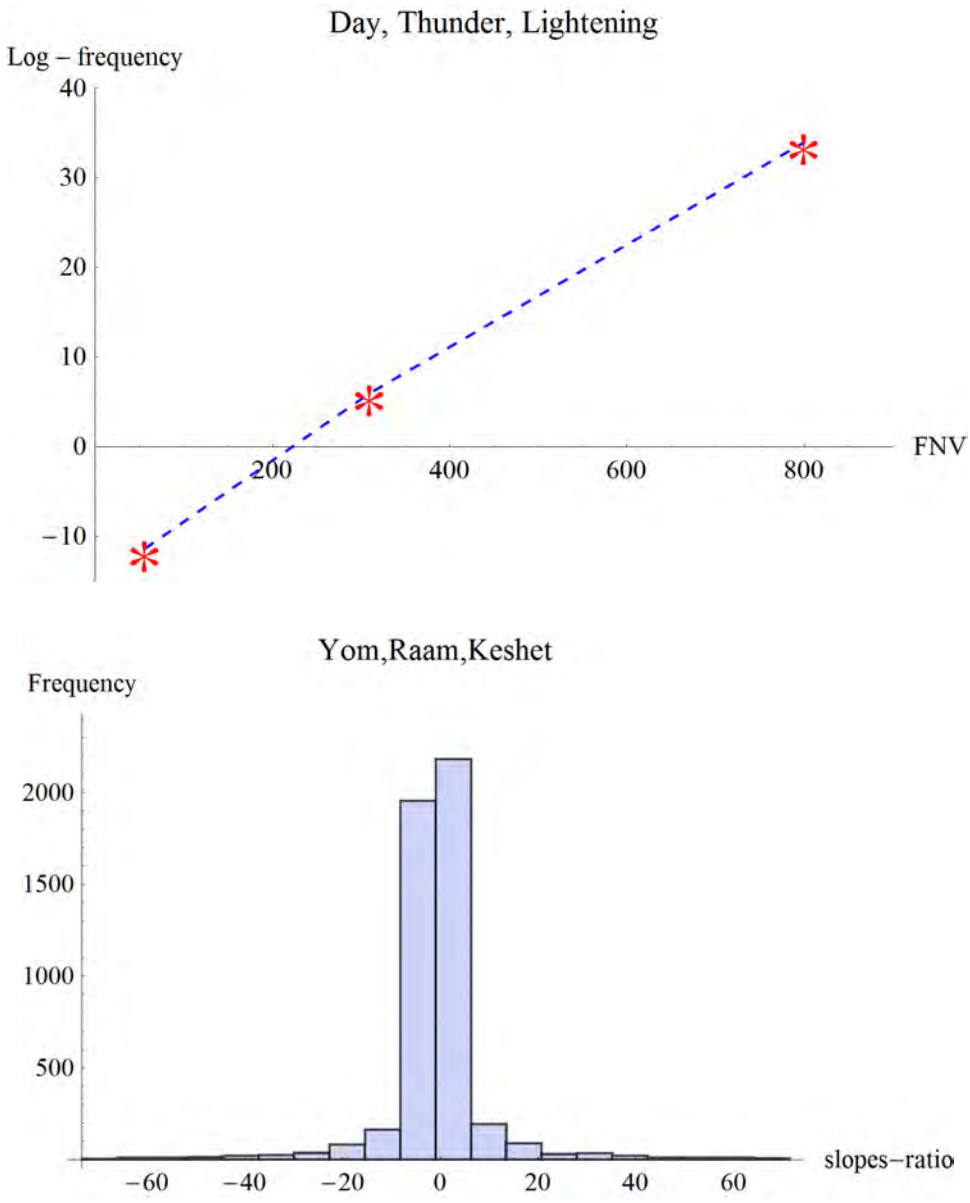

Figure 21.7. Example 7: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. FNV (Frequency numerical value) is numerical value of the Hebrew word.

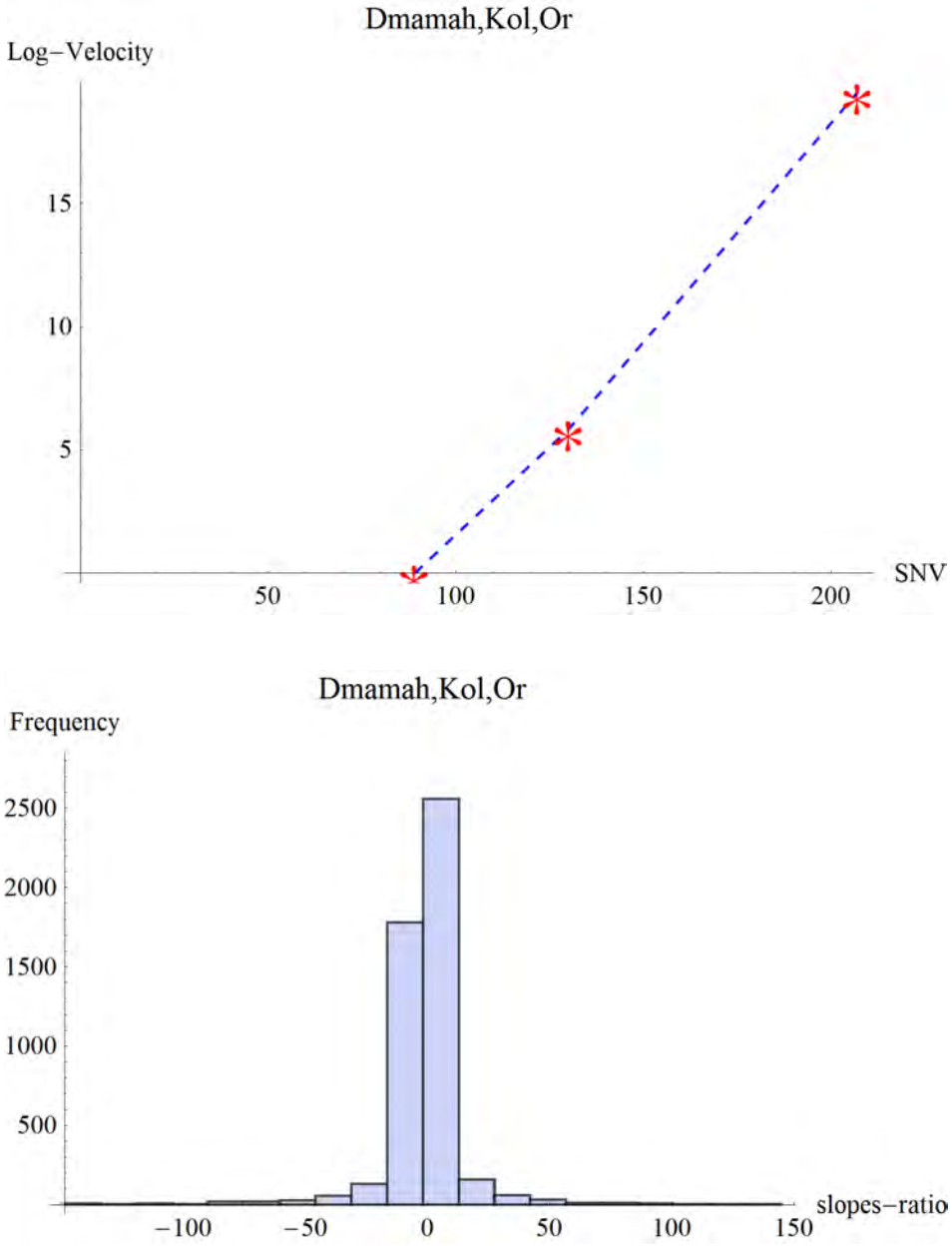

Figure 21.8. Example 8: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. SNV (Speed numerical value) is numerical value of the Hebrew word.

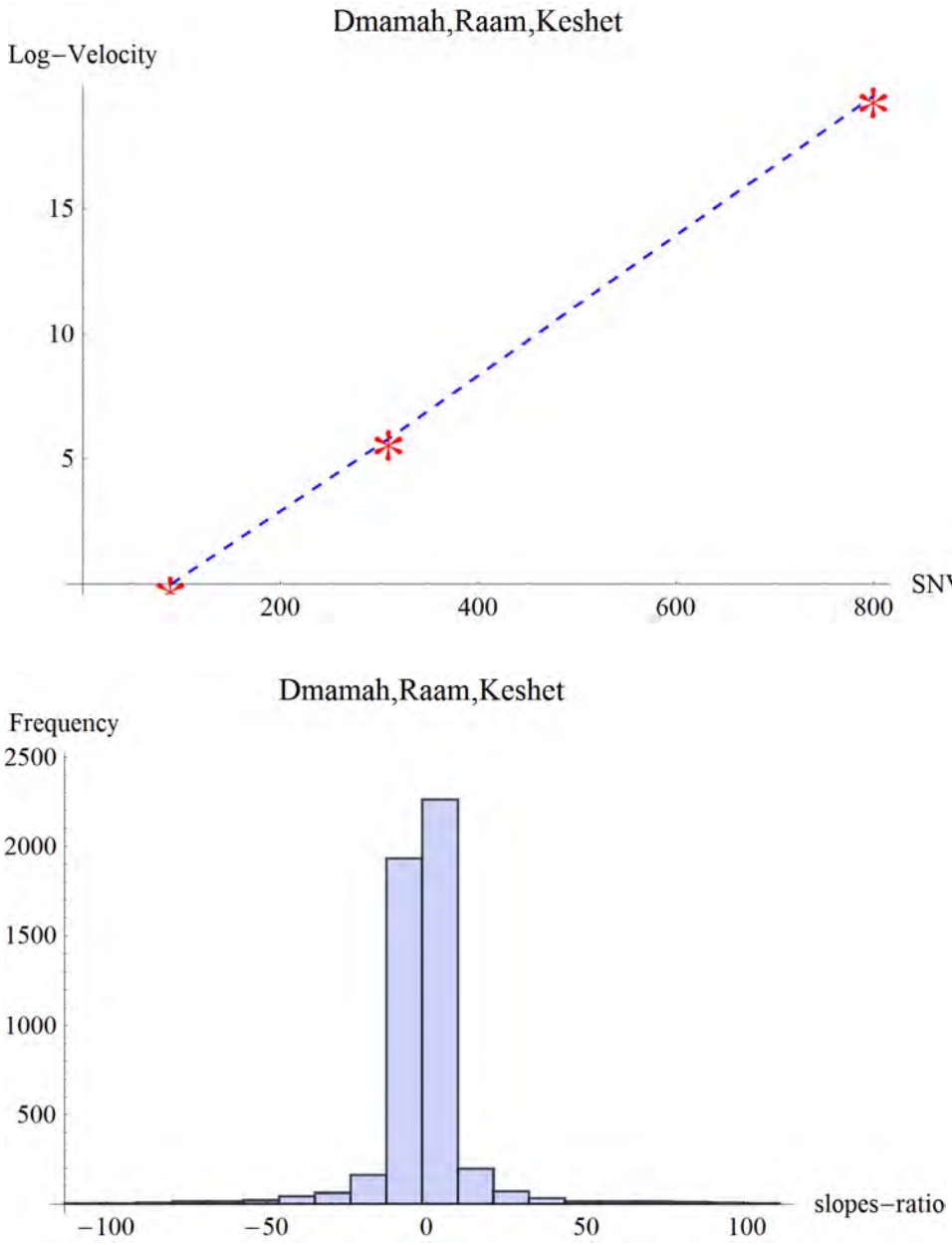

Figure 21.9. Example 9: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. SNV (Speed numerical value) is numerical value of the Hebrew word.

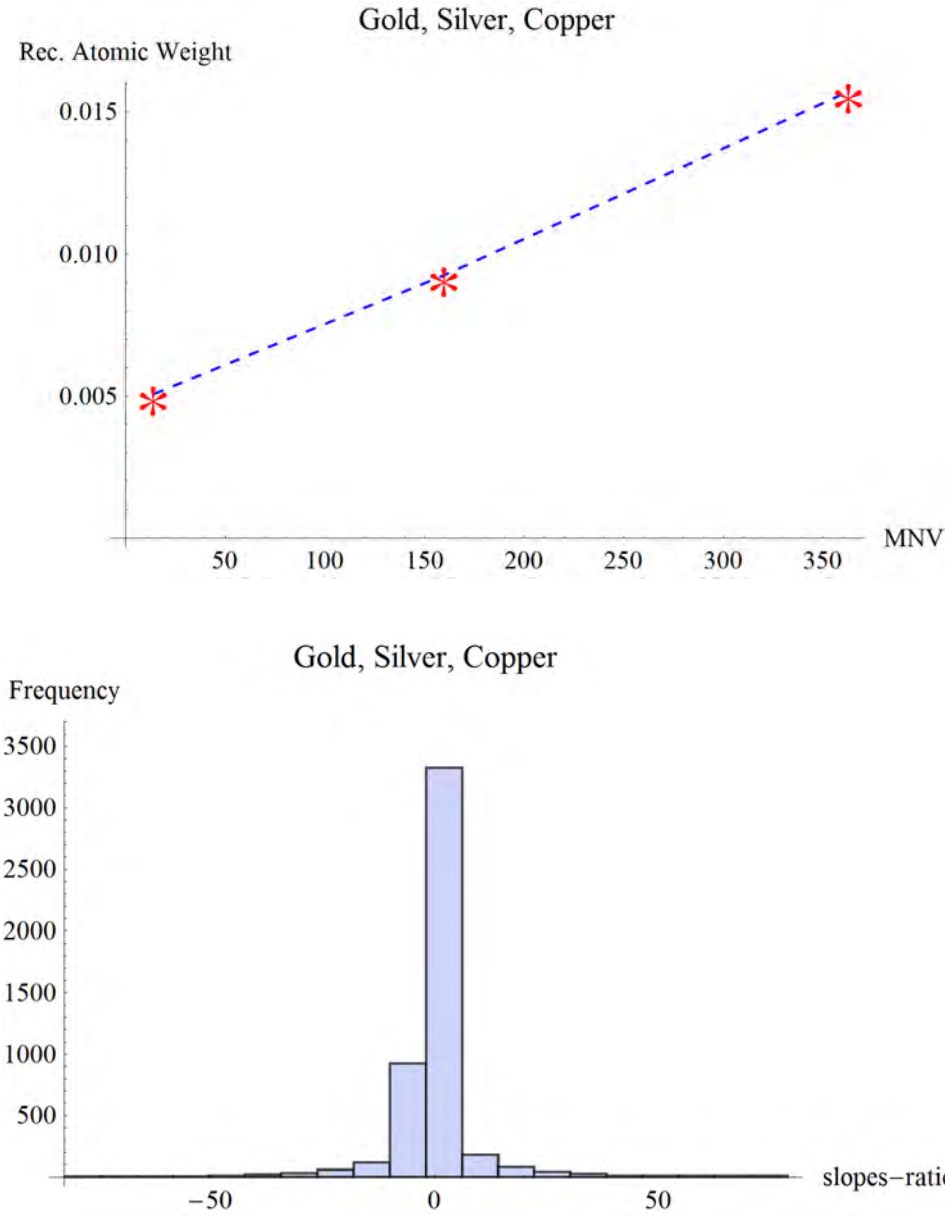

Figure 21.10. Example 10: Plot of data-points (upper figure) and a histogram of slopes-ratio for n=5000 trios of artificially generated Hebrew words. MNV (Metal numerical value) is numerical value of the Hebrew word.

CHAPTER 22

Genesis Creation Story and Recent Cosmological Findings—A Statistical Evaluation

22.1 Abstract and Structure of the Chapter

Evolution of the universe is depicted in our civilization on two different time-scales: in Genesis story, where the universe evolution is described in "Days," and in modern day cosmology, described in billions of years (Giga-years; Gyrs). While the latter scale is scientifically validated by both theory and observation, the former scale is considered an article of faith, incompatible with the scientific scale. In this chapter, we relate to most recent findings regarding dating of significant cosmological events and pinpoint corresponding events in the biblical time-scale. We then apply statistical analysis to establish possible correspondence between the two time-scales.

The structure of this chapter is as follows: in section 22.2 we describe the nature of the analyses conducted. In section 22.3, data sources and data used in the pursuing statistical analyses are expounded. Section 22.4 delivers results from the statistical analyses with some predictions, as implied by the derived data-driven statistical models. Section 22.5 addresses some methodological issues associated with current and former analyses, and section 22.6 delivers some conclusions.

22.2 Introduction

The story of the creation of the universe and its evolution has been, for the better part of humankind existence on Earth, an article of faith belonging in the sphere of religion. In the Judeo-Christian religious culture, the "history" of the universe is unfolding in the first chapter of Genesis, where the universe evolution is described in terms of six time phases. Each of these phases, denoted "Day,"

has characteristic momentous events, which had taken place either via Divine utterance or by Divine actual creating (or making). Thus, light was created, on the first day, by utterance: "And God said, Let there be light: and there was light" (Gen.1:3). By contrast, on the sixth day: "And God *made* the beasts of the Earth after their kind, and cattle after their kind, and everything that creeps on the Earth after its kind." (Gen.1:25). Similarly, for humankind: "So God *created* Mankind in his own image, in the image of God he created him; male and female he created them" (Gen. 2:27). (Author's italics are for emphasis).

According to Genesis, the story of creation is unfolding in six days. However, there is also the seventh day, about which the Bible is mute, except for saying in no obscure terms that on that day the act of creation had ceased: "And by the seventh day God ended his work which he had done; and he rested on the seventh day from all his work which he had done" (Gen. 2:2). Thus, while the evolution of the universe from the moment of creation of "the heaven and the earth" to creation of humankind is depicted as unfolding in six "Days," the "destiny" of the seventh day, and what had "occurred" on that day (or perhaps might happen in the future according to Jewish faith, as will be shortly expounded) remains largely undefined.

Biblical story of creation constitutes one time-scale, which had been the subject of much scholarly discourse, Jewish and non-Jewish, from ancient times to present day.

A second time-scale is provided by the Jewish calendar. The latter "measures" the time that has elapsed since the creation of mankind, as depicted in the first chapter of Genesis. Jewish tradition asserts that mankind was created on the sixth day, in fact the same instant, when the first lunar month started. Thus, the Jewish calendar is supposed to deliver the time-scale of mankind existence on Earth (find details and references in chapter 18). However, Jewish tradition goes farther than that. As expressed by "Moses the man of God": "For a thousand years in thy sight are but like yesterday" (Psalms 90:4), Jewish tradition believes that humankind evolution is a repetition of Genesis story of creation. Just as God had rested on the seventh day, so would peace prevail and the Divine would bring forth his kingdom, with the coming of the messiah, at the end of six thousand years (for example, the Jewish year, which had started September, 22nd, 2006, was the 5767th in the Hebrew calendar year).

The Jewish calendar time-scale is not the subject of this chapter, and will not be referred to any further here.

A third time-scale is provided by modern day cosmology. With the ever-developing and more sophisticated measurement and observational techniques at their disposal, science and technology have been able to pinpoint with ever-increasing accuracy occurrence times of various momentous events in the evolution of the universe. Fortunately, some of these events are described in non-ambiguous

terms in Genesis creation story. For example, no one doubts that according to the Bible "light" was created on the first day, or that "the two great lights; the greater light to rule the day, and the lesser light to rule the night" (Gen.1:16) relates to the creation, on the fourth day, of the sun and the moon, respectively. Other events may be less clear-cut, yet they may still reasonably correlate with known cosmological events, aided by how the best of Jewish interpreters had perceived these events over thousands of years of Jewish scholarship.

In this chapter, we analyze dating of six cosmological events, as they are depicted in biblical time-scale and in modern-cosmology time-scale. We then attempt to establish, by means of rigorous statistical analysis, whether a statistically significant relationship exists between the two time-scales. Two principles guide us in conducting this study:

(1) We do not manipulate numbers; neither do we provide data unsubstantiated by credible and well-recognized sources;

(2) We do not manipulate the techniques used in the statistical analysis; only well known and widely accepted statistical techniques are employed.

With this general characterization of the study to be strictly adhered to, this research is conducted in two parts. The first part, expounded in section 22.3, describes how the data for this study were obtained. The second part, in section 22.4, analyzes the data, with the explicit intent of establishing whether a statistically significant relationship exists between the two time-scales.

22.3 The Data

22.3.1 Definition of Events

In this section we relate to six events, well recognized by modern science and probably related to in Genesis story:

(1) Creation of light; section 22.3.2;

(2) Creation of first large-scale celestial structures (galaxies, nebulae); section 22.3.3;

(3) Creation of the sun; section 22.3.4;

(4) Creation of the moon; section 22.3.4;

(5) Creation of multi-cellular and sexually reproducible life on Earth; section 22.3.5;

(6) Creation of mankind; section 22.3.6.

These events will be addressed as they are depicted on two time-scales:

- **Cosmologic time-scale:** Dates or ages in this time-scale will be measured from the moment of the big bang. The measurement unit is billion of years, or Gyrs (giga-years, where giga means 10^9). Values in this time-scale will be referred to as "response values." In regular statistical-modeling parlance, a "response" is the variable whose variation we attempt to explain (via the mathematical-statistical relationship). The response is also commonly denoted the "dependent variable."
- **Biblical time-scale:** Dates or ages in this time-scale will be expressed in "Days" (from time zero, whatever that might mean in biblical discourse). Values in this time-scale will be referred to as "regressor values." In statistical modeling, the "explanatory" variable, namely, the variable whose variation explains most variation in the response (via the mathematical relationship) is called regressor variable, or, simply, regressor. The latter is also often referred to as the "independent variable."

The two time-scales, the cosmologic and the biblical, will henceforth be denoted by variables "Y" and "X", respectively. In this section, we assign values to the two variables with respect to the six events defined earlier. The sample of six observations will later be used to statistically evaluate whether a significant relationship exists between X and Y.

Note, that the six points in the sample are not of equal reliability, as far as scientific dating is concerned. While cosmologic dating of the source for the cosmic microwave background (CMB) radiation (creation of light, as we know it today; observation point 1), for the creation of the sun and the moon (points 3 and 4) and for the appearance of Homo Sapiens (point 6) are of relatively small margins of error (relative to the order of magnitude of the cosmologic time-scale), this cannot be extended to the other two observations in the sample. A main reason is that the other points describe events that may have stretched over extended periods of time, which are meaningful even on the cosmologic time-scale. For example, it is difficult to date the appearance of large-scale structures in the universe with errors much smaller than, say, ±(1/2) Gyr, a meaningful error even in the cosmic time-scale.

Accordingly, two separate analyses will be conducted in section 22.4, with the controversial observations (section 22.4.1) and with their exclusion (section 22.4.2). It is emphasized, though, that we have done our utmost to provide the

most acceptable current mainstream estimates for all sample points, including the two hard-to-estimate points.

22.3.2 Light

Cosmologic value (Y1)

At the time of the big bang, the universe was so hot that no atoms could be created, and therefore no light, as we know it today, was visible. Only when the universe cooled down to such a degree that atoms could have formed did light become tangible. As described elsewhere in the book (section 14.2), according to modern cosmologies, at the time of the big bang, the universe was a soup of radiation and particles—or, in the words of Singh (2004), "The universe contained mainly protons, neutrons and electrons, all bathed in a sea of light." The universe was so hot that possibly forming atoms were continually ripped apart by radiation as soon as they were formed. Therefore, the universe was opaque, and "any light beam moving in this super-hot universe would be absorbed after traveling a short distance, so the universe looked cloudy." (Kaku, 2005, 58). Shortly after the big bang, the universe had undergone an era of quick inflation, when the universe expanded by perhaps a factor of 10^{30} or more. With inflation and ever since, the universe has been cooling down. "After 380,000 years, however, the temperature dropped to 3000 degrees. Below that temperature, atoms were no longer ripped apart by collision. As a result stable atoms could form, and light beams could now travel for light years without being absorbed." (Kaku, 2005, 58). A similar description is given by Greene (2004): "Electrically charged particles, like electrons and protons, which disrupt the motion of light beams, combined to form electrically neutral atoms, which then allowed light to travel freely. Ever since, such ancient light—produced in the early stages of the universe—has traveled unimpeded, and today suffuses all of space with microwave photons." (Greene, 2004, 515).

Light, as it is known to us today, was "created" as a result of the creation of the first hydrogen and helium atoms, about 380,000 years *after* the big bang, in an event called *recombination*. This event produced what is now known as the cosmic microwave background (CMB) radiation that spread all over the universe.

In terms of the cosmologic time-scale, and expressed by its unit, we have for the first data point:

$$Y_1 = 380{,}000(10^{-9}) = 0.00038 \text{ Gyr}$$

Biblical Value (X1)

According to Genesis creation story, light was created by the utterance of the Divine "let there be light," on the first day of creation. Therefore:

$$X_1 = 1 \text{ day}$$

22.3.3 Formation of First Large-scale Celestial Structures

Cosmologic value (Y2)

The question of when were first celestial structures been formed has drawn the attention and research efforts of astronomers and cosmologists for the better part of the twentieth century and to this day. We base our estimate on various sources that seem to converge.

In the abstract of their paper, Gratton *et al.* (1997) present as their fifth result that "The age of the bona fide old globular clusters (Oosterhoff II and BHB), based on the absolute magnitude of the turnoff (a theoretically robust indicator) is:

$$\text{Age} = 11.8 \text{ Gyr}$$

with errors +2.1 and -2.5 Gyr as the 95% confidence range."

A references-based account is a web-site maintained by Wright of UCLA (at http://www.astro.ucla.edu/~wright/age.html). Regarding the age of the oldest globular clusters, Wright writes: "Chaboyer *et al.* (1998) give 11.5 ± 1.3 Gyr for the *mean* age." Regarding the age of the oldest white dwarfs, Wright writes: "In 2004 Hansen *et al.* gave an age for globular cluster M4 of 12.1 ± 0.9 Gyr, which is very consistent with the age of globular clusters from the main sequence turnoff." Inspection of the quoted paper reveals that in fact the number given is 12.1 Gyr, with a 95% *lower* limit of 10.3 Gyr.

In a paper from 2005, Peloso *et al.* report the determination of the age of the Galactic thin disk by means of Th/Eu nucleo-cosmo-chronology. They claim that "This method is only weakly dependent on stellar evolutions models, therefore allowing an important verification of the most used dating techniques, which are the fitting of isochrones to the oldest Galactic open clusters, and the calculation of white dwarf cooling sequences." Furthermore, their result, "(8.8 ± 1.7) Gyr, corroborates the most recent white dwarf ages determined via cooling sequence calculations."

Another source is NASA web-page from January, 2006 (http://www.nasa.gov/vision/universe/starsgalaxies/fuse_fossil_galaxies.html). This page states: "After

the creation flash, the lights went out, because there were no stars or any other bright objects—they had not yet formed. This long night is known as the cosmic dark ages, when no stars existed. The present universe is mostly ionized, and astronomers generally agree that this re-ionization occurred at the end of the dark ages, between 12.5 and 13 billion years ago, when the first large-scale structures (galaxies, galaxy clusters) were forming." Note that the rough estimate given by NASA is consistent with the more precise estimates quoted by Wright earlier.

"Dark Ages" are also described in a relatively recent web-page at http://asia.spaceref.com/news/viewpr.html?pid=20827 (source: National Astronomical Observatory of Japan, press release from September, 2006). According to this source, as the dark ages came to conclusion, first large-scale structures appeared in the universe. This happened as a result of the re-ionization of the universe, and "In this case, most of the re-ionization would have taken place earlier than 12.88 billion years ago".

Kaku (2005, 11) estimates the ages of oldest stars as 12 billon years.

Given the conflicting values reported in most recent publications, it is hard to arrive at a value that seems to be acceptable to all. We therefore opted to relate to the two numbers reported in Wright's account (and quoted earlier), which deliver dating ages of *actual* observable large-scale structures. Averaging these numbers, we obtain a value of 11.8 Gyr (average of 11.5 and 12.1).

Therefore:

$$Y_2 = 13.7 - 11.8 = 1.9 \text{ Gyr}$$

(The most updated current age of the universe, from the big bang, is 13.7 ± 0.2 Gyr)

Comments

The value of Y_2, as defined here, is currently a subject of intensive research effort, attempting to identify a timeline for the formation of first large-scale structures in the universe. It is therefore open to debate, and requires special attention in the pursuing statistical analysis. Deleting this observation from the analysis, however, would not fundamentally alter the conclusions obtained. As related earlier, an additional analysis, excluding this observation and another, is conducted in section 22.4.2.

Biblical Value (X2)

Genesis story of creation does not relate specifically to the formation of stars or galaxies (obviously the latter were unknown in biblical times), but rather to

the formation of the sky: "And God said, "Let there be an expanse between the waters to separate water from water". So God made the expanse and separated the water under the expanse from the water above it. And it was so. God called the expanse "sky". And there was evening, and there was morning—the second day" (Gen.1:6-8).

Therefore:

$$X_2 = 2 \text{ day}$$

22.3.4 Creation of Sun and Moon

Cosmologic Values (Y3, Y4)

The ages of the sun and the moon are:

- The Sun: 4.57 ± 0.02 Gyr (Source: http://en.wikipedia.org/wiki/Sun)
- The Moon: 4.53 ± 0.01 Gyr (Source: http://en.wikipedia.org/wiki/Moon#Formation)

Time of creation of the sun (Y_3) and the moon (Y_4) in the cosmologic time-scale:

$$Y_3 = 13.7 - 4.57 = 9.13 \text{ Gyr (Sun)}$$

$$Y_4 = 13.7 - 4.53 = 9.17 \text{ Gyr (Moon)}$$

Biblical Values (X3, X4)

No controversy exists among biblical interpreters that the Bible refers to the sun and the moon as created on the fourth day. Therefore:

$$X_3 = 4 \text{ day}; X_4 = 4 \text{ day}$$

22.3.5 Creation of Life on Earth

Cosmologic Value (Y5)

Since the sun and the moon were created on the fourth day (section 22.3.4), one has to assume that the description of life on Earth as created on the fifth day relates to the first appearance of life. This is emphasized since the Bible describes appearance of life on Earth (in the form of grass and trees) already on the third

day, when the sun was not yet. Jewish scholars have addressed this challenging mystery, and gave it various interpretations (mostly symbolic and allegoric). We would ignore this day (the only day which is inconsistent with the *order* mandated by the scientific timeline), and assume that the biblical description for the fifth day, regarding generation of life in the water and "above the Earth," relates to first formation of life on Earth.

It is extremely difficult to provide dating for first appearance of most forms of life on Earth. We assume here that two ingredients are essential for all forms of life as now known: living organisms are multi-cellular and sexually reproduced. An excerpt from Wikepedia, the free encyclopedia, representative of other sources, summarizes first signs of life, as just characterized, and their timeline (Source: Wikipedia, the free encyclopedia, at http://en.wikipedia.org/wiki/Timeline_of_evolution; MA means "million years ago"):

- 1200 Ma: Sexual reproduction evolves, leading to faster evolution. While most life still exists in oceans and lakes, some cyano-bacteria may already live in moist soil by this time.
- 1000 Ma: Multi-cellular organisms appear, initially colonial algae, and later seaweeds, living in the oceans.

Both these time-dating estimates rely on references from 2005 (see details in the afore-cited source).

A related source for the *former* dating (sexual reproduction) is an article from Wikipedia, the free encyclopedia (http://en.wikipedia.org/wiki/Sexual_reproduction#Origin of Reproduction):

"The evolution of sex is a major puzzle. The first fossilized evidence of sexually reproducing organisms is from eukaryotes of the Stenian period, about 1.2 to 1 billion years ago. Sexual reproduction is the primary method of reproduction for the vast majority of visible organisms, including almost all animals and plants. Bacterial conjugation, the transfer of DNA between two bacteria, is often mistakenly confused with sexual reproduction, because the mechanics are similar."

A related source for the *latter* dating (multi-cellular life), yet from the same source (http://en.wikipedia.org/wiki/Multicellular organism):

"The oldest known taxonomically resolved multi-cellular organism is a red algae, Bangiomorpha pubescens, found fossilized in 1.2 billion year old rock from the Ectasian period of the Mesoproterozoic era." This figure is also quoted by White (2007), in a table reporting "Significant dates in the history of the universe".

Crystal (1993, 19) dates earliest marine life and fossils to the Precambrian Riphean period. This period had stretched from 1.6 Gyr ago to 0.65 Gyr ago, with mid-value of 1.125 Gyr ago.

Given these sources, and assuming that Genesis story, relating to the fifth day, rightly depicts first signs of life as originating in water, we assign for the origin-of-life dating (averaging 1.2 and 1.0 Gyr, from the first source quoted above, and consistent with Crystal, 1993):

$$Y_5 = 13.7 - 1.1 = 12.6 \text{ Gyr}$$

Biblical Value (X5)

Ignoring the mysterious and unexplainable description for the creation of life on the third day (*before* the sun was "made"), Genesis story of life on Earth is depicted succinctly as originating on the fifth day: "And God said, "Let the water teem with living creatures, and let birds fly above the Earth across the expanse of the sky." So God created the great creatures of the sea and every living and moving thing with which the water teems, according to their kinds, and every winged bird according to its kind. And God saw that it was good … And there was evening and there was morning—the fifth day" (Gen. 1:20-21, 23). Accordingly:

$$X_5 = 5 \text{ day}$$

22.3.6 Creation of Mankind

Cosmologic Value (Y6)

How old is the human race? Controversy exists and is ongoing. It is difficult to pinpoint time reference for the first appearance of humans on the surface of Earth, not least because scientists are divided on what constitutes a species that can be defined human. Since there is no controversy that the "age" of currently existing human species is measurable in hundreds of thousands of years (not in millions of years), high precision is not essential to estimate Y_6.

As reported in Wikipedia, the free encyclopedia, "Anatomically modern humans—Homo sapiens—are believed to have originated somewhere around 200,000 years ago or earlier in Africa;" (http://en.wikipedia.org/wiki/History_of_Earth; Also: http://en.wikipedia.org/wiki/Human).

Other sources roughly corroborate this estimate for the age of Homo sapiens. Therefore:

$$Y_6 = 13.7 - 200{,}000(10^{-9}) = 13.6998 \text{ Gyr}$$

Note, that since Y_6 is measured in Gyr the admissible margin of error for this estimate, which would still be inconsequential for the pursuing statistical analysis, is quite large.

Biblical Value (X6)

Biblical story of the creation of mankind specifies that it has taken place on the sixth day (Gen. 1:27). This is the only detail given. However, Jewish tradition, according to Oral Torah ("Torah She-Be-Al-Peh"), gives a more exact timing: Friday, after the fourteenth hour (since sunset of the previous day), which is the beginning of the third hour into the day of Friday (the Jewish day starts at sunset of the previous day, supposedly taking place at 6PM of the previous day). In fact, this very detail, known in Hebrew by the concept of "Molad Ve-Yad", is fundamental for calculating the average lunar month duration, which, according to Jewish tradition, is 29.530594 days (vs. 29.530589, the value reported in NASA site). In turn, this ancient Jewish value for the duration of the lunar month is cornerstone for the Hebrew calendar, and for the adaptations needed to render it compatible with the solar year. Find further details and references in chapter 18.

Adopting this date from established and often quoted traditional Jewish interpretations for biblical dating of the creation of man (as told in Gen.1:27), we obtain for X_6:

$$X_6 = 5 + 14/24 = 5.5833 \text{ day}$$

Table 22.1 displays all values, derived in this section. This table serves for the statistical analyses in section 22.4.

Table 22.1. Dating of cosmic events in the evolution of the universe and Earth, according to Genesis (Ch. 1), X, and according to recent cosmologic findings, Y.

Event #	Event Description (Creation of)	X (Biblical, "Day")	Y (Cosmic, Gyr)	Model's Residuals (Obs. – Pred., Gyr) (Fig. 22.1)
1	"Light"	1	0.0003	0.479866
2	"Cosmic Large-Scale Structures"	2	1.9	-0.789095
3–4	"Sun"	4	9.13	0.103745
	"Moon"	4	9.17	0.143745
5	"Multi-cellular sexually-reproduced life"	5	12.6	0.405165
6	"Humans"	5.5833	13.6998	-0.343425

22.4 Statistical Analysis and Predictions

Table 22.1 displays six observations, as currently available with respect to two time-scales: the scientific cosmic time-scale, measured in Gyr, and biblical time-scale, measured in days. For the latter scale, we have been assisted by oral Jewish tradition, going back at least two thousands years, to determine the value of a single observation (X_6). For the former scale, it has been emphasized that with regard to two observations, there seems to be scientific controversy whether estimates can be given for the Y values to any reasonable accuracy. One observation regards approximate dating for the appearance of first large-scale structures (at the end of the dark ages and the re-ionization of the universe). The other observation regards the beginning of life on Earth as we know it (namely, characterized by first appearance of multi-cellular and sexually reproducing life). Accordingly, the statistical analysis is divided into two parts:

- Section 22.4.1: statistical analysis applied to the complete sample (six observations);
- Section 22.4.2: statistical analysis applied to a reduced sample (four observations only; two possibly controversial observations removed).

22.4.1 Statistical Analysis of the Complete Sample

In this section, we statistically test two mutually exclusive hypotheses:

- H_0: There is no relationship between the two time-scales;
- H_1: The two time-scales are linearly related (implying that the two time-scales measure the same "thing", only in different units).

To test these hypotheses, linear regression analysis was applied to the complete sample, with biblical time-scale serving as the independent variable (the horizontal axis), and the cosmic scientific time-scale as the dependent variable (the vertical axis). For n=6, linear regression analysis yields linear correlation of 0.9963, with adjusted R^2 of 0.9907. For 1 and 4 degrees of freedom, the sample F-ratio value is 534.8, which is statistically significant (p=0.000021). In other words, the probability of the observations aligning themselves on a straight line, the way they did, by chance alone (that is, if H_0 was true), is less than 0.0021%.

Figure 22.1 displays the results with the associated 95% confidence limits. All observations are within these limits. The linear regression equation is given in the figure caption (atop the plot). Note, that the results of this analysis would

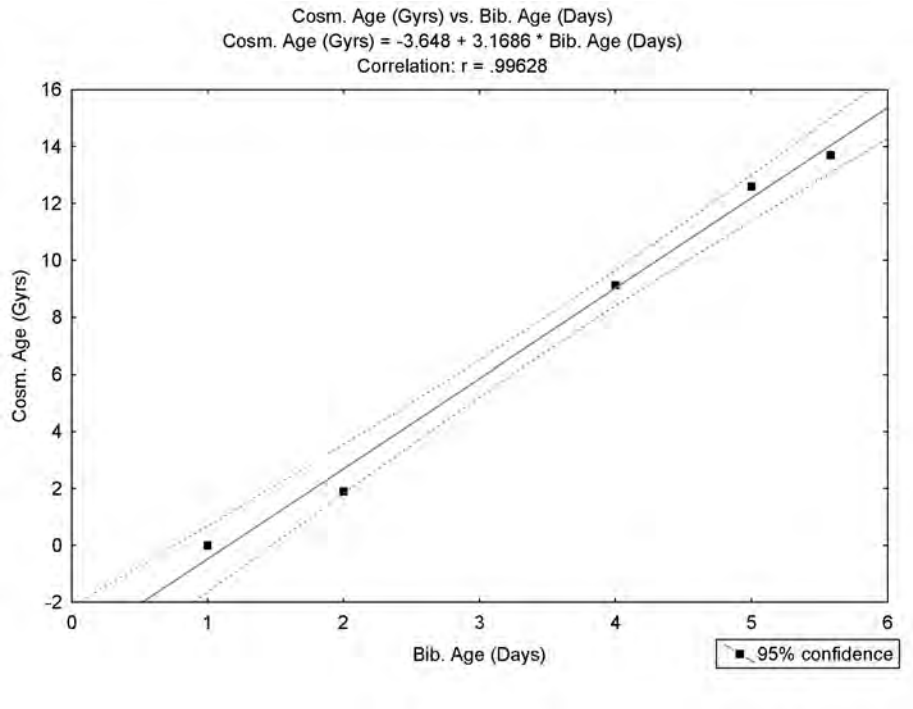

Figure 22.1. Linear regression analysis for the complete sample (n=6)

have been greatly altered if dating of the creation of mankind, according to biblical scale, ignored traditional Jewish Oral Torah (namely, if X_6 would have been assigned a different value).

22.4.2 Statistical Analysis of the Reduced Sample (observations 2 and 5 excluded)

For reasons detailed earlier, two observations, with debatable response values, have been removed from the sample. These are observation 2 (appearance of first large-scale structures in the universe; "sky" created) and observation 5 (first appearance of life on Earth).

With the remaining four observations in the sample, the statistical analysis was repeated. For n=4, linear correlation of 0.9998 was obtained, with adjusted R^2 of 0.9995. For 1 and 2 degrees of freedom, the sample F-ratio value is 6064.8 with p=0.000165. In other words, the probability of the four observations aligning themselves on a straight line, the way they did, by chance alone (that is, were H_0 true) is less than 0.0165%.

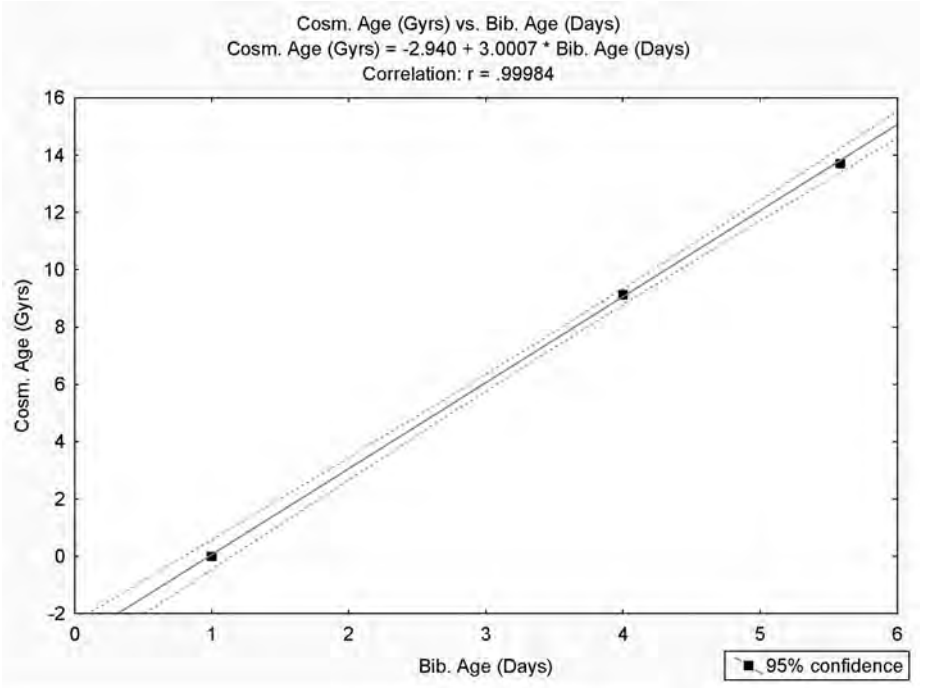

Figure 22.2. Linear regression analysis for the reduced sample (n=4).

Figure 22.2 displays the results with the associated 95% confidence limits. All observations are within these limits. Note that the confidence limits are so close to the linear regression line that they are hardly distinguishable from one another.

22.4.3 Scientific Prediction???

A peculiar feature of both linear regression models, derived in sections 22.4.1 and 22.4.2, is that time zero does not coincide with the instant of the big bang—time zero is roughly 3 Gyr earlier (insert zero into the right-hand side of either equation).

Given the peculiar new concepts of "Dark energy" and "Dark matter", now widely entertained by modern cosmology, is it possible that cosmologists, at some future point in time, would update their estimates to claim that only the visible universe was created at the big bang, however the "Dark" constituents of our universe preceded the estimated instant of the big bang by approximately 3 Gyr???

22.5 Methodological Aspects—Some Comments

In this section we address some methodological aspects pertaining to the statistical analyses of this chapter. We also respond to some comments, of a more general character, regarding the statistical analyses in this composition, which we have encountered in public presentations delivered since publication of the first edition of the book.

22.5.1 Selection of X Values (Genesis creation story)

A legitimate concern may be raised regarding dating of various cosmological events described in Genesis creation story. For example, light was created by utterance of the Divine on the first day; therefore we have assigned $X_1=1$. However, nowhere in scripture is there indication at what point of time, in the first "Day," was light created. One may therefore wonder why not assign $X_1=0.5$ (namely, light created at the *middle* of the first "Day," whatever "Day" means), or $X_1=0$ (namely, light created at the *start* of the first "Day")?

There are two sorts of justifications for this legitimate question. The first is that by Jewish tradition any instant given in terms of time units refers to the end of the specified time unit. Relate, for example, to Molad ve-Yad (chapter 18). This term, part and parcel of Jewish Oral Torah, embodies Jewish credo that first man was created at the *end* of the fourteenth hour of Genesis "Friday", and that this is also the instant when the moon started its first cycle. However, "ve-Yad" only symbolizes "14" in terms of numerical values of Hebrew letters (refer to chapter 18). Nowhere in Jewish tradition does it say at what instant in the fourteenth hour (whatever "Hour" means) was the first human being created. Although this looks marginal and inconsequential, the ramifications of this assertion cannot be discounted: Jewish calendar is based on the moon, and according to Jewish tradition the average lunar month is 29.53059 days (refer to chapter 18). As the reader may realize on reading that chapter, obtaining the correct value for the lunar month duration requires the assumption that man was created at the *end* of the fourteenth hour. The high accuracy, achieved in calculating the duration of the lunar month, could not have been obtained had we assumed another value for the instant of man creation (and the beginning of the first lunar cycle). Asserting that Adam was created at the *end* of the fourteenth hour of Friday thus becomes crucial for the calculation of lunar month duration according to Jewish tradition.

In a similar vein, we have assumed in our analyses that if, for example, Genesis story asserts that light was created on the first day of creation, this implies $X_1=1$, namely, the *end* of the first day. Same rule had been applied throughout the data collection process, as described earlier.

A second argument, pertaining to why we were justified in selecting integer values for events mentioned in Genesis creation story, relates to a more general argument regarding the nature of explorative scientific research. This is addressed in the next section.

22.5.2 The Nature of Scientific Empirical Modeling

Scientific enquiries typically progress in a two-phase process. In the first phase, patterns in noisy data are searched for in order to detect those that may eventually prove to contain valid information. In the second phase, hypotheses are generated and tested, very often by means of statistical hypotheses testing. The first phase is that of exploration, and it represents the induction part of the research. The second phase is the deduction part of the research, when newly generated hypotheses are put to statistical testing in order to establish the general validity of the pattern, formerly detected in the sample.

A risk that often accompanies a genuine scientific enquiry is that the investigator may have innocently manipulated the data collection process to fit his or her preconceived hypotheses. For example, the search for patterns may have been directed to detect a certain category of patterns, ignoring others. Thus, one may argue, when statistical testing is eventually implemented there is no wonder that statistically significant results are obtained. While this is obviously a valid point, there is no escape from the fact that the very nature of scientific exploration requires probing the data until possibly meaningful patterns were revealed. Therefore, one cannot blame a scientist that data were manipulated if he or she had made several attempts to arrive at possibly meaningful patterns. After all, this is what scientific enquiry is all about. One can only hope that manipulation of the data mining process, in order to arrive at statistically-proven valid patterns of nature, remains within allowable, acceptable and legitimate parameters.

To learn of the relevance of these arguments to the statistical analyses presented in this book (and particularly for the results of this chapter), consider the claim that the numerical values of the triad of Hebrew words for "moon, Earth, sun" delivers information about the relative size of these celestial bodies (section 8.3). One of the arguments I have encountered in my oral presentations on the subject was that same rule should apply to all Hebrew words for this triad, and, furthermore, that this rule would be accepted as valid only if found to apply to other features of the same celestial bodies, for example, their mass density.

I consider such severe requirements for acceptance of the scientific validity of the statistical analyses in this book outrageous and unfair. Such demands are never put on any other scientific enquiry of nature. For example, suppose that we investigate the relationship between the level of cholesterol in the human blood (X, the

independent variable) and the level of a certain other ingredient (Y, the response). If a significant relationship was found, say, via regression analysis, however no significant relationship was found with other ingredients in the blood, this does not imply that the statistical analysis was invalid. It is understood that "nature" was so designed that cholesterol is correlated with the investigated ingredient, but not with others. Likewise, if numerical values of a certain triad of Hebrew words for certain celestial bodies are correlated with the diameters of these bodies, and the relationship has been proven to be statistically significant, no further corroboration is required for the validity of this analysis. One does not need to prove that other similar Hebrew words maintain the same relationship, neither that same relationship should hold with regard to other features of the respective celestial bodies.

Summing up, scientific research progresses by empirically detecting possibly information-carrying patterns, and then statistically testing these patterns to establish that their occurrence randomly in the sample is improbable. If a certain pattern proves to be statistically insignificant, then a search for other patterns begins. This is an iterative process, and it remains legitimate so long as all tested patterns are within the parameters of the investigation.

Same reasoning may be applied to the analyses in this chapter. If statistical analysis shows that results are significant only for integer values of X (apart from X_6, as explained earlier), however same analyses result in insignificant outcomes if other values are assigned to X (like X_1=0.5), this does not imply that the analyses are not valid. Rather, it implies the existence of a certain "state-of-nature," according to which only integer values deliver significant results. This is how Genesis creation story, with its hidden story, was probably intended to be delivered in the first place. No further tests are required.

This same approach has been implemented throughout the statistical analyses presented in this book. These analyses, it is our conviction, should withstand any unbiased scientific scrutiny.

22.5.3 Why Not Publish in Recognized Scientific Journals?

The reader may wonder why the statistical analyses in this book, including those in the current chapter, have not been submitted for publication in recognized and highly-esteemed scientific journals, like Science or Nature. The answer may be easily guessed: no journal was willing to even consider reviewing (let alone publish) papers with claims, as displayed in this book. Open-mindedness to all facts of nature, source of pride for many highly-revered journals, ended when claims of religious flavor, no matter how scientifically corroborated, were involved. Therefore, as a result of responses received to preliminary enquiries, none of the

statistical analyses displayed in this book have ever been submitted for review in peer-reviewed journals

I can hardly blame editors who have refused even seeing a first draft of a paper. I might have decided likewise, have I not known better.

22.6 Conclusions

This study is an attempt to relate in a serious and scientifically rigorous fashion to two time-scales, whose compatibility with one another had plagued Western Civilization with endless and often overheated debate for many years. Obviously, this debate has become ever more heated with recent scientific findings, commonly perceived to provide final "victory" to the scientific time-scale over the biblical time-scale.

The statistical analyses, provided in this chapter, seem to suggest that these two time-scales are in fact one and the same, with one time-scale derivable from the other by a simple linear transformation. Furthermore, the latter conclusion is not shaken by the removal of possibly controversial observations, since the rest of the observations in the sample, of more reliable nature, still deliver highly statistically significant results.

How could such different time-scales, derived from two so different modes of human observation upon the world, be yet so compatible with one another? This indeed remains a mystery.

CHAPTER 23

New results (an update, November, 2012)

On December, 4, 2009, the Israeli daily, the Jerusalem Post, published an interview with me about the findings of this book. The interview was posted on the Internet and translated to other languages. Following this interview, numerous communications were received and articles about the methodology used in the book published in various Jewish local newspapers (for example, Benazra, 2010ab). Some writers provided me with findings of their own. Concurrently, I continued with my own research and found some new relationships (not yet made public).

The purpose of this new chapter (added to the 2012 revision of the book) is to deliver an update that reflects these endeavors and expound their results. It opens (section 23.1) with an introduction of the Jewish roots of the approach pursued in this book, namely, the belief that there exist hidden linkages between physical properties of "entities" of the real world and respective biblical verses or biblical Hebrew words that relate to these entities. Some results (not all new), which demonstrate realizations of this belief, are displayed in Table 23.1. No statistical analysis is attempted to establish the validity of these findings. Section 23.2 is a "Parable (all facts imaginary; conclusions valid)". I have found this parable useful in explaining why a linear relationship between two sets of observations, collected by two measuring devices possibly operating on different scales, indicates that the two sets of observations deliver identical information. While this may seem self-evident and redundant to readers trained in the exact sciences, it may not be so for other readers. Therefore a numerical example is introduced, given in the form of a parable. In section 23.3 a simple new detailed example is introduced, which relates to velocity as the physical trait associated with various Hebrew words. Its purpose is to demonstrate (once again) the significance of a linear relationship. A

unique (and significant) feature of this example is that two sets of biblical Hebrew words that are analyzed share a common word. The two sets are represented by two lines that indeed intersect at the shared word (Figure 23.2). This example appears as separate Examples 8 and 9 in Table 21.1. Section 23.4 addresses the main theme of this chapter, namely, the planets and their physical properties. This analysis is a continuation and extension of earlier analyses (chapter 8). It is especially important due to the large number of observations (large sample size) involved in the analyses. Section 23.5 delivers some further numerical examples, received from a reader of the Jerusalem Post interview. The last section 23.6 relates to a new finding regarding species names in the Bible.

23.1 Introduction

An ancient Jewish tradition assumes the existence of hidden linkages between physical traits of "entities" of the real world and respective biblical verses or biblical Hebrew words. This conviction is expressed not merely by general assertions, like "Bezaleel knew how to assemble letters with which heaven and Earth had been created" (Talmud, Berachot, 55a), but also in various detailed examples, often reflecting efforts to extract real (often useful) information about the physical world from analysis of the structure and the numerical values of related words, or verses, that appear in the Hebrew old-testament Bible. For example, the numerical value of *Heraion* (pregnancy; Hoshea 9:11) represents the expected duration of human pregnancy (271 days; Midrash Rabbah, Bereshit, 20). Also therein, Rabbi Shmuel relates to a verse from the Bible: "*Harbeh arbeh itzvonech ve-heronech*" ("I will greatly multiply the pain of thy child bearing", Gen. 2:16). Since *harbeh* ("greatly") is numerically equivalent to 212, an embryo surviving 212 days, thus Rabbi Shmuel, will probably survive the whole pregnancy.

Further examples, relating to "counts" data, are given in Table 23.1 (some repeat examples given earlier in the book).

Table 23.1. Numerical examples (with "counts" data) for matches between numerical values of biblical Hebrew words and corresponding values of related major physical traits

Biblical Hebrew word (English)	Num. value of Hebrew word	Associated physical trait	Num. Value of physical Trait	Source	Example quoted in:
"ש.נ.ה" (*Shanah*, Year)	**355**	Duration (number of days) of lunar-based year	29.530589X12= **354.3671**	Average lunar month (from NASA site)	(Here, ch. 18)
"י.ד" (*Yad*, hand)	**14**	Number of bones in human hand	**14**	Common knowledge	(Here, 10.3.6)
"ה.ר.י.ו.ן" (*Heraion*, pregnancy)	**271**	Duration (number of days) of Human Pregnancy	273 or **271.5**	Common knowledge	Midrash Rabbah (here, 2.1.2)
"א.ד.ם" (*Adam*, human being)	**45**	Number of chromosomes common to all human beings	**45** (23 pairs, one sex chrom. different for male and female)	Common knowledge	No prior reference
"ג.מ.ל" (*Gamal*, camel)	**73***	Number of chromosomes common to all camels	**73** (37 pairs, one sex chrom. different for male and female)	Site: Answer.com	No prior reference
"ח.ל.ד" (*Choled*, rat)	**42***	Number of chromosomes	**42** (21 pairs)	Site: wikipedia.org	No prior reference

* These examples are a small subset from a larger sample; not all animal names in biblical Hebrew succumb to this linkage; possible reasons: only rarely does a single number of chromosomes characterizes all branches of a given species; also, not all species names in the Bible have interpretations agreed by all.

While these examples and many others may be perceived as a collection of anecdotes ("cherry picking", in statistical parlance), statistical analyses detailed earlier in this book, which refer to data measured on continuous scales, seem to suggest that the Hebrew tradition may have deeper roots in reality than initially

and intuitively suggested by documented Jewish oral and written tradition. Some further analyses are expounded in this chapter. All analyses attempt to establish that there is a linear relationship between the numerical values of Hebrew words, representing entities with a common physical trait, and respective values of this trait (measured on a shared measuring scale). For example, later in this chapter (section 23.3) we analyze "velocity" (physical trait) of light, sound and silence (or standstill) in relation to respective Biblical Hebrew words. Linear relationships are found. Why is this important? The following parable explains it all.

23.2 A Parable (all facts imaginary; conclusions valid)

At the beginning of the twentieth century, an archeological excavating expedition arrived to the Holy Land to carry out some research in the vicinity of the city of Jericho. A while into the excavation, a papyrus was exposed that contained a series of twenty numbers. These are given in Table 23.2a (denoted "First set").

Table 23.2. Two sets of measurements reported by the excavation delegation (Section 23.2).

a. First set

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
80.6	87.8	68	57.2	62.6	78.8	50	57.2	80.6	55.4
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
62.6	71.6	80.6	93.2	59	53.6	62.6	71.6	86	91.4

b. Second set

Temperatures measured at this site for 20 days in the year 150 BC										
No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Tem.	27	31	20	14	17	26	10	14	27	13
No.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Tem.	17	22	27	31	15	12	17	22	31	33

No caption explained what the numbers meant so the mysterious papyrus was stored in a secured place and excavation continued. A while later, a second papyrus was revealed, with a second list of numbers (of same size as before; refer to Table 23.2b).

However, this time the caption gave exact details of the nature of these numbers and when these numbers were collected. It read: "Temperatures measured at this site for 20 days in the year 150 BC". Researchers were delighted and they had no doubt that this was an authentic document; however they were still at loss explaining the numbers in the first document, even after consulting the best available statisticians of the time. Several months later, a young archeologist from the expedition came up with a brilliant idea: Perhaps the numbers in the first document are measurements of same temperatures as specified in the second document. After some scholarly arguments and mutual persuasions, the team decided to test this hypothesis statistically.

How could the new hypothesis be tested?

Figure 23.1 plots the two sets.

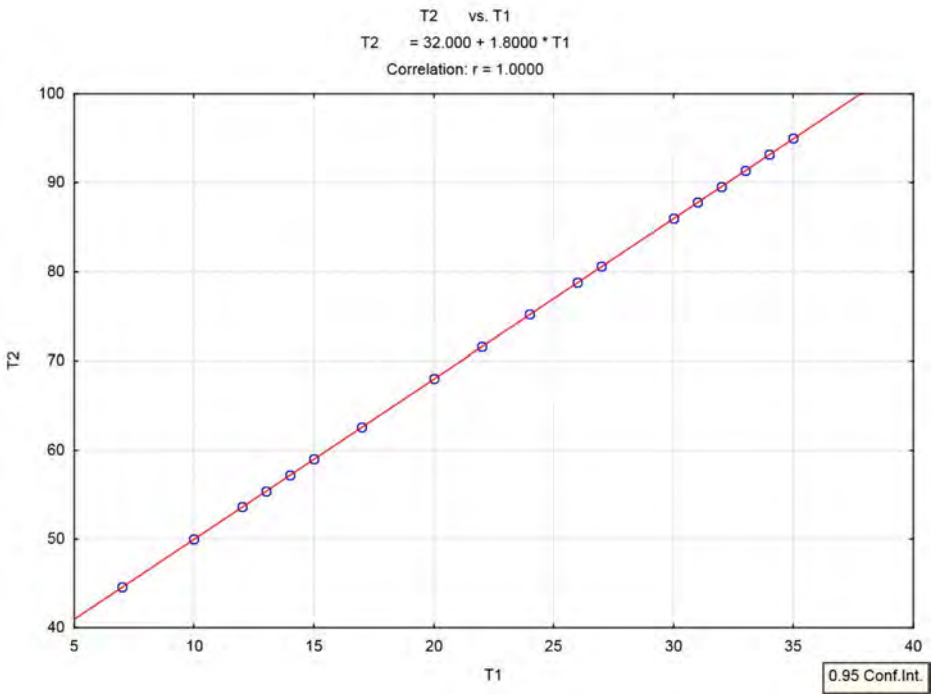

Figure 23.1. Temperature measurements in F° (T2) as function of C° (T1)

A linear relationship is obvious. Linear regression analysis gave the following equation:

$T_2 = 32 + 1.8\ T_1$

Data analysis indeed validated the young archeologist's choice of method to resolve the mystery surrounding the first set of numbers. Her conjecture was indeed validated.

23.3 An Introductory Example

This example is a modification of examples given in this book (section 12.4.2) and in Benazra (2010b). We have already alluded to this example in section 23.1. Therein we referred to the trio of words (light, sound, silence) and their shared physical trait—speed. We now elaborate further on this example and expand it. Light may be represented in Hebrew by *keshet* (rainbow) or . . . *or* (light). Sound may be represented by *raam* (thunder) or . . . *kol* (sound or voice). What Hebrew word should represent "silence"? Interestingly, two different phenomena associated with zero speed, namely, "silence" and "standstill", share in Hebrew a common root: D.M.M. Thus, *domem* denotes in Hebrew all non-living objects (assuming "living" is associated with self mobility) but also objects that do not produce sound (silent). We have elected to use in this example *dmamah*, a Hebrew word derived from the above root (D.M.M.) that has (surprisingly!) the double meaning of silence and stillness. Table 23.3 displays the two trios of Hebrew words, which share a common word, with their respective numerical values, denoted SNV (Speed Numerical Values). Also given are the respective speeds of light and sound (the latter's speed is measured at air temperature of 20°C).

Table 23.3. Data for analysis of velocities (light, sound, zero-speed)
SNV - Speed numerical value. Sound speed in air at 20°C.

Hebrew	**SNV**	**Speed (m/s)**	**Log Speed**
Or (*light)*	207 (1+6+200)	299 792 458	19.52
Keshet (rainbow)	800 (100+300+400)	299 792 458	19.52
Kol (*sound, voice*)	136 (100+6+30)	343.26	5.84
Raam (thunder)	310 (200+70+40)	343.26	5.84
Dmamah (silence, stillness)	89 (4+40+40+5)	1	0

Note that since temperature and air pressure both affect the speed of sound the value selected is somewhat arbitrary. However, selecting another temperature and pressure would not alter the general result (given the log-speed scale used in the analysis). The natural log scale is necessary, as in some earlier analyses in this book, due to differences in order of magnitude of the different speeds taking part in the analysis. Also, the "speed" of silence (or stillness) on the log scale was chosen to be zero (on the original scale this represents a near-zero speed of 1 meter per second (m/s), about a third of a percent of the speed of sound). Figure 23.2 is a plot of the data in Table 23.3 (speed is in m/s, given on a log scale on the vertical axis).

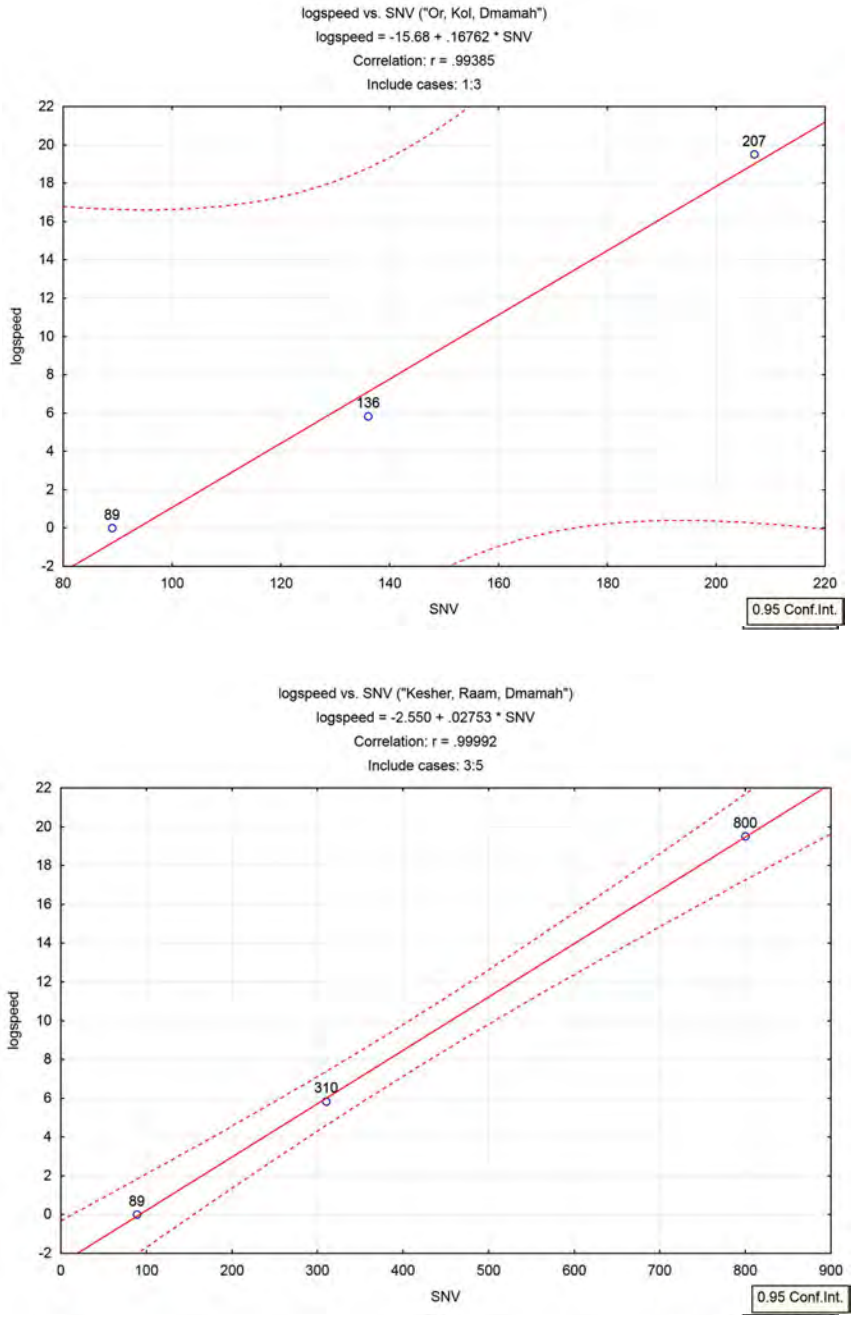

Figure 23.2. Two sets of intra-related Hebrew words and their relationship to speed (on a log scale). SNV—Speed Numerical Value.

We realize that the two trios of words, (*Keshet, Raam, Dmamah*) and (*Or, Kol, Dmamah*), are represented, with the allied speed values, by two lines with significance levels of .0081 and .0706, respectively. The lines converge (intersect) at a point with SNV (x-value) nearly equal to that of *Dmamah* (silence, standstill). Table 21.1 (Examples 8 and 9) and Figures 21.8 and 21.9 display additional computer-simulation results associated with these examples.

23.4 Primary Example—The Planets

23.4.1 Planetary Diameters

This example examines a possible link between names for celestial objects that appear in the Hebrew Bible and known physical properties of the planets. This is an extension of the analysis in Section 8.3, which related only to the planets' diameters. As related therein, we are unaware of any scholarly interpretation that attributes celestial biblical names to specific planets. However, certain names are traditionally interpreted to be associated with groups of stars or just representing a planet (no attribution attempted). We discard these traditional interpretations, and assume that all references to celestial objects in biblical Hebrew (excluding the sun and the moon) relate to planets. There are five such names: *Kimah* (Amos 5:8; Job 9:9, 38:31), *Ksil* (Isa.13:10; Amos 5:8; Job 9:9, 38:31), *Ash* (Job 9:9), *Aish* (Job 38:32) and *Teman* (Job 9:9). The latter means in biblical Hebrew also south, but from the general context of the verse where it appears *Teman* obviously relates to a celestial object (and so is it interpreted by Jewish biblical scholars). We add to this set *Kochav,* which in biblical Hebrew simply means star. *Kochav* is assumed here to relate also to an unknown planet, though in the Bible it most often appears in the plural to signify all stars. Two other names added to the set are *Mazar* (only the plural, *Mazarot* or *Mezarim*, appear in the Bible, at Job 38:32 and Job 38:9, respectively), and *Shachar*. The first (*Mazar*) is interpreted in Even-Shoshan (1988) the same as *Mazal* (a planet, in both ancient and modern Hebrew). The second is often interpreted by Jewish scholars as "a morning star" (relate, for example, to SofS. 6:10, and how Jewish commentators interpret it). As elaborated on at some length in Section 8.3, these names probably represented originally the two most luminary stars in the sky, after the sun and the moon, namely, Venus (probably named *Mazar* in Hebrew) and Jupiter (probably named *Shachar* in Hebrew; refer to 8.3). As we shall see, statistical analysis indeed corroborates this attribution of meanings to the two words.

We now have nine biblical names for celestial objects (including Earth). Apart from the latter, which planets do these names possibly allude to?

For no obvious alternative method to assign names to planets, we sort in an ascending order the numerical values of the biblical Hebrew names (denoted ONV for celestial "Object Numerical Values"), and likewise for the equatorial diameters (as given at NASA site, including also Pluto that had recently been omitted from the list of planets). Table 23.4 displays the results.

Table 23.4. Data for equatorial diameters and mass densities of planets with their assumed biblical names and their Object Numerical Values (ONV)

Name	**Hebrew name**	**ONV**	**Equatorial Diameter* (km)**	**Log(diameter)**	**Mass Density* (g/cm^3)**
Pluto	*Kochav*	48	2302	7.7415	2.00
Mercury	*Kimah*	75	4879	8.4928	5.43
Mars	*Ksil*	120	6794	8.8238	3.94
Venus	*Mazar*	247	12104	9.4013	5.24
Earth	*Eretz*	291	12756	9.4538	5.51
Neptune	*Ash*	370	49528	10.8103	1.76
Uranus	*Aish*	*380*	51118	10.8419	1.30
Saturn	*Teman*	490	120536	11.6997	0.70
Jupiter	*Shachar*	508	142984	11.8705	1.33

* Source: http://solarsystem.jpl.nasa.gov/planets/charchart.cfm

The most surprising finding in this table is that the words *Mazar* and *Shachar* indeed occupies in the sorted list same ordinal positions as the very same planets that these names have been attributed to from altogether non-statistical arguments (Sections 8.3.4 and 8.3.5). Also Earth occupies same positions in both sorted lists. We conclude that this convergence of three planets to identical ordinal positions in the two separately sorted lists add to the validity of the pursuing analyses.

Plotting the planets' diameters on the vertical axis and ONV on the horizontal axis results in Figure 23.3.

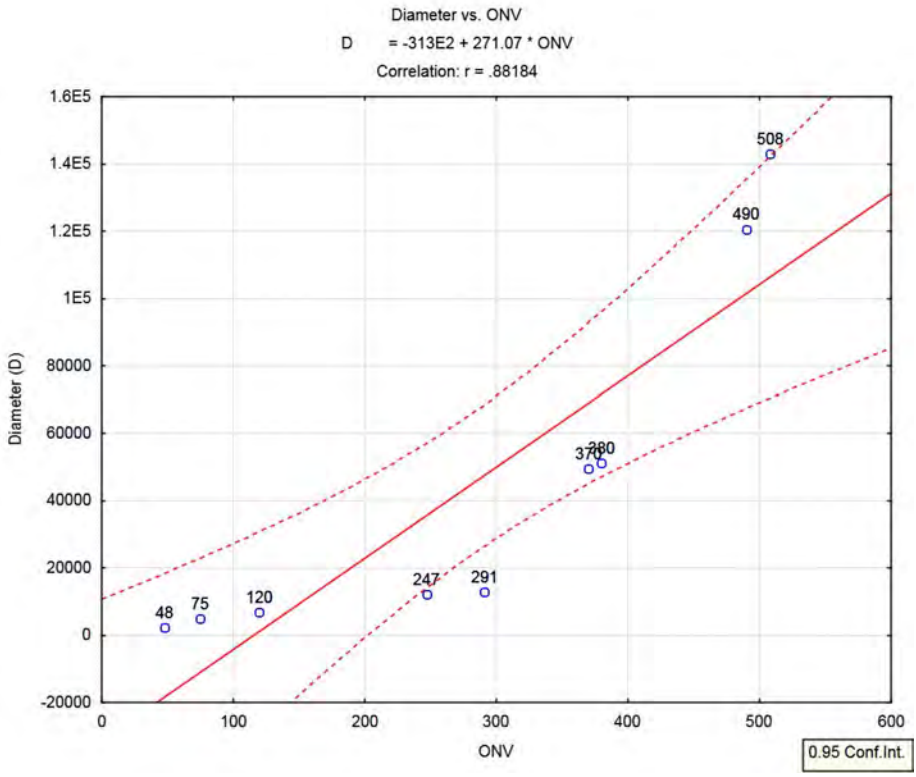

Figure 23.3. Data points for the planets (n=9) on original scale (D).

A nonlinear relationship is evidenced by the plotted points. Proceeding as in the previous example (namely, plotting diameters on a log scale) we obtain Figure 23.4.

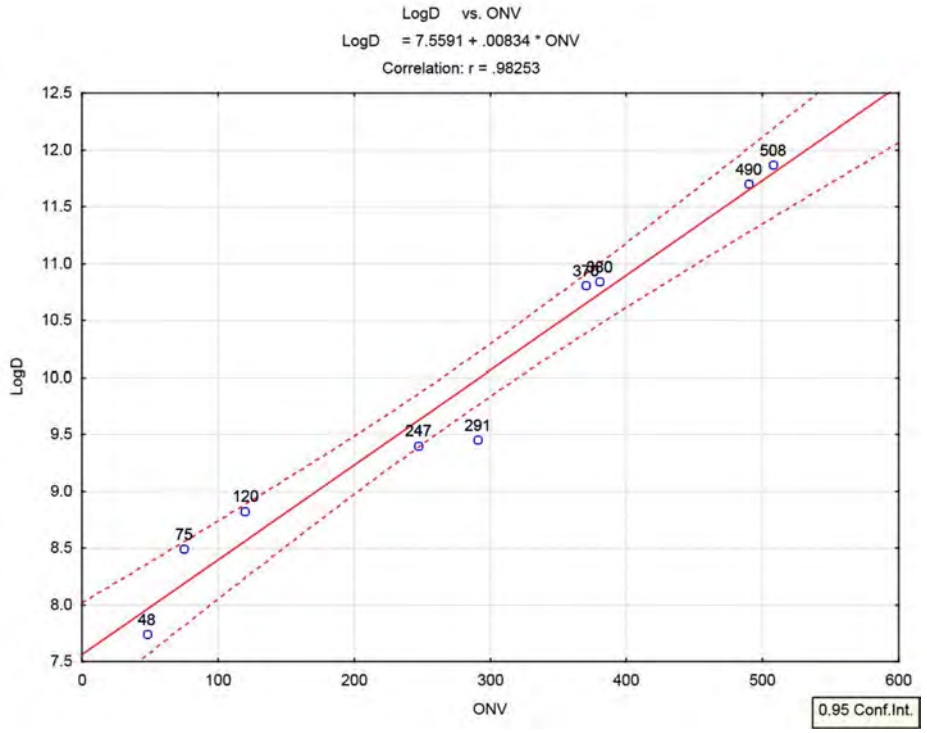

Figure 23.4. Log-diameter ("LogD") of the planets (n=9) as function of their Object Numerical Values (ONV). All planets' names are biblical. Earth (ONV=291) is somewhat deviant.

A linear relationship surfaces, unexpectedly and with no logical explanation. Statistical linear regression analysis was applied to the entire sample of nine points to ascertain whether the linear relationship is significant. With n=9, a correlation (ρ) of 0.9825 is obtained, with model F-ratio of 195.2, which is highly significant ($p<0.000002$). Confidence interval limits (95% confidence) are also plotted in Figure 23.4. Since Earth (ONV=291) lies somewhat below the lower confidence limit, the previous analysis is re-run, excluding Earth. Results are plotted in Figure 23.5.

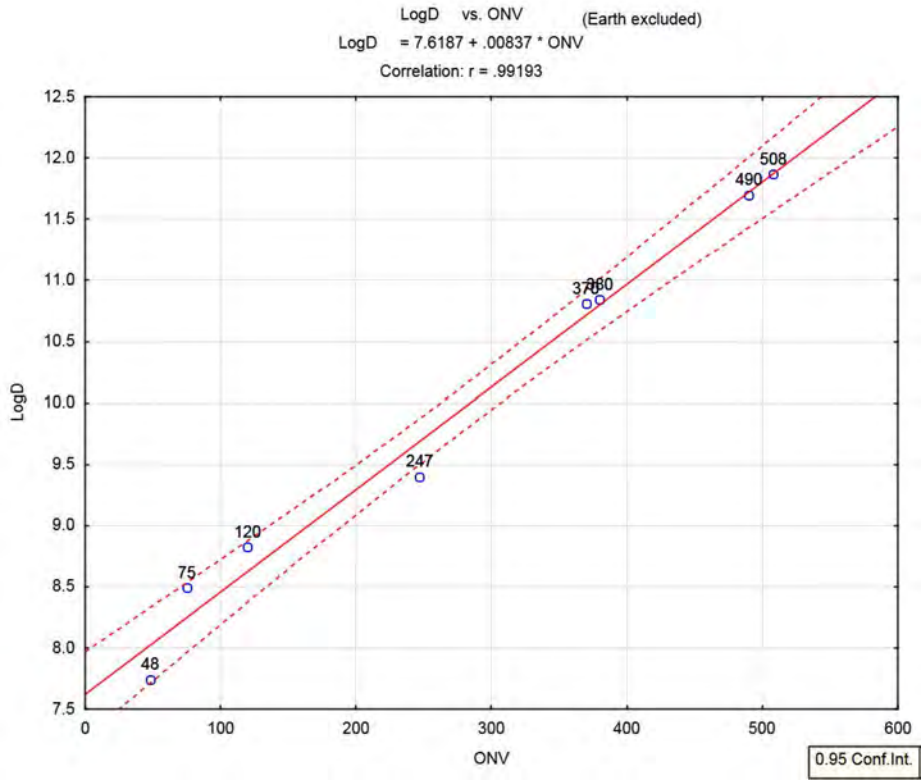

Figure 23.5. Log-diameter ("LogD") of the planets as function of their ONV (n=8, excluding Earth)

With n=8, ρ is now 0.9919, and model F-ratio has jumped to 367 (formerly 195.2), a highly significant result ($p<0.000001$).

23.4.2 Planetary Orbital Angular Momentums (OAM)

The idea for this analysis was forwarded to me by Dr. Howard Sharpe from Canada. Assembly of data sets and all analyses presented herewith are the author's.

One of the most significant characteristics of a planet's orbit is its orbital angular momentum (OAM). The latter is defined as the product of the planet's mass (M; kg) times the planet's average distance from the sun (R, average orbital

radius; meters) times the planet's average orbital speed (V; meters per second):

$$OAM = M*R*V = M(2\pi R^2) / T,$$

where T is orbital period (in seconds). Table 23.5 displays Hebrew words' numerical values (ONVs, as in Table 23.4) together with planets' OAM values ($kg*m^2/sec$; m is "meter"), both in their original and log values.

Table 23.5. Data for planetary orbital angular momentum (OAM) with assumed biblical names and their Object Numerical Values (ONV). E3 means 10^3.

Name	Hebrew name	Object Numerical Value (ONV)	Angular Orbital Momentum (OAM; kg*m/sec)	Log(OAM)	Mass (M; kg)	Log(M)
Pluto	*Kochav*	43	3.6E38	88.78	1.310E22	50.896
Mercury	*Kimah*	75	9.1E38	89.71	3.302E23	54.153
Mars	*Ksil*	120	3.5E39	91.05	6.418E23	54.819
Venus	*Mazar*	247	1.8E40	92.69	4.868E24	56.845
Earth	*Eretz*	291	2.7E40	93.10	5.974E24	57.049
Neptune*	*Ash*	370	2.5E42	97.62	1.024E26	59.887
Uranus*	*Aish*	380	1.7E42	97.24	8.685E25	59.726
Saturn	*Teman*	490	7.8E42	98.76	5.685E26	61.604
Jupiter	*Shachar*	508	1.9E43	99.65	1.899E27	62.812

* Ordinal positions of these two planets were determined in Table 23.4 according to their equatorial diameters; these positions are preserved here even though sorting according to OAM or M should lead to swapping of these positions.

On comparison of Tables 23.4 and 23.5 we realize that when sorted according to their OAM values, only Neptune and Uranius could not have maintained their original ordinal positions (as given in Table 23.4). The mass density of Neptune (1.76 g/cm^3) is larger than that of Uranius (1.30 g/cm^3), however the equatorial radius of the latter (25,559 km) is larger than that of

the former (24,764 km). Both equatorial radius and mass density affect OAM (as evidenced by the formula above). It is therefore not necessary that nearly all planets in Table 23.5 (with Uranius and Neptune excepted) should have preserved their sorted positions both with respect to equatorial diameter and to OAM. Yet they do. Due to the proximity in both size and OAM of Neptune and Uranius we have decided to preserve in Table 23.5 same ordinal positions for all planets as given in Table 23.4.

Figure 23.6 presents the results (the vertical axis presents log-OAM).

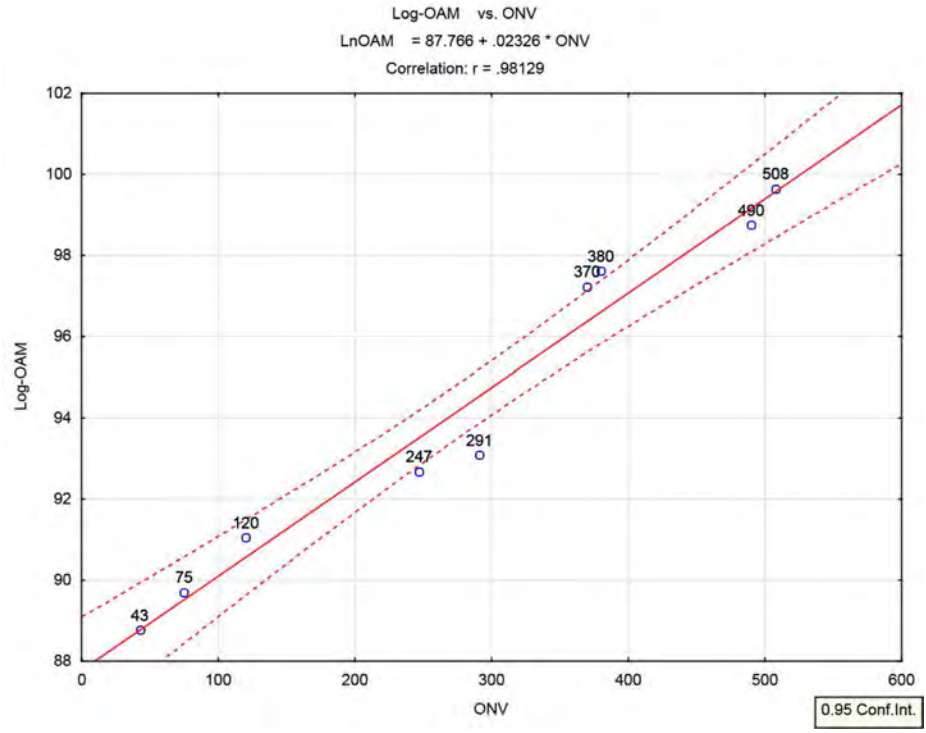

Figure 23.6. Planetary log-OAM (log orbital angular momentum, n=9) as function of Object Numerical Value (ONV)

We realize that all nine points align themselves near a straight line. The adjusted ρ-squared (ρ is correlation) is 0.958. Model F-ratio is 181.8, which, for n=9, is highly significant ($p<0.000003$). Since Earth data-point is somewhat deviant (below the lower confidence limit) it is removed from the sample, and linear regression analysis re-run for a sample of n=8. The adjusted ρ-squared is 0.977. The model F-ratio is now 294.3, which, for n=8, is highly significant

($p<0.000003$). The results are presented (with Earth excluded) in Figure 23.7.

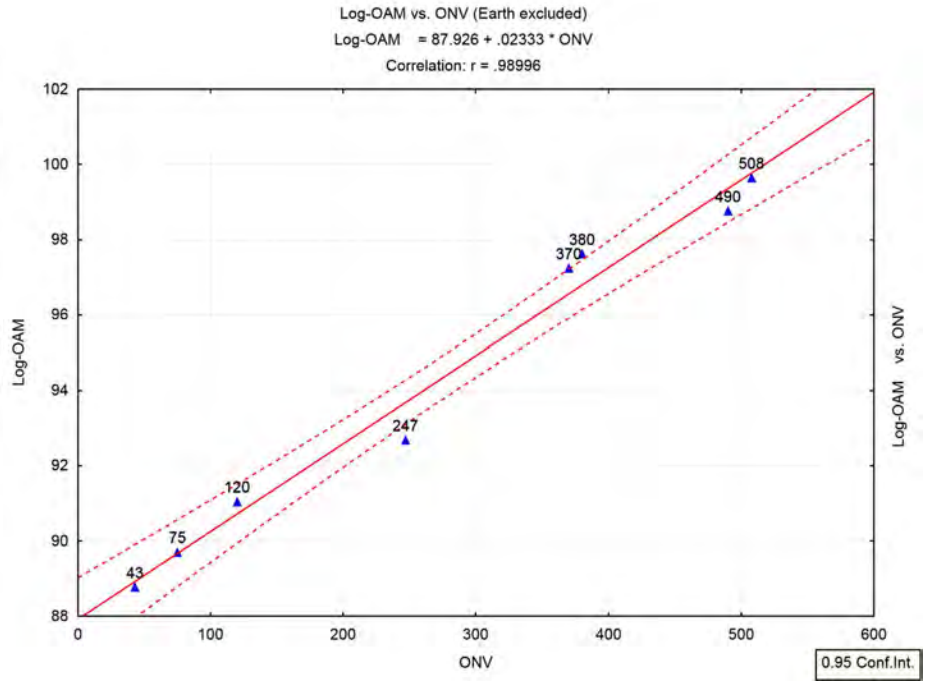

Figure 23.7. Planetary log-OAM (log orbital angular momentum) as function of ONV (n=8, Earth excluded)

23.4.3 Planetary Masses

Planets' diameters and planets' masses, both measured on a *log* scale, should be linearly inter-related if they shared equal mass densities. However, we know that average mass densities of planets differ (relate to Table 23.4). Therefore, values of planets' masses are added to Table 23.5, and we explore the relationship between ONV and respective planetary mass for all nine planets.

Figure 23.8 displays the results.

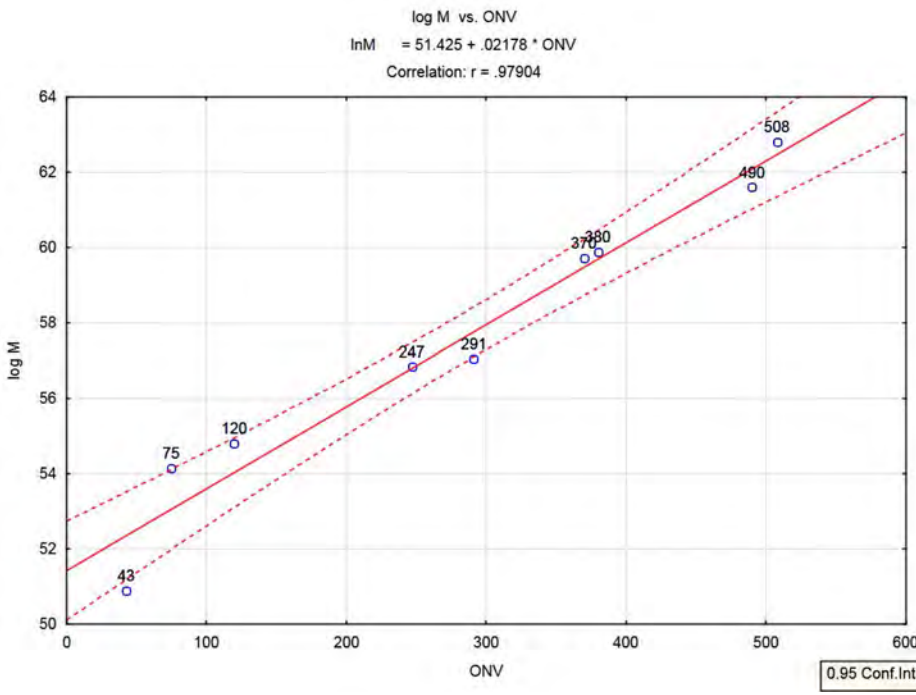

Figure 23.8. Planetary log-M (Mass, in kg; n=9) as function of ONV

A linear relationship is evidenced by the plot. From linear regression analysis with n=9, the adjusted ρ-squared is 0.953 and model F-ratio is 161.8, which is highly significant ($p<0.000004$).

23.5 Some Further Numerical Examples

Examples in this section, though numerical, are not accompanied by statistical analysis. They were forwarded to me by an American Obstetrician/ Gynecologist, living and working in Mali, West Africa. He preferred to

remain anonymous and therefore we will refer to him as Dr. X. Permission was granted to publicize excerpts from his e-mails, as given below.

23.5.1 How Long is Human Pregnancy?

In his e-mail to me, Dr. X regards the duration of human pregnancy. Earlier in the book, I have quoted the numerical value of 271 days for "Herayon" (pregnancy) as indicative of expected duration of human pregnancy (sub-section 2.1.2). However I quote two commonly accepted methods to calculate duration of human pregnancy: "One method is to measure human pregnancy from fertilization time, which is commonly accepted to be, on average, 266 days. Another method is to measure human pregnancy from the last menstrual period, which is commonly accepted as 280 days. The simple average (midpoint) between these two figures is 273 days (about nine months)."

Thus Dr. X in his e-mail:

> "Dr Nagele, a physician in the 1850's or so, created a rule for estimating the due date of a human pregnancy based on the first day of the last menstrual period. At this point, no one even knew that ovulation and therefore conception was taking place at approximately day 14 of the ovulatory cycle, so the only fixed point was the first day of the last menstrual cycle, and of course, one is not pregnant at this point, as one is actively sloughing the endometrial contents. Nevertheless, this is the one fixed point by which to date a pregnancy, and in his study of patients, he determined that the due date is 280 days after the first day of the woman's last menstrual cycle. He invented a rule by which to estimate this for patients. It is still used today—Nagele's rule (information available on Wikipedia under this heading): Take the first day of the last cycle and then subtract three calendar months and add 7 days—the resulting day (about 280 days later) will be the patient's approximate due date.
>
> Later, in the 1930's or 40's it was determined (O'Dowd and Phillip, 1994) that ovulation, and therefore conception, was taking place approximately 14 days after the first day of the last menstrual period. Thus the classic length of human gestation of 266 days after ovulation (and therefore conception, plus or minus one day, as both the sperm and the egg can live in the female genital tract for about one day in the unfertilized state, before dying) was established.

These two numbers have been used ever since, and you refer to them in your book. However, Dr Robert Mittendorf *et al.* (1990) published a comprehensive study of estimated delivery dates of American women. As far as I know, this is the most recent scholarship done on this question. Interestingly the research found that for women who had never had a child before, the average length of pregnancy was 274 days after conception, while for women who have had at least one baby before, the average length of gestation was 269 days. I find it fascinating that the average of these two is 271.5!! It is remarkable to me that 271 is found to be so near the center of the distribution by the most recent scholarship.

Thus Dr Mittendorf's data show average gestation to be about 5 days longer on average than Dr Nagele's data, and this only serves to further tighten the biblical evidence for 271. I suspect a true picture of the data would show a bell shaped curve centered directly on 271."

23.5.2 What Percentage of Human Blood is Cellular?

In the same message, Dr. X relates to the fact that blood in Hebrew ("Dam") is numerically equivalent to 44. This is referred to in section 10.3.4 and also in section 2.1.3, where I draw attention that whenever a numerical value of a biblical Hebrew word amounts to a repeated appearance of a single digit (like "Sheleg", snow, equaling 333), this digit indicates a major physical property of the object that the word is associated with. Relating to human blood, I have interpreted the repeated "4" as signaling the number of human blood varieties. Dr. X believes that the number "44" conveys an even deeper meaning, signaling the proportion of cellular blood (all the rest is liquid) in the human blood:

"One other thing that strengthens your case is the fact that one standard measure of human blood is called the hematocrit. This is the percentage of blood that is cellular (the rest being liquid—the plasma). The hematocrit normal values vary between males and females, but normally they are cited to be 42-50% for men and 35-47% for women. Consult any laboratory manual and you will see that the norms cited for male and female hemoglobins always contain the number 44 for both, and a simple average of the male and female norms will always center around 44!!! I looked at several different limits of normal according to different texts and sites, and found my averages to always

be between 42.5 and 45. So . . . this is astounding, eh?? 44 is definitely a key number for human blood."

23.6 Species Biblical Names

Biblical names of species belonging to the *plant* or the *animal* kingdoms abound in the Bible. The meanings of these names (namely, which currently known species they allude to) are not always clear. The Bible refers to Adam as the absolute name-giver (Gen. 2: 19-20), and some biblical scholars have attempted to attach significance to specific names by relating to known qualities of the species. For example, "dog" in Hebrew may also be read "Like heart", referring to qualities commonly attributed to domesticated dogs. In this section, we relate to a newly found feature that we believe is common to an unexplainably high proportion of biblical species names. We present a large sample of names that share this characteristic, and perform a certain probability calculation that seems to suggest that this unique property is probably too common in the Hebrew Bible to be considered as sheer coincidence (actual frequency of occurrence of the phenomenon far exceeds the calculated probability, assuming randomness). We provide no explanation for this phenomenon, however suggest possible explanations for its significance.

Let the numerical value (NV) of a Hebrew letter, as given in Table 1.1 of this book, be registered by the following formula:

$$NV = k*10^{m} \quad (m=0,1,2)$$

For example, the eleventh letter, *Kaf* ("כ"), has NV = 20 = $2(10)^1$ (k=2, m=1). Note that k delivers the "value" of the letter while m denotes its order of magnitude. Table 23.6 displays all Hebrew letters classified (uniquely) according to their (k, m) values.

The phenomenon we refer to may be articulated as follows: For most species names in biblical Hebrew, at least two letters share the same k. For example, in *Adam*, both the second letter in the name, *Dalet*, and the third letter, *Mem*, are associated with k=4. In *Tamar* (palm tree) both the first letter (*Tav*, value of 400) and the second letter (*Mem*, value of 40) share same k=4. In *Kelev* (dog) both the first letter (*Kaf*, value of 20) and the last letter (*Bet*, value of 2) share the same k=2.

To learn how probable is that configuration (how likely it is to happen by chance), we have calculated the probability that in a species name of three letters, at least two letters share the same k. We assume that all letters have equal probability to appear in each of the three positions of the name, and denote by Pk the probability that any letter selected randomly will have the given value of k. Table 23.6 displays these probabilities.

Table 23.6. Hebrew letters classified according to their numerical values (NV) registered as:

$$NV = k*10^m.$$

For example, the eleventh letter, Kaf ("כ"), has NV= 20 = $2(10)^1$ (k=2, m=1)

k	m			k occurrence (P_k, %)
	0	1	2	
1	א	י	ק	3 (13.6364%)
2	ב	כ	ר	3 (13.6364%)
3	ג	ל	ש	3 (13.6364%)
4	ד	מ	ת	3 (13.6364%)
5	ה	נ		2 (9.0909%)
6	ו	ס		2 (9.0909%)
7	ז	ע		2 (9.0909%)
8	ח	פ		2 (9.0909%)
9	ט	צ		2 (9.0909%)
Total				22 (100%)

Let us define the following:

A (a random event) = In a Hebrew name of three letters same k appears in at least two letters.

P_k = Probability that a Hebrew letter selected at random has a value of k (according to the formula $NV = k(10)^m$; Relate to Table 23.6);

Given k, the (conditional) probability of A, according to the binomial probability model, is:

$$P(A \mid k) = \sum_{j=2}^{3} \binom{3}{j} P_k^j (1 - P_k)^{3-j}$$

The (unconditional) probability of A is, according to the formula of total probability:

$$P(A) = \sum_{k=1}^{9} P_k \sum_{j=2}^{3} \binom{3}{j} P_k^j (1 - P_k)^{3-j}$$

Using the probabilities, {Pk}, in Table 23.6, we find:

$$\mathrm{P(A)} = \frac{560}{14641} = 3.825\%$$

In other words, we expect this phenomenon to occur by chance in about 3.8% of species names in the Bible. We currently do not have count of the total number of biblical species names (either of three letters or otherwise). Table 23.7 presents a sample of species names in biblical Hebrew that conform to the above characterization (namely, a common k shared by at least two letters in the name), together with the associated k.

Table 23.7. Biblical Hebrew species names with at least two letters sharing same k. Names with two different k's having this characterization are classified twice (once for each k) and are starred. Altogether there are 69 *different* names in this list.

k	Biblical species names (in Hebrew)
1	איל, ארי, איה, ילק, קאת, לביא, אנקה*, לילית*, קשוא
2	כלב, כבש, בקר, כר, דבר, רהב, ברוד, ארבה, ערב, ברוש, בור, כפיר, זבוב, עכבר, זרזיר*, דבורה, דרדר*, ערער*, ברקן, כרכם
3	ליש, שלו, שחל, שועל, גמל, שלך, לילית*, חרגל, אשל
4	אדם, רותם, תמר, עתוד, תחמס, תנשמת, שממית, תולעת, דוכיפת, דרדר*, תדהר
5	יונה, תאנה, נמלה, יענה, קנה, עזניה, תנין, אנקה*, אנפה, לבנה, קנמון, לבונה, סנה
6	סוס, סוף, כוס
7	עז, עזניה, זרזיר*, ערער*
8	שחף, אפרח, שפיפן, צפצפה*, חוח
9	צפצפה*

The number of different names in the table (69, of which 27 are three-letter names) is large. It is hard to believe that this number (27) comprises only 3.8% (probability of occurring randomly) of all three-letter species names that appear in the Bible.

A natural question arises: If based on the probability calculation listed above one cannot perceive this phenomenon as coincidence, then . . . what is its significance?

We have no definite answer but can offer two possible responses. First, if a certain structure (pattern) is found in biblical species names that occurs with frequency that defies randomness, obviously it has significance. Secondly, referring to the substance of this phenomenon we may contemplate two possible frameworks for discussion. First, earlier in the book we have related to the fact that the word "life" in Hebrew, *Chaim,* implies double in a symmetrical way (section 5.5). Does the same hold true for the *double* appearance of same k in two different letters?

A more outrageous framework for discussion may have to do with the double helix in cell chromosomes of every sexually multiplying living creature. Since

occasionally numerical values of Hebrew biblical species names correspond to their number of chromosomes (refer to three examples in Table 23.1), does the common k convey information related in any way to the genetics of that species ("and whatever the man called every living creature, that was its *name*"; Gen. 2:19)?

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Epilogue: Some Personal Reflections

A central concept of the Jewish faith is *hashgacha pratit* (divine Providence—literally, divine "personal caretaking".) What this implies is that everything that occurs in one's life is accounted for, registered somewhere, and that you are guided by God to do the right things. This occasionally materializes in "bad things happening to good people." The fundamental Jewish tenet of *hashgacha pratit* perhaps finds its most sublime expression in the words of God to King David, after the latter has expressed his wish to build the temple. God's reply: "Are you the one to build me a house to dwell in?" (2 Samuel 7:5). "I will raise up your offspring to succeed you … He is the one who will build a house for my Name … I will be his father, and he shall be my son. When he does wrong, I will chasten him with the rod of men, and with such plagues as befall the sons of Adam" (2 Samuel 7:12–14).

Similar believes are often shared by nonreligious individuals, however spiritually inclined, who hold the conviction that each of us has guardian angels to guide us throughout our life journey.

I believe that each of us is constantly bombarded with clues that point to the right things to do. Being trained in the statistical mode of thinking, and therefore sensitized to improbable coincidences, I have encountered in my own life experience countless episodes, where wrong decisions were made … yet, in hindsight, seemingly meaningless random events, improbable in nature, could have saved me from the wrong decisions; if only had I been attentive enough at the time. Regrettably, most of us have been raised in a culture that does not traditionally train us to look for such clues. Consequently, these clues are most often wasted as a result of ignorance and ignoring.

All of the above has been found to be extremely relevant with regard to the initial hesitation I experienced with regard to publishing this book, as alluded to in the preface. This hesitation persevered throughout the authoring process. Yet, as happens to us all, clues rained down in abundance in various forms and ways that at times were indeed stunning. These clues were expressed in different

fashions. Countless times, books opened exactly to where a desired subject could be researched. There were other ways these clues presented themselves as well, and they were no less unlikely or amazing. Gradually, as this book progressed toward its final form, my initial reluctance to write this book gradually diminished. Enthusiasm took its place.

I conclude this epilogue on a personal note.

In the last four years, I have lost all of those most dear to me, people who have nourished me intellectually and emotionally—some of them for many years.

First the news came about Professor Yehuda T. Radday's death. I was attending a conference at a hotel in Tel-Aviv when a colleague notified me about Yehuda passing away. I first met Yehuda when I was still a young teaching assistant at Haifa University, back in the 1970s. I researched with Yehuda, a biblical scholar affiliated with the Technion, doing statistical analysis of biblical texts. The objective was to statistically detect possible multiple authorship in various books of the Bible. A few published papers were the result of this shared effort. In 1985, our coauthored book was published by the Biblical Institute Press (E Pontificio Instituto Biblico) in Rome. The book presented results of the statistical analysis of the book of Genesis, and as in earlier research endeavors, attempted to establish possible multiple authorship, this time in relation to the well-known documentary hypothesis, which claims multiple authorship for the book of Genesis (there was none). Since that time, Yehuda and I had maintained close friendship, notwithstanding the huge age difference. We used to meet periodically and enjoy each other's tales about the fruits of our respective sources of creativity. Yehuda died on September 11, 2001. I was at that time in Canada, attending a conference, giving some lectures and canceling others where needed flights were unavailable. I was not aware of Yehuda's death until that day at the conference. I have until today a deep sense of sorrow that I was not in Israel prior to his passing away.

Hugh and Judy Sinclair lived in Toronto, Canada. Hugh was family-related to Ruth, and when I decided to spend my sabbatical at McMaster University in 2002–2003, Hugh and his wife were our hosts in Toronto every single weekend. Hugh, like Judy, was an artist. Hugh was the most uncritical person I have ever met. He knew how to express his mind, but he was always infinitely warm and open and forthcoming. At times, I wondered whether such a man really existed. A few days after the twin towers collapsed in New York, we attended the synagogue together, for the Rosh Hashanah morning prayer. The mood was subdued. On the evening of that day, we were supposed to take our flight back to Israel. The prayer was moving; the choir was touching. I could not restrain my tears.

Then a stranger approached me and handed me a piece of paper. It read: "Congratulations! You have been designated to open the Ark … Please go up to the Bimah [the raised stage] when we reach page 173, and be prepared to follow

the instructions you will be given." I was surprised, because apart from Hugh and Judy, I knew nobody in the audience, no one in the audience knew me. Hugh explained what the note handed to me meant. He asked if he could join me. So I was standing there with Hugh, in front of a huge audience, and together we opened the doors of the Ark before the Blessing of the Cohanim (the priests), then closed it together as the public blessing was over. Less than a year later, when we were still in Canada, Hugh passed away of a heart failure. It happened one week before the end of the summer semester at McMaster University, where I delivered a statistics course at the time, and two weeks before my flight back to Israel for an interim visit.

I have felt since that the shared public service Hugh and I were coincidentally required to deliver at that awesome Rosh Hashanah, in September 2001, at that synagogue in front of a large audience of prayers, was a symbolic prelude for his later untimely departure.

And then my mother departed, at ninety-four, a week before the conclusion of the winter semester at Ben-Gurion University, on January 7, 2005.

Let this book be dedicated to them and to my father (deceased in September 1967), who have nourished my soul with so much wisdom, care, and love while it was still possible.