QUANTITATIVE METHODS FOR EXPLORING THE RELATIONSHIP BETWEEN BOOKS OF THE SEPTUAGINT

Karen H. Jobes

One of the mysteries of the history of the ancient Greek Bible is the survival of two different textual traditions for several books of the Septuagint corpus. There are at least two different Greek versions of the books of Judges, Esther, Daniel, Susanna, Tobit, and Judith. The immediate question that comes to mind is why are double versions of these books extant, and of only these books? Is it an accident of history that a second Greek version of these particular books happened to survive? Or is it the case that a second Greek version existed only for these several books, and if that is so, then why for these books only?

The most fundamental question concerns the relationship between the double textual traditions. Is one a recension of the other, is each a translation independently produced from a Hebrew Vorlage, or is one or both of the texts neither a translation nor a recension, but instead a midrashic rewrite of the biblical story? If each is an independent translation, then the question arises whether both translate the same Hebrew Vorlage, and if not, what is the relationship between the Hebrew Vorlagen represented by each of the two Greek versions?

Eberhard Nestle, whose work is commemorated in this volume, examined the relationship of the two Greek textual traditions of the book of Tobit. Codex Sinaiticus contains one of the versions, the other is found in Codex Vaticanus. Nestle documented that the Sinaiticus text of Tobit more closely represents its original Semitic Vorlage, which he presumed to be the Masoretic Text (MT). Each of the two Greek versions for the several biblical books can be examined to determine which more closely or literally represents the extant MT. However, that determination alone does not answer questions about whether the more literal translation is the original translation or a later recension that corrected the original toward MT, or whether each Greek version is an independently made translation, one of which used a more literal style of translation.

Clearly, the relationship of the double Greek versions to each other and to their respective Vorlagen is important to textual criticism of both the Hebrew text and its original Greek translation. Therefore, working from the extant texts to distinguish somehow translation style from subsequent recensional activity is one of the fundamental challenges of Septuagint studies and is directly relevant to the task of textual
criticism. Methodologies are needed to compare and describe the differences between
two or more Greek texts with each other and with MT.

An attempt to define the theory of textual comparisons was described first by James
Barr in 1979 in The Typology of Literalism in Ancient Biblical Translations. Barr was
not content with characterizing a Greek text by the opposing categories of 'free' and
'literal', categories so often used to describe a Greek translation with respect to its
presumed Hebrew Vorlage. He describes these classifications as 'very rough and
impressionistic'.

It is easier to categorize what one means by a 'literal' Greek translation in com-
parison to the Hebrew than it is to describe the many ways a translation can be 'free'.
Therefore, Barr attempted to bring more precision to the term 'literal' by identifying six
categories that are 'distinguishable modes of difference between a more literal and less
literal rendering of a Hebrew text'. Moreover, Barr made the excellent point that 'there
are different ways of being literal and of being free, so that a translation can be literal
and free at the same time but in different modes or on different levels'.

About the same time, Emanuel Tov was also working on the problem of providing
a more precise definition of the categories 'literal' and 'free' as applied to Greek
translations of Hebrew Vorlagen. In his classic work The Text-Critical Use of the
Septuagint in Biblical Research, Tov identified five criteria that are similar to those
proposed by Barr:

1. lexical consistency, defined as whether a given Hebrew word is consistently trans-
   lated by the same Greek word,
2. equivalence between units of Hebrew and units of Greek,
3. the preservation of Hebrew word order in the Greek,
4. the extent of correspondence between individual elements of the Hebrew unit with
elements of the Greek unit, and
5. the linguistic adequacy of the corresponding Greek expression.

The nature of four of Tov's five criteria is such that they can be counted, thus the
degree to which the Greek text adheres to the Hebrew Vorlage can be at least partially
quantified.

In the same decade, a computer database for Septuagint studies was being designed
and implemented by Tov and Robert Kraft. Called CATS (Computer Assisted Tools
for Septuagint Studies), it contains Rahlfs's text of the Septuagint in parallel units
with the Masoretic text. This database made possible initial attempts to quantify the
characteristics of literal translation technique and the use of the resulting percentages
to compare and rank the books of the Septuagint on a scale of literal to free.

For instance, using the five criteria identified by Tov as a theoretical foundation, in
1983 Tov and Ben Wright searched the CATS database for five syntactical features of
the Greek text in thirty books of the Septuagint. For each of the thirty books, they
listed the frequency of occurrence of each of the five syntactical items and the ratio
of the number of occurrences to an appropriate total, and expressed that ratio as a
percentage. One indication of the degree of literalness of the translation technique is
how often the Greek preposition ἐν (en, 'in') is used to translate the Hebrew
preposition ע (ba', 'in, at, with'). Tov and Wright compared the Greek and Hebrew text
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of each biblical book, counting how often ἐν translated 2. They calculated the ratio of the number of occurrences of the Greek preposition ἐν which translated the Hebrew preposition 2 to the total number of occurrences of 2, and expressed that ratio as a percentage. The thirty books were then ranked in descending order of percentages, with Qohelet ranked first at 92.4 per cent and Job ranked last at 27.7 per cent. This ranking indicates that the translator of Qohelet translated this Hebrew preposition consistently, while the translator of Job apparently did not.

This and other similar attempts to quantify translation technique were criticized by Ann CLI Aelmaelaeus. In the introduction to her book On the Trail of the Septuagint Translators she makes a distinction between translation technique as understood as an object of study, as if 'the Septuagint translators had a technique or a method of translation that can be discovered and described', and translation technique 'regarded as a question of method followed in the study of linguistic phenomena in the translation.' She associates the attempt to quantify word order, consistency in lexical choice, and one-for-one syntactic equivalence by percentages of occurrence with the first approach, and asks what could such abstract percentages actually mean, since it is impossible to calculate an ideal percentage for literalness in a certain linguistic phenomenon, still less so if the evidence of several phenomena is combined. Thus, percentages of literalness are difficult to interpret, and for that matter often incorrect, although they give the impression of being accurate."

Her point is well taken, for unlike a perfect 100 per cent on an objective exam to which an individual student's performance can be measured, there is no linguistic ideal external to the texts themselves which defines a perfectly 'literal' translation. However, this problem can be accounted for in a methodology that allows the Greek texts themselves to define the poles of what is meant by 'free' and 'literal' for each syntactical criterion examined. Moreover, although the ranking of books based on relative percentages does move toward quantifying the categories of 'literal' and 'free', a simple ranking of books based on relative percentages still leaves unanswered questions. Since 100 per cent cannot be the standard measure of literalness, how close to 100 per cent must a given criterion be in order to be considered 'literal'? How close must the ranked percentages of a given criterion in two different books be to consider them as representing the same translation technique? And can such information be used to distinguish a translation from a recension?

Aelmaelaeus does allow that if one regards translation technique 'as a question of the method followed in the study of linguistic phenomena in the translation', then percentages are useful to facilitate comparison between 'various books containing a different number of cases of a particular kind'. In fact, she uses percentages extensively in her own work. "The practical importance of the distinction she makes in what is meant by 'translation technique' can be debated, but what is clear is that in practice of method scholars count the relative frequencies of the occurrence of certain linguistic features of the Greek texts and use those relative frequencies to compare and rank books of the Septuagint with respect to each other.

Since this is being done, quantitative methodologies are needed that are designed:

1. to directly compare the occurrence of a given linguistic feature in two or more texts;
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(2) to determine the overall central tendency of a text by integrating many linguistic features within one book and in comparison to others;

(3) to reveal linguistic patterns that can be used to construct and test theories about the translation technique and recensional development of the Septuagint texts.

Some scholars have been suspicious of the use of percentages to compare the work of different translators. Since there are no ideal control texts available, it is difficult to interpret differences in the percentages between the various books of the Septuagint. As Aemelaeus asks, 'How much variation can be expected in the work of one translator, and how great a change unmistakably speaks for a different translator?" In the case of such comparisons made between the double Greek texts, one could rephrase the question: how much linguistic variation can we expect between a recension and the Greek text from which it was produced? Is it possible to identify linguistic criteria that help distinguish between the two?

This paper presents a quantitative approach that can be used to explore whether and to what extent a comparative study of syntax can inform the discussion about the characterization of translation technique and whether the identification of recensional activity within a text can be assisted by such syntactical study. There are at least three advantages to using syntax to characterize a Greek text in relation to others. First, syntax extends throughout the entire text and its analysis yields greater amounts of data in comparison to the amount of data involved in studies of morphology or lexicology, which are constrained by their nature to individual and relatively few occurrences within a given text.

Second, the syntax of a text could not avoid reflecting the nature of the translation technique used by the translator or the nature of subsequent concerted recensional activity, for such endeavours by their nature encompass the entire text. Occasional changes made by scribes to harmonize individual readings in the manuscripts or to update individual words by replacing them with more contemporary synonyms should not be considered recensional activity.

Third, the translator or recensor is less conscious of syntactical choices, which operate at the level of linguistic proficiency and personal style, as opposed to lexical choices that are to a greater extent more deliberate, and to additions and omissions that tend to be motivated by very conscious extra-linguistic concerns such as theology or politics. Therefore, to the extent that syntax bears the fingerprint of the translator or recensor it can be used as an indicator in the attempt to identify translation technique from recensional activity when it is combined with studies of morphology, of lexicology, and of the theological or political Tendenz.

The assumption that syntax does bear the fingerprint of its author is certainly one that needs more theoretical grounding, but it is being used in other text-based disciplines to explore issues of authorship and textual relationships. Such methods have already been applied by scholars to texts as diverse as Euripides, books of the New Testament, Shakespeare, and the Federalist Papers of early American history, with a view to enlightening issues such as authorship and date of composition. The Journal of Literary and Linguistic Computing (JLLC) has been published at Oxford University for at least the last decade, and is dedicated to quantitative methods of textual study.

Moreover, it has been generally assumed in past studies of the Greek biblical texts
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that the distinguishing marks of the translator or recensor are reflected in identifiable syntactical features of the Greek, which can be counted for each book. Beginning with Soisalon-Soininen’s work on the infinitive in the Septuagint, others in the Helsinki school have produced a wealth of numerical information about the occurrences of certain syntactical features. For instance, Rajja Sollamo has produced countings of the translation of pronouns in the Pentateuch. Ben Wright responded to Ralph Martin’s work on syntax criticism, by publishing enumerations of the frequency of Greek prepositions relative to εκ for each book of the Septuagint.

Whether and to what extent syntax can be used to identify a particular translation style, recension, period of time, or geographical provenance in which the text was produced is an important theoretical question that is worthy of further concerted discussion. It has long been recognized that the syntax of the Greek translation of the Septuagint texts is distinctive enough to distinguish them from texts composed in Greek. But is there enough syntactical variation among the Greek texts of the Septuagint to be used to separate the texts into distinctive groups, and if so, which elements of syntax would serve that purpose, and how much variation is enough? Based on my work with the double versions of Esther and Daniel I suspect the answer to the first question is yes, but much more work needs to be done to establish this hypothesis. The methodology I propose is intended in part to answer that question, and to provide syntactical profiles against which studies of morphology and lexicology can be interpreted.

From my work on the double versions of Esther and Daniel I have developed two quantitative approaches: (a) syntactic profiling of Greek texts and (b) tools for statistical analysis of texts. These methods are intended to compensate for some of the problems and limitations observed in other approaches and are intended to be used along with, not in place of, the more traditional approaches. First, these methods are intended to help evaluate selected, isolated examples that are presented as representative of the character of the text by providing an overall profile against which such selected examples can be considered.

Second, recognizing that all Septuagint texts are a mixture of ‘literal’ and ‘free’ features, these methodologies are designed to show more specifically which elements of the syntax of a given Greek text can be said to be ‘literal’ and which ‘free’ and, furthermore, which elements may be not at all useful for making such distinctions.

Third, these methodologies are designed to provide a quantified measurement of the central tendency and variation of the syntax of a given text in comparison to a norm that is defined by the rest of the corpus of texts themselves, thus addressing the problem identified by Aijmalacius that there is no external, ideal text to which the texts can be meaningfully compared. Such normalized quantitative analysis moves the discussion beyond simply ranking the books by relative percentages and provides the advantage that the syntax of two or more Greek texts can be directly and meaningfully compared to the norm of the corpus of which they are a member.

1. SYNTACTIC PROFILES

A syntactic profile is a graphic representation of selected elements of syntax of a given text displayed along an axis showing the relative frequency of an individual element of
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syntax in relation to the average frequency of occurrence of that element in texts known to have been composed in Greek (−1) and in texts known to have been translated from a Semitic source (+1).

A syntactic profile of a text will show at a glance the central tendency and variation in the syntax of the text. Because the axis is normalized, the syntactic profiles of more than one text can be directly compared without the danger of comparing 'apples and oranges'.

The profiles for the double versions of Esther and Daniel (Graph 1) were compiled using seventeen elements of syntax that were originally identified by Raymond Martin as indicators of a Semitic source behind a Greek text. Martin's seventeen criteria are:

Criteria 1-8. The relative frequency of occurrence of eight prepositions with respect to the preposition ἐν:
1. ἐπί with the genitive
   (dia, 'through')
2. ἐπί in all occurrences
   (dia, 'through, because of')
3. εἰς
   (eis, 'into')
4. κατά with the accusative
   (kata, 'down, against, according to')
5. κατά in all occurrences
   (kata, 'down, against, according to')
6. τῇ in all occurrences
   (peri, 'concerning, around')
7. πρὸς with the dative
   (pros, 'to, toward')
8. ὑπὸ with the genitive
   (hipo, 'by')
9. the frequency of occurrence of the coordinating καὶ (kai, 'and') relative to ἐν (de, 'but', 'and')
10. the percentage of articles separated from their substantives
11. the relative frequency of dependent genitives following the word on which they depend
12. the relative frequency of occurrence of dependent genitive personal pronouns
13. the relative frequency of genitive personal pronouns dependent on anarthrous substantives
14. the relative frequency of attributive adjectives preceding the word they qualify
15. the relative frequency of attributive adjectives
16. the relative frequency of adverbial participles
17. the relative frequency of the dative case without the preposition ἐν

The axis of the syntactic profile extends between −1 and +1. Minus 1 represents the average of the frequency of occurrence for each of the seventeen elements of syntax in texts known to have been composed in Greek (normalized to −1). Plus 1 represents the average of the same elements of syntax in texts known to have been translated from a Semitic source (normalized to +1). Normalizing the relative frequencies of the syntax in a given text to the average frequency of occurrence within the larger corpus addresses the problem that, language being what it is, there is no ideal standard to which the syntax of a text can be compared. The texts themselves collectively must define the norm against which any given Greek text is compared. The norm for translated Greek was determined by the average frequency of occurrence of the seventeen criteria as they occur in the books of the Septuagint translated from Hebrew. The norm for composition Greek was determined by the average frequency of occurrence of those same
The LXX of Esther $S = 0.33 \pm 0.74$
(excl. #1 & 2)

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The AT of Esther $S = 0.39 \pm 0.71$
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$\sigma$-Daniel (excl.#1&2) $S = 0.54 \pm 0.66$

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Th Daniel (excl.#1, 2, 7) $S = 0.62 \pm 0.70$

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**Composition**

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**Translation**

The numbers in the boxes refer to the criterion number. For instance, the normalized ratio of criterion #10 is 0.1 for LXX Esther, 0.3 for AT Esther, 0.8 for $\sigma$-Daniel and 1.04 for Th Daniel. If the ratio of every criterion equaled the norm for translation Greek, all of the boxes would pile up over +1; if the ratio of every criterion equaled the norm for composition Greek, all of the boxes would pile up over -1.

**Graph 1.** The syntax of the Greek versions of Daniel compared to the Greek versions of Esther
criteria in a total of 1,500 lines taken from Plutarch's Lives, Polybius, Epictetus, Josephus, and selected papyri.  

(More texts composed in Greek should be analysed and the norm recalculated, so that the size of the sampling of texts composed in Greek is approximately the same as the size of the texts translated from Greek.)

Martin chose these seventeen criteria because he believed the relative frequency of occurrence of these elements of Greek syntax would reflect the influence of a Semitic Vorlage. It is not the mere occurrence of these items in a text that is significant, for all of them could be expected to occur in any Greek text, but it is the relative frequency of occurrence that Martin believed identified Greek texts that had been translated from a Semitic source. For example, the rationale behind criterion 9, the relative frequency of ἔνει with respect to ἀνά is that a Greek translator may choose to render the Hebrew noun-consecutive with either the Greek conjunction καὶ or the postpositive ἄν. Martin theorized that a text translated from a Semitic source would contain a higher proportion of occurrences of καὶ to ἄν than would a text originally composed in Greek, because a translator would frequently choose to translate the noun-consecutive with καὶ to retain Hebrew word order. Therefore, the relative frequency of occurrence of καὶ to ἄν could be used as an indicator of a Semitic source lying behind a Greek text. Syntactic profiles can test whether such a criterion actually functions as claimed.

I originally employed Martin's seventeen criteria in my study of whether the alpha-text of Esther (AT) was a translation of a Semitic source or not. However, I departed from Martin in the way I analysed and interpreted the resulting ratios.  

Martin's primary interests were in describing the relationship between the Greek and the Hebrew it translated. My interests began there but moved toward using syntactic criticism to explore possible relationships between two or more Greek texts. I developed the methodology of syntactic profiling in order to facilitate the display and interpretation of large quantities of syntactic information and to allow direct comparison of the syntax of the alpha-text with the o'-text of Esther, and then with the two Greek versions of Daniel. Using Martin's data for Polybius, Josephus, and some of the documentary papyri, as well as my own analysis of 3 Maccabees, I also profiled these four texts known to have been composed in Greek, as a point of comparison (Graph 2).

Although I used the seventeen criteria identified by Martin, other elements of syntax could be added to the profiles for a fuller characterization of a given Greek text and a broader base of comparison between them. In fact, other syntactic criteria should be profiled, because these particular seventeen were chosen by Martin for their presumed value in relationship to a Semitic Vorlage, not for providing a broad basis of comparison between two or more Greek texts.

Each numbered box on the syntactic profile represents one of the seventeen elements of syntax, and is numbered accordingly. The position of the box on the axis indicates how close that element of syntax in the given text is to either the norm for texts composed in Greek (−1) or the norm for texts translated from a Semitic source (+1). Note that for texts composed in Greek (Graph 2), the boxes tend to pile up toward −1; for Greek texts translated from a Semitic source, the boxes tend to pile up toward +1. Note also that ±1 are not limits, but merely averages that mark the norm defined by the larger corpus.) The profile also shows at a glance which elements of syntax deviate from the norms, and to what extent.

As an example, consider criterion 9 on Graph 1, the relative frequency of καὶ
The numbers in the boxes refer to the criterion number. For instance, the normalized ratio of criterion #10 is < -1.5 for Polybius, -1.2 for Josephus and -0.6 for the selected papyri. If the ratio of every criterion equaled the norm for composition Greek, all of the boxes for these texts would pile up over -1. (Data from R. Martin, *Syntactical Evidence of Semitic Sources in Greek Documents* (Missoula: University of Montana, 1974).)

**Graph 2.** A profile of the syntax of texts composed in Greek.
with respect to δέ. The value of this criterion for the alpha-text of Esther was computed by:

1. Counting the number of occurrences of κοί in AT where it is used to coordinate two independent clauses and the total number of occurrences of δέ.\(^\text{53}\)
2. Computing the ratio of number κοί/number δέ.
3. Normalizing that ratio to the norms for translation and composition Greek.
4. Plotting the normalized ratio on the profile.

Notice that the relative frequency of occurrence of κοί with respect to δέ is about the same in the texts known to have been composed in Greek (see Graph 2) as in the two Greek texts of Esther and the Old Greek of Daniel (Graph 3).\(^\text{54}\) This data can be argued in at least two different directions. One could use this as one tiny bit of evidence that the two texts of Esther and the ὄνομα του Daniel are either not translations of a Semitic source, or that they have been so revised as to lose their Semitic flavour. Of course, one would need substantially more evidence to support such a theory. Or, one could conclude — more reasonably, in my opinion — that the relative frequency of κοί with respect to δέ is a very weak indicator of the Vorlage of these three texts and probably should not be used to retrovert a ων-ων-consecutive in the presumed Hebrew Vorlage of these particular texts.\(^\text{55}\)

Criterion 1.4 — the relative frequency of attributive adjectives preceding the word they qualify — is also among the eight criteria that occur with approximately the same relative frequency in the papyri as in the Septuagint text. Since it is clear that the documentary papyri were composed in koine Greek and did not undergo any subsequent scribal transmission or recensional activity, the comparison of their profile with the Septuagint books is enlightening. The comparison suggests that the Septuagint translator may simply have been following the standard conventions of koine Greek rather than slavishly following the Hebrew Vorlage, and that the conventional patterns of usage in koine happened for these elements of syntax to be similar to the corresponding pattern in the Hebrew language. Thus syntactic profiles may yield information that guides textual critics in the task of knowing which elements of Greek syntax are useful for detecting Semitic sources, and therefore can be reliably retroverted, and which simply reflect the coincidence of similar syntactic patterns in the koine Greek and Hebrew languages.

This example illustrates the value of syntactic profiles for investigating claims that a particular element of Greek syntax reflects its Hebrew Vorlage, and is thus useful for reconstruction of the Hebrew, by allowing its relative frequency of occurrence in the given text to be directly compared to the norm for texts composed in Greek. An element of syntax truly distinctive to translation Greek would consistently fall on the +1 end of the axis for Septuagint texts and consistently fall on the −1 end of the axis for texts composed in Greek. This methodology does not a priori decide the issue, it simply presents the data in a format that narrows the options and facilitates a more focused discussion.

Even though a given element of syntax may not be a very reliable indicator of a Semitic Vorlage, it nevertheless remains a true characteristic of the profile of the given text, and is useful for the purpose of comparing the syntax of two or more Greek texts.
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For instance, notice in Graph 1 that the relative frequency of the occurrence of κατι in Theodotion Daniel is markedly different from the two Greek texts of Esther and the o'-text of Daniel, and in Theodotion Daniel is much closer to the norm for Septuagint texts.

This brings to mind the reigning theory that Theodotion Daniel corrected the o'-text of Daniel toward a Semitic text. Hence, the difference between the o'-text and Theodotion in the number of occurrences of κατι with respect to δε could be interpreted as the introduction of κατι wherever there was a δε-consecutive in the Hebrew text in circulation at the time and place the Theodotion recension was produced. This brings us to the question of whether, and to what extent, syntax can be used to help identify the characteristics of a recension.

Let us take as a working hypothesis the theory that the o'-text of Daniel was the textual base from which Theodotion Daniel was produced with the intent of 'correcting' the Greek toward a contemporaneous Hebrew/Aramaic text of Daniel. I am not arguing here for or against this hypothesis, but simply wish to show how syntactic profiles can be used to test a hypothesis and how they can suggest specific directions of further study. A comparison of the two profiles of Daniel (Graph 1) shows a distinct shift toward the right for three of the criteria:

Criterion 9, the relative frequency of κατι with respect to δε,
Criterion 13, the relative frequency of genitive personal pronouns dependent on anarthrous substantives, and
Criterion 16, the relative frequency of adverbial participles.

If Theodotion Daniel was produced by one or more revisions of the o'-text, then these profiles suggest that those revisions at least involved (no doubt among many other changes):

1. replacing post-positive conjunctions, such as δε, with a coordinating κατι;
2. removing the Greek definite article from nouns qualified by a possessive pronoun;
3. removing adverbial participles or replacing them with some other construction.

These are the three largest shifts when the syntax of the o'-text of Daniel is compared to Theodotion Daniel that shift the syntax toward what has been described as a more literal rendering. By simply taking the difference between each normalized ratio for each of the two texts and ranking those differences in descending order, the largest shifts in syntax between the double Greek versions can be specifically identified. If one text is a revision of the other, the syntactic profiles identify specifically what effect the revisor's work had on syntax.

On the other hand, notice that two of the criteria – 11 and 19 – shift markedly to the left. If Theodotion is a recension of the o'-text, which is our working hypothesis, then someone must have:

1. moved dependent genitives to precede rather than follow their substantives, and
2. added attributive adjectives, but apparently followed Hebrew convention by positioning them most often to follow rather than precede the noun they qualify (because the position of criterion 14, the relative frequency of attributive adjectives preceding the word they qualify, remains the same in both profiles).
Karen H. Jobes

Seeing shifts in the syntax in both directions raises some questions. Were both shifts in syntax the result of the one and the same revision? If so, the revisor’s concern to make the o’-text of Daniel more ‘literal’ in comparison to his Hebrew text was not consistently executed (not that complete consistency must be expected from one recensior). Or, do these two shifts in opposite directions represent two different strata of recensional activity? For instance, perhaps the shift in syntax toward the norm for composition Greek was contributed to the profile by the various additions to the text of Daniel composed in Greek. These, of course, were untouched by the revisor who ‘corrected’ the Greek toward the Hebrew, because for those additions there was no corresponding Hebrew. To explore these questions one would return to the Greek texts of Daniel with this very specific information in hand, to compare occurrences of the dependent genitives and attributive adjectives, looking to see if these changes fall with certain portions of the text. The distribution of the changes would then suggest the direction of further investigation of recensional activity.

Note, however, that criterion 14, the relative frequency of attributive adjectives preceding the word they qualify, is among the eight criteria that occur with approximately the same relative frequency in the papyri as in the Septuagint texts. If the revisor of Thedotion Daniel did indeed add attributive adjectives after the qualified substantive, a comparison with the syntactic profile of the papyri suggests that it may have been simply because of the conventions of koine and not to conform it toward any Semitic text. This means that the position of the attributive adjective cannot be used to support our working hypothesis that the changes made to produce Thedotion Daniel were in the interests of correcting it toward the contemporaneous Hebrew text. Thus, syntactic profiles are useful for identifying whether given elements of syntax can be used to distinguish recensional activity from general patterns of koine usage.

My point here is not to argue for or against the hypothesis about the relationship of the two texts of Daniel, but simply to show that syntactic profiles focus the questions and narrow the field for further research. They do not prove the working hypothesis, but rather present data that must be accounted for by any hypothesis claiming to explain the relationship between the two Greek texts. Syntactic profiles organize and graphically display large amounts of syntactic data in a format that facilitates communication and allows hypotheses about translation technique and recensional activity to be raised and tested. I emphasize that this method is not constrained to the seventeen criteria adopted from Martin, but could be used to profile any other syntactic element that can be counted, such as the relative frequency of the articular infinitive, the genitive absolute, and so on.

S-numbers. In order to quantify the overall syntactic profile of a given text and to easily compare it to other texts, the S-number (Syntax-number) of the text can be computed. The S-number is the average value of the normalized frequencies of occurrence for each element of syntax examined (in this case seventeen). An S-number = -1 would indicate that the syntax of the given text perfectly matches, for every element of syntax examined, the norm for texts composed in Greek; an S-number = +1 would indicate that the syntax of the given text perfectly matches the norm for texts translated from a Semitic source. Of course, it is very unlikely that such a text exists (Table 1).

Eberhard Nestle, whose work we are commemorating with this volume, discussed


Table 1: Greek texts sorted by S-number

<table>
<thead>
<tr>
<th>Text</th>
<th>S-number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polybius</td>
<td>-1.68 ± 0.97 (using Martin's data)</td>
</tr>
<tr>
<td>Josephus</td>
<td>-1.38 ± 1.10 (using Martin's data)</td>
</tr>
<tr>
<td>add. E Esther</td>
<td>-0.87 ± 0.88</td>
</tr>
<tr>
<td>3 Macc</td>
<td>-0.46 ± 0.84</td>
</tr>
<tr>
<td>Selected Papyri</td>
<td>-0.25 ± 0.65 (using Martin's data)</td>
</tr>
<tr>
<td>LXX Susanna</td>
<td>0.28 ± 0.73</td>
</tr>
<tr>
<td>B Susanna</td>
<td>0.33 ± 0.67</td>
</tr>
<tr>
<td>LXX Esther</td>
<td>0.33 ± 0.74</td>
</tr>
<tr>
<td>proto-LXX Esther</td>
<td>0.36 ± 0.62</td>
</tr>
<tr>
<td>AT Esther</td>
<td>0.39 ± 0.71</td>
</tr>
<tr>
<td>Tobit Φ' (Alexandrinus &amp; Vaticanus)</td>
<td>0.43 ± 0.70</td>
</tr>
<tr>
<td>proto-AT Esther</td>
<td>0.49 ± 0.89</td>
</tr>
<tr>
<td>o'- Daniel</td>
<td>0.54 ± 0.66</td>
</tr>
<tr>
<td>Th Daniel</td>
<td>0.61 ± 0.70</td>
</tr>
<tr>
<td>Tobit Φ' (Sinaiticus)</td>
<td>0.63 ± 0.58</td>
</tr>
</tbody>
</table>

The relationship of the double textual traditions of the Greek Tobit, one being found in Codex Sinaiticus, the other in Vaticanus. After examining only a few elements of syntax, he concluded that the Sinaiticus text of Tobit more closely represents its original Semitic Vorlage, assuming that the extant MT was in fact its Vorlage. A comparison of his conclusion with the S-numbers of the two textual traditions of Tobit shows that Sinaiticus is indeed in overall syntax closer to the norm for Septuagint texts than the text found in Vaticanus. The same general shift in syntax, though of lesser magnitude, is found in the comparison of LXX Susanna and Theodotion Susanna, as well as between LXX Esther and the alpha-text of Esther. How great a shift in syntax could be expected to result from a major revision remains a question for further investigation.

Now one might ask how are these numbers any better than the simple percentages found in the work of others? The ranking of simple percentages of relative frequency are not indexed to anything, thus making comparisons of those percentages from book to book difficult to interpret. Moreover, comparing simple percentages of occurrence of one element of syntax to another element is like comparing apples and oranges, because there is no inherent relationship between them. For instance, in the study done by Tov and Wright, 'Criteria for Literalness' there is no inherent significance in the fact that in 2 Kings 2 is translated by 8% 83 per cent of the time and that the ratio of occurrence of κριν to βίω is 0.35, because there was no point of reference with which to compare the percentage to what might have been expected. There is no common link to relate these two numbers to each other. Such percentages are good as far they go, and they are useful to arrange the books in some relative order as Tov and Wright have done.

In contrast to simple percentages, S-numbers are tied to the norm as defined by the other books of the corpus. An S-number greater than zero shows that the syntax of the text in question tends overall toward the norm for Septuagint texts. An S-number less than zero shows that the syntax of the text in question tends overall toward the norm...
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for texts composed in Greek. The difference between the S-number and +1 or -1 shows
how far the text varies from the respective norms. Two texts with equal S-numbers
would have the same overall syntax, and at glance at their respective profiles would
reveal how each element of syntax compares and contributes to the similarity. This is
actually true of Theodotion Daniel and the Sinaiticus text of Tobit, whose S-numbers
are virtually equal. Such a finding suggests that further investigation of the relationship
between these two texts might be especially fruitful (Graph 3).

When the S-numbers are plotted, claims about 'literal' and 'freer' translation
technique can be evaluated (Graph 4). It is generally said that AT Esther is the freer
of the two Greek versions, because it does not follow the Hebrew Masoretic Text as
closer as does the o'-text of Esther. Graph 4 shows that despite the many differences
in the minuta of the two texts, overall there is virtually no difference between the
syntax of the o'-text of Esther and AT. Therefore, if we wish to characterise AT as 'freer'
that the o'-text of Esther, we must look to other features of the text for that
characterization - these seventeen elements of syntax show AT Esther is no more or less
'literal' than that of the o'-text of Esther. And in fact, this was corroborated by my study
comparing the agreement of the two texts of Esther to the Masoretic text. The reason
that AT Esther gives the impression of being a freer translation than the o'-text of
Esther is not found in its syntax, but in the many small phrases and minuses of the two
Greek texts that have no correspondence in the Hebrew. Where there is corresponding
text that can be compared between all three, the agreement of the AT with the
Masoretic text approaches that of the o'-text with MT. 99

To summarize, the methodology of syntactic profiling:

(1) Provides a profile of the entire text for each examined element of syntax.
(2) Allows the texts themselves to define the norms for texts translated from a Semitic
   Vorlage and for those composed in Greek.
(3) Presents large amounts of syntactic data in a format that facilitates its communi-
   cation and interpretation.
(4) Allows the syntax of two or more texts to be directly compared.
(5) Provides a method for testing the claim that the frequency of occurrence of a certain
   syntactic element reflects Semitic influence rather than general koine usage.
(6) Allows the testing of hypotheses about the relationship of Greek texts.
(7) Specifies what elements of syntax should be investigated further as potential
   indicators of recensional relationship.

II. TOOLS FOR THE STATISTICAL ANALYSIS
OF GREEK TEXTS

The fact that the study of the Greek biblical texts has not been devoid of quantitative
aspects suggests that statistical methods can be appropriately applied to further explore
the relationship of the Greek versions and to aid in reconstructing their recensional
history. The work of Tov and Wright cited above is but one example of a quantitative
study of the Greek texts. Another example is the work of the Helsinki school, which
has produced a wealth of quantitative information about the Greek Pentateuch. “The
work of Soisalon-Soininen on the infinitive,” Raija Sollamo’s work on the translation
Graph 3. The syntactic profiles of the Greek versions of Daniel and Tobit.
 GRAPH 4. S-numbers with standard deviations
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of pronouns in the Greek Pentateuch, and Aejneler's study of several syntactic features of the Greek Pentateuch have produced many quantitative indicators of translation technique. Such quantified studies are particularly well suited to further statistical analysis that would facilitate comparison with work done by other scholars in other books of the Septuagint corpus.

Biblical scholars tend to view the use of statistics in studies of the Greek with ambivalence. Statistics may be well suited for the physical sciences and engineering, but after all, in textual studies we are handling human language, and ancient human language at that. Our interests are qualitative and intuitive, not quantitative and precise. There seems to be an unbridgeable chasm between the quantitative precision implied by the use of statistics, and the relatively inexact and qualitative methodologies of historical and linguistic research.

Therefore, a word to justify the use of statistics in the study of language is in order. Most of us are familiar with predictive statistics, which are based on probabilities being effectively used to predict outcomes by extrapolating from small, random samples of a population to inferences about the population at large. For instance, a pharmaceutical company will design drug tests using relatively small numbers of participants to test the effectiveness of the drug on the population at large. Clearly this is not the kind of statistics needed in a situation where we are not free to design the experiment. One might think of the extant Greek texts as samples of the larger population of koine texts that were preserved through historical happenstance. They are, therefore, 'random' samples as far as our interests in syntax are concerned, since they were chosen for preservation on theological and historical grounds, not because of any linguistic features of that text that would bias our analysis of syntax. Our interest in statistical analysis of these texts is not in predictive statistics, unless making predictions about that larger population of koine texts that have not survived is of relevance. Our interests lie with descriptive statistics that allow us to organize and describe a very large quantity of syntactical data in a form that is concise and convenient, and that facilitates ease of discussion about and interpretation of the syntactic data.

How can language, which by nature is qualitative, be quantified for statistical analysis? Because of the widespread use of computers it has become common to quantify a human quality – gender, for instance – with a zero or one (representing male or female), thereby allowing all sorts of other similar qualitative factors to be quantified and statistically correlated to gender.

Similarly, a Greek text can be quantified and correlated with its corresponding Hebrew Vorlage. For instance, the Hebrew causal קָרָא (kārā, 'for, because') can be rendered with either the Greek conjunction οὖν (oun, 'because') or γὰρ (gar, 'for'). These translation decisions can be quantified with a zero or one and statistically described, relating the actual occurrences of each translation choice to the total number possible, that is, by the number of occurrences of קָרָא in the Hebrew. Of course, more than simply two translation choices may exist, and usually do, which would require a bit more sophisticated quantification, but the point is that elements examined as criteria for characterizing translation technique and recensional activity can be quantified. And if they can be quantified, they can be statistically described. Therefore, statistical analysis of texts should be one of the tools used to enlighten our knowledge of the origin and development of the Septuagint.
Karen H. Jobes

\textbf{Table 2. Translation of causal in יָד in the Pentateuch}

<table>
<thead>
<tr>
<th></th>
<th>Total possible</th>
<th>יָד</th>
<th>יָדַי</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genesis</td>
<td>155</td>
<td>68</td>
<td>87</td>
</tr>
<tr>
<td>Exodus</td>
<td>91</td>
<td>12</td>
<td>79</td>
</tr>
<tr>
<td>Leviticus</td>
<td>63</td>
<td>40</td>
<td>23</td>
</tr>
<tr>
<td>Numbers</td>
<td>75</td>
<td>55</td>
<td>20</td>
</tr>
<tr>
<td>Deuteronomy</td>
<td>137</td>
<td>102</td>
<td>35</td>
</tr>
</tbody>
</table>

Aejmelaeus is indeed correct in stating that a quantitative approach to the Greek texts has thus far not produced much fruit, if we use the computer simply to count the number of times a given syntactical feature occurs. Yet her work, and that of the Helsinki school in which she was trained, is focused on identifying syntactical features and attempting to relate those features to translation technique by counting their relative frequency in a text and comparing that count to other texts. For instance, in her effort to characterize the translation technique employed in the Pentateuch, Aejmelaeus has studied how the Hebrew conjunction יָד, when it introduces a causal clause, has been translated in the Greek Pentateuch. She counts how many times a causal יָד is translated by יָדַי and how many times by יָד (Table 2).\footnote{11}

Once such data is collected, what answers about the relationships among the books can it provide? Can such data be used to determine, for instance, if the causal יָד was handled consistently in the translation of all five books of the Pentateuch? Note that in Exodus the causal יָד is translated by יָדַי a much greater percentage of occurrences (87 per cent) than in Numbers (27 per cent). Is it likely that such variation is the result of choices made by one translator, or does such variation suggest the work of two different translators? If so, could the translation of the causal יָד be correlated with other similar data – for instance the occurrence of possessive pronouns – to explore whether certain books or portions of books could be identified with its respective translator? Statistical analysis can help answer such questions, and many more. Such information is useful to the textual critic reconstructing either the original Greek or the Hebrew \textit{Vorlage} by providing a characterization of the text against which individual textual critical decisions can be considered.

But counting relative frequencies and calculating percentages cannot answer our questions about the larger picture for the very reason Aejmelaeus has identified: unless we know if these percentages represent a true difference in the way the Hebrew causal יָד was translated we have no way to evaluate the differences indicated among the books of the Pentateuch or to compare them, for instance, to the translation technique of other books in the Septuagint corpus.

A methodology that could meaningfully relate the relative frequencies of the occurrence of syntax in one book to that of another would allow many interesting questions to be probed. Does the Greek syntax of the Pentateuch suggest that all five books were translated with the same technique or not, and if not, does this imply different translators, and if so, were they working at the same time or at different times? Do the kaike sections of Samuel-Kings share textual features with any other books of the Septuagint that could enlighten recensional history? Do the books for which two
Exploring the Relationship between Books of the Septuagint

distinct textual traditions exist exhibit syntax that allows them to be grouped? For instance, does the syntax of AT Esther, OG Daniel, and one of the versions of Judges exhibit common characteristics that suggests they were produced at the same time, or by the same translation school? There is, of course, no magic formula by which one can mathematically crank out the answers to such questions, but statistical methodologies are needed to help bring the answers within reach.

There are relatively straightforward statistical tests that can compare the relative frequency of a feature found in one Greek text to the occurrence of that same feature in two or more other texts and determine whether that syntactical feature is used significantly differently among them. As more and more syntactical features are identified, counted, and compared, it will become apparent whether a group of texts share common distinctive features of syntax, and which texts comprise such a grouping. The use of statistical methods could help determine which texts share given criteria. Such information could then be used to confirm or disprove theories about the relationship of the texts.

There are dozens, if not hundreds, of statistical tests, but two will be employed here for comparing the frequency of occurrence of syntactical features in two or more texts: (1) analysis of variance, (2) the Tukey-Kramer multiple comparison test. For instance, an analysis of variance helps to answer the question whether or not overall throughout all five books of the Pentateuch the translation of ἀκούσαντι is handled consistently. Analysis of variance (ANOVA) may be calculated by hand (as I have done here) but it is a standard statistical method available in software such as SPSS (Statistical Package for the Social Sciences), SAS, and Cynat, which run on many different computers. Analysis of variance is used to classify observations into groups on the basis of a single property. This method could be used to group texts of the Septuagint that share any property that can be counted.

An individual translator could be expected to handle a given element of syntax in Hebrew consistently. This does not mean that he would always translate a causal ἀκούσαντι with ὑπήρξαντι or with ὑπήρξαντι, but that the number of times he chose one over the other would be relatively consistent throughout all the books he translated. When such consistency is not found, it raises the question whether more than one translator was at work. Analysis of variance measures the variation from the mean number of times ἀκούσαντι is translated by ὑπήρξαντι as opposed to ὑπήρξαντι to determine if in any one or more of the books that ratio is beyond what would be expected for consistency.

Calculation of the variance of the frequency of occurrence for the translation of the Hebrew causal ἀκούσαντι by ὑπήρξαντι and ὑπήρξαντι in the Pentateuch indicates with a confidence level of 95 per cent that the translation of ἀκούσαντι was not handled consistently across the five books of the Pentateuch. Once analysis of variance has determined that there is at least one book exhibiting a significant difference among the five on this point, a further test, the Tukey-Kramer multiple comparison, can be applied to determine which book(s) of the Pentateuch handle the causal ἀκούσαντι differently from the others.

Such statistical testing is necessary because the percentages themselves do not unambiguously indicate significant variation. For instance, does the 31 per cent difference between the frequency of translation of the causal ἀκούσαντι with ὑπήρξαντι in Exodus (87 per cent) compared to Genesis (56 per cent) indeed reflect a significant difference in translation technique (Table 2)? Numbers (27 per cent) and Deuteronomy (25 per cent) seem to
_table 3. Comparison of how causal ḫ is translated in Pentateuch

<table>
<thead>
<tr>
<th></th>
<th>Genesis</th>
<th>Exodus</th>
<th>Leviticus</th>
<th>Numbers</th>
<th>Deuteronomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genesis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exodus</td>
<td>different</td>
<td></td>
<td>different</td>
<td>different</td>
<td>different</td>
</tr>
<tr>
<td>Leviticus</td>
<td>different</td>
<td></td>
<td>different</td>
<td>different</td>
<td>different</td>
</tr>
<tr>
<td>Numbers</td>
<td>different</td>
<td></td>
<td>different</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deuteronomy</td>
<td>different</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_table 4. Comparison of how causal ḫ is translated omitting Exodus

<table>
<thead>
<tr>
<th></th>
<th>Genesis</th>
<th>Leviticus</th>
<th>Numbers</th>
<th>Deuteronomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genesis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leviticus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers</td>
<td>different</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deuteronomy</td>
<td>different</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

reflect a consistently infrequent translation of the causal ḫ with γάρ. Does Leviticus at 36 per cent group with Genesis or Numbers or neither? When the Tukey-Kramer multiple comparison is applied, the following pair-wise relationships emerge, with a 95 per cent level of confidence. In statistical terms this means there is a less than 5 per cent chance that two books declared 'different' with respect to this element of syntax are in fact the same, with 'different' meaning the frequency with which ḫ versus γάρ appears in works produced by one translation technique versus another technique (Table 3).

Even though the percentages (Table 2) indicate the relative frequency of γάρ in Genesis (56 per cent) and Leviticus (56 per cent) might be different, the Tukey-Kramer test indicates that there is no statistically significant difference between the frequency of translation of the causal ḫ by γάρ in Genesis as compared to Leviticus.

Note, however, that two other interesting patterns emerge. The handling of the causal ḫ in Exodus is clearly different from the other four books of the Pentateuch. Furthermore, Numbers and Deuteronomy are different both from Genesis and Exodus. If Exodus is omitted and the analysis of variance is recalculated, there remains a significant difference in the handling of the causal ḫ among the other four books. Tukey-Kramer analysis indicates this in Table 4.

This statistical analysis indicates that Exodus is different from the other four books of the Pentateuch in its handling of the causal ḫ, but not in the same way that Numbers and Deuteronomy are different from Genesis. There emerge at least three groupings: Exodus by itself, Numbers-Deuteronomy, and Genesis. In both texts Leviticus cannot be shown to be different from either Numbers-Deuteronomy or from Genesis. Further examination of other of its characteristics would be needed.

Does this same grouping emerge if a different feature of syntax is chosen? For instance, if the relative frequency of the repetition of possessive pronouns is examined, does Exodus again stand out from the other four? The research of Raija Solom...
Exploring the Relationship between Books of the Septuagint

### Table 5. Repetition of the possessive pronoun in the Greek Pentateuch

<table>
<thead>
<tr>
<th></th>
<th>Total possible</th>
<th>Pronoun repeated</th>
<th>Pronoun not repeated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genesis</td>
<td>47</td>
<td>24 (51%)</td>
<td>23 (49%)</td>
</tr>
<tr>
<td>Exodus</td>
<td>50</td>
<td>20 (40%)</td>
<td>30 (60%)</td>
</tr>
<tr>
<td>Leviticus</td>
<td>32</td>
<td>24 (75%)</td>
<td>8 (25%)</td>
</tr>
<tr>
<td>Numbers</td>
<td>43</td>
<td>37 (86%)</td>
<td>6 (14%)</td>
</tr>
<tr>
<td>Deuteronomy</td>
<td>72</td>
<td>55 (76%)</td>
<td>17 (24%)</td>
</tr>
</tbody>
</table>

### Table 6. Comparison of how possessive pronouns are translated in the Pentateuch

<table>
<thead>
<tr>
<th></th>
<th>Genesis</th>
<th>Exodus</th>
<th>Leviticus</th>
<th>Numbers</th>
<th>Deuteronomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genesis</td>
<td>—</td>
<td>different</td>
<td>different</td>
<td>different</td>
<td>—</td>
</tr>
<tr>
<td>Exodus</td>
<td>—</td>
<td>different</td>
<td>—</td>
<td>different</td>
<td>—</td>
</tr>
<tr>
<td>Leviticus</td>
<td>different</td>
<td>different</td>
<td>—</td>
<td>different</td>
<td>—</td>
</tr>
<tr>
<td>Numbers</td>
<td>different</td>
<td>different</td>
<td>—</td>
<td>different</td>
<td>—</td>
</tr>
<tr>
<td>Deuteronomy</td>
<td>different</td>
<td>different</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

provides a counting of the number of times the possessive pronoun, repeated in Hebrew syntax for coordinate items, is translated similarly in Greek, in violation of Greek practice (Table 5). Analysis of variance indicates with a 95 per cent confidence level that there is indeed a significant difference in the frequency of occurrence of the repetition of the pronoun in the translation of the various books of the Pentateuch. The further Tukey-Kramer multiple comparison indicates relationships among the books (Table 6).

Patterns emerge that are similar to those found for the translation of the causal ה. Again, Exodus exhibits significant differences with three of the other books, and Numbers-Deuteronomy group together again. Leviticus is significantly different from Exodus in the way it translates the possessive pronoun, but again does not distinguish itself from Genesis. Other features of its syntax would have to be examined to see if significant differences between it and Genesis emerge.

As these few examples illustrate, statistical analysis can be used to explore the relationship between the Greek biblical books and their textual history. However, some cautions are indeed necessary. It is easy to plug numbers into a formula and crank out more numbers on a calculator or computer that are then claimed to indicate some meaningful conclusion. But the old maxim, ‘garbage in-garbage out’ certainly applies here. To assure meaningful conclusions, the hypothesis being tested must be framed in a way appropriate to the statistical methods being applied. Furthermore, the results indicated must not be pressed beyond what the statistical test that was employed allows. Statistics are but a tool that can help explore the characteristics of the Greek texts. There is, of course, no mathematical or statistical methodology that could prove the relationship between two texts. However, when joined with traditional methodology, quantitative analysis will enlighten the question of the origin and textual history of the Greek Bible.
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NOTES

10. Ajmone-Marsan, On the Trail, p. 3.
20. For a full mathematical description of how the relative frequencies are normalized see Jobes, The Alpha-Text, p. 40.
21. See Martin, Syntactical Evidence, pp. 6, 18.
22. For a critique of the problems and limitations of Martin's methodology see Jobes, The Alpha-Text, pp. 25-47.
23. The question arises of how variant readings would affect these results. For a large number of occurrences, the possibility of a variant reading for a few of them probably would not make any statistically significant difference in the profile.

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24 Criterion 2 is omitted from the profile of 5 Maccohos because the text does not contain the minimum number of occurrences of ου as needed for meaningful analysis. See Jobes, *The Alpha-Text*, pp. 35-36 for a list of the minimum number of occurrences required for each of the seventeen criteria.

25 Dana and Maucke’s reference to the frequency with which ου was used in Koine Greek corroborates the weakness of ου as an indicator of a Semitic Vorlage. ‘The ordinary Hellenist, as the papyrus records reveal, had but few conjunctions in his vocabulary, and ου was the main one’, *A Manual of the Greek New Testament* (Saddle River, NJ: Prentice Hall, 1955), p. 350.


27 Neutle, *Septuagintastudien*, iii.


30 Soisalon-Soininen, ‘Die Infinitive in der Septuaginta’.

31 Sollano, *Repetition of the Possessive Pronoun*.

32 Aujesky, *On the Trail*.

33 Aujesky, p. 25.

34 The author wishes to gratefully acknowledge Dr Russell Howell, Professor of Mathematics at Westminster College, for several conversations about which statistical methods might be of greatest relevance to this problem and for critiquing this section of the paper.

35 In statistical terms, the null hypothesis is that each sample (i.e. book) would exhibit the same relative frequencies of φ and υφ if produced by the same translator.


37 Sollano, *Repetition*, Genesis, p. 195; Exodus, p. 30; Leviticus, p. 45; Numbers, p. 51; Deuteronomy, p. 64.