

ASPECTS OF THE TRANSLATION TECHNIQUE OF THE SEPTUAGINT: THE FINITE VERB IN THE SEPTUAGINT OF DEUTERONOMY

by

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I, the undersigned, declare that the work contained in this thesis is my own original work and has not previously in its entirety or in part been submitted at any university for a degree.

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Abstract

Two major religions, Judaism and Christianity, use the ancient Hebrew Bible as Holy Scripture. These books were translated in the last three centuries before the common era. The oldest of these translations is the Septuagint, a Greek translation. Not only are the Hebrew and Greek texts that were involved in the original translation process missing, but precious little is known about the doctrine and translation methods of the translators of the Septuagint. Much can be learned about these crucial issues, however, if the translation technique followed by those ancient translators is studied by comparing the present Hebrew and Greek texts.

A new method to determine and describe the translation technique of the Septuagint was proposed and tested in this dissertation. This method is based on the use of the Computer Assisted Tools for Septuagint Studies (CATSS) data base and statistical methods. The translation technique of the book Deuteronomy was described using different criteria, all of which measure the frequency of non-literal renderings. Three different groups of criteria were utilized, viz. the Tov criteria as proposed by E. Tov, criteria defined using the markers in the CATSS data base called the CATSS criteria, and grammatical criteria using the person of the verb. Each criterion was applied to the data base individually. The translation units were determined first, after which the translation technique found within the translation unit was described. The methodology implemented discriminates between significant and insignificant trends in translation technique.

It became clear that the results of the different criteria indicate different translation units and different translation techniques for each of the criteria. Except for some criteria using the person of the verb, very little indication was found that the traditional translation units are supported by the data used in this study. In fact, it seems as if translation units should be determined before the translation technique is described. The translation technique should then be described according to the indicated units.

Not all the Tov criteria could be utilized, but their results are in agreement to some extent. The CATSS criteria proved to be more difficult to implement than expected, but some of the criteria rendered excellent results. The person of the verb was discussed in detail using 12 different criteria. The results of the criteria utilizing the person of the verb are disappointing, and provide some scope for future research.

The results rendered by this new approach are firm and easy to interpret. In addition, it is possible to utilize these results when dealing with specific text-critical problems.

Opsomming

Die antieke Hebreeuse Bybel word deur twee godsdienstige groepe, Judaïsme en die Christendom, as Heilige Skrif gebruik. Hierdie boeke is in die laaste drie eeue voor die begin van die huidige era vertaal. Die oudste vertaling is die Griekse vertaling, genoem die Septuagint. Die Hebreeuse en die Griekse tekste wat by hierdie vertaalproses betrokke was, is verlore. Daarbenewens is baie min van die lering en vertalingstegniek van die vertalers van die Septuagint bekend. Indien die vertalingstegniek, wat deur hierdie vertalers gevolg is, bestudeer word deur die huidige Hebreeuse en Griekse tekste met mekaar te vergelyk, kan daar lig op hierdie probleme gewerp word.

'n Nuwe metode waarvolgens die vertalingstegniek van die Septuagint bepaal en omskryf kan word, is in hierdie verhandeling voorgestel en getoets. Die metodologie is gebaseer op die gebruik van die Computer Assisted Tools for Septuagint Studies (CATSS) databasis en statistiese metodes. Die vertalingstegniek van die boek Deuteronomium is omskryf deur gebruik te maak van verskillende kriteria, wat almal die frekwensie van nie-letterlike vertalingselemente meet. Drie verskillende groepe kriteria is gebruik, nl. die Tov-kriteria, soos voorgestel deur E. Tov, die CATSS-kriteria, gebaseer op merkers in die CATSS databasis en grammatikale kriteria, in die vorm van die persoon van die werkwoord. Elke kriterium is individueel op die databasis toegepas. Die vertalingseenhede is eers vasgestel, waarna die vertalingstegniek beskryf is. Die metodologie wat gebruik is, onderskei tussen betekenisvolle en nie-betekenisvolle neigings in vertalingstegniek.

Dit is duidelik dat die resultate van die verskillende kriteria verskillende vertalingseenhede en verskillende vertalingstegnieke vir elk van die kriteria aandui. Uitgesonder sommige kriteria, wat gebruik maak van die persoon van die werkwoord, is daar baie min ondersteuning gevind vir die handhawing van tradisionele vertalingseenhede. Dit wil eerder voorkom asof vertalingseenhede bepaal moet word voordat daar met die beskrywing van vertalingstegniek voortgegaan kan word. Die vertalingstegniek moet dan beskryf word met inagneming van die verskillende vertalingseenhede.

Nie al die Tov-kriteria kon gebruik word nie, maar die resultate van dié wat gebruik kon word, stem tot 'n mate ooreen. Dit het geblyk dat die CATSS-kriteria baie moeiliker was om te implementeer as wat verwag is. Sommige van hierdie kriteria het egter uitstekende resultate gelever. Die persoon van die werkwoord is in nouere besonderhede ondersoek, deur gebruik te maak van 12 verskillende kriteria. Die resultate van die kriteria wat van die persoon van die werkwoord gebruik gemaak het, is teleurstellend, en bied moontlikhede vir addisionele navorsing.

Die resultate wat deur die nuwe metode van ondersoek gelever word, is vas en maklik om te interpreteer. Dit is ook moontlik om hierdie resultate te gebruik wanneer spesifieke tekskritiese probleme ondersoek moet word.

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My interest in the LXX was roused during graduate studies at the University of Stellenbosch. **Johann Cook** is one of the all too few teachers able to inspire a love for a subject in a student by his own enthusiasm and drive in research. He not only lectured me on the subject of translation technique of the LXX, but also taught me to love it and then allowed me to explore the field on my own, while subtly guiding my attempts to understand the delicate web of information which makes up this subject field. In my opinion, this is the highest accolade possible to give any teacher or mentor.

The research documented in this dissertation did not take place in isolation. It is based on the work of others to a degree greater than could normally be expected of research projects in the field of the Hebrew Bible.

Emanuel Tov and Robert Kraft are the directors of the **CATSS** project, the computer data base that consists of the parallel aligned texts of Hebrew and Greek versions of the Hebrew Bible. Normally, a student working on a dissertation would have to accumulate such data on his/her own. (In this case, the data obtained from the CATSS data base amount to about 15 000 000 characters!) The existence of the data base, and the permission to use it allowed the researcher to concentrate on the essence of the dissertation, eliminating a lot of the preliminary work.

The CATSS data base is enhanced by the Hebrew morphological analysis generated by the research team of **R.F. Poswick** at Maredsous. Without the Hebrew morphological data made available by that project through the CATSS data base, the author would not have been able to conduct computer searches of the data to the extent done in chapters 3, 4 and 5. My heartfelt thanks for such detailed data to Br Poswick and his team.

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Some of this research took place within the environment of the **Research Unit for Computer Applications to the Language and Text of the Old Testament**. Walter Claassen is the director of this research unit, funded in part by the Human Sciences Research Council (HSRC) of South Africa, and based at the University of Stellenbosch. The research would not have been possible without the support rendered by this environment, and without the foresight of Charles Fensham and Walter Claassen to apply computer technology to the subject of the Hebrew Bible.

The author, although having taken courses in statistical methodology, was unable to solve some of the fundamental statistical problems of this research. In this regard, the service the University of Pretoria renders to postgraduate students proved to be of vital importance. The **Section Research Support** of

the **Department of Information Management** at this university collaborate with the **Department of Statistics** to provide statistical and computer-related advice and service for which the student does not have to pay. Hennie Groeneveld, a professor at the Department of Statistics, was kind enough to be of assistance to this author, and proposed solutions to problems statisticians at other universities hesitated even to look at. His advice and practical approach to the problems proved to be so important that the author is entitled to claim that the results of this research would have been impossible without his input. However, as he was only consulted when the project was well under way, he could not contribute to the overall design of the project. He therefore had to contend with some mistakes in the design impossible to remedy at that stage. It would therefore be unfair to lay any mistakes in the statistical methodology at his door.

Research of this nature always seems to have some financial implications. In the case of this study, the financial implications were profound, as the CATSS research centre in Jerusalem had to be visited and the work was computer related. The individuals and institutions that sponsor such research not only show their appreciation for the importance of the research itself, but also put their trust in the researcher being able to deliver the goods. For the funds, but more importantly, for their faith, I would like to offer my most grateful thanks to the following (in alphabetic order):

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In concurrence with the agreements made with the HSRC, the following statement has to be made:

"Financial assistance rendered by the Institute for Research Development of the Human Sciences Research Council towards the cost of this research is hereby acknowledged. Opinions expressed or conclusions arrived at are those of the author and are not to be regarded as those of the Institute for Research Development of the Human Sciences Research Council."

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The manuscript was checked for grammar by the firm **Lexika** in Stellenbosch. However, as some suggestions were overruled by the author and as alterations were made to the manuscript after it had been checked, all errors in this regard are to be regarded as that of the author.

Elana Mauer was so kind as to proofread sections of the manuscript. Not only did she correct my grammar, but she also pointed out sections where the logic seemed to fail or falter, and where the text was not user friendly. My most sincere thanks to her for a task performed out of friendship.

Although this researcher was fortunate to be able to depend on many people and institutions for support while writing this dissertation, responsibility for all mistakes, inaccuracies and misconceptions possibly contained in this work is that of the author.

Finally, as is usual with the writing of dissertations, one's colleagues, family and friends are exposed to all the work and, sometimes, frustration that accompanies an undertaking of such a nature. To all of them, but particularly to Daleen and Jandré, my thanks for their support. I also want to thank my father, Esrie, Surina and Barry, who kindly supplied secluded environments in which much of the work was done, as well as support in all respects.

Memorable Quotes

"Aan die ander kant kan (die elektroniese rekenaar) 'n ontploffing van wetenskaplike kennis veroorsaak wat binne 'n paar dekades die wêreld wesenlik kan verander. Navorsers sal nou veel meer tyd hê om aan basiese navorsing te bestee." Fensham, F.C. 1968.

"(Translating an instrument from a source language to a target language is) ... probably the most complex type of event yet produced in the evolution of the cosmos." Richards, I. 1953: 250.

"Die Franse het 'n oulike gesegde oor die vertaling van poësie. Hulle vergelyk dit met 'n vrou. *Quand elle est belle, sê hulle, elle n'est pas fidèle. Et quand elle est fidèle elle n'est pas belle.*" Krige, U. 1987. *Verse van Lorca. Vertaal en Verwerk deur Uys Krige*. Cape Town: Human & Rousseau.

"In short, Bach does not give us literal translations but artistic adaptations." *Bach - The Six Clavier Concerti after Vivaldi*. E.M.I. Records: P8361.

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307), and that the Letter tried to give to the (maybe older) Hebrew texts in Egypt "... a contemporary authority as having been selected by the High Priest in Jerusalem..." (Tov, 1992). Both these recent proposals are based on the premise that the Hebrew scriptures continued their literary development after the LXX had been translated.⁴

Exactly how, why, when, where and by whom the Torah was originally translated may never be known for certain. It is accepted that there is at least a gist of historical truth in the Letter of Aristeas. Whatever the case may be, it seems probable that the Torah was translated into Greek by Jews for Greek-speaking Jews, and probably in Egypt. The translation of the rest of the Hebrew Bible was done subsequently.

The Greek translation of the Hebrew Bible seemed to be popular amongst the Greek-speaking Jews that lived outside Palestine.⁵ After the fall of Jerusalem in 70 CE, however, this popularity seemed to decline sharply, as the Jewish religion again turned to the original Hebrew version of the Law (Brock, 1992: 320-321). Judaism moved away from the LXX because Christians used the LXX in their debates with the Jews and because there was some dissatisfaction by Orthodox Judaism with the textual alterations incorporated in the LXX (Deist, 1978: 157).

In the new, largely Greek-speaking Christian community, the LXX was used as Holy Scripture (Cook, 1990: 257). The translation of the Bible into Latin and its official recognition in the fourth century CE implied that the LXX would not be the sole version of the Holy Bible for Christians. The LXX remained a subject of study in the Christian religious community, even through the Dark Ages. From the time of the first translation, a lot of recension was done to the original translation.⁶ The LXX was also retranslated a number of times, using translation techniques differing from those of the original

⁴ This is also supported by A. Aejmelaeus (1992: 381, 387).

⁵ "Greek-speaking Jews" should be taken to mean people born as Jews, as well as proselytes, both groups of which were able to use Greek as a language of communication. Whether the Jewish communities outside Palestine were still able to understand Hebrew is another topic altogether.

⁶ So much so, that it became necessary to distinguish between the first translation, now called the Old Greek (not in existence in its original form anymore), and the present version of the Greek translation, popularly called the LXX. Dominique Barthélemy proved in his *Les Devanciers d'Aquila* that the present LXX text is "... a Jewish recension of the old LXX text" (Wevers, 1988: 23).

In the present work, the designation LXX will be used in a wider context, intended to incorporate all of the history of the Greek translation, while the term Old Greek will be used to refer specifically to the first translation. Both terms will, however, refer only to the Pentateuch.

translation, and the original translation underwent several recensions.⁷ The translators and supporters of each of these translations and recensions claimed theirs to be the most authoritative and/or faithful translation. As these different Greek translations were transmitted through the ages, copied by hand, "corrected", correlated with each other and sometimes merged by later editors, different textual traditions were formed. At this stage no single manuscript exists of which can be claimed that it is a faithful copy of the Old Greek.

During the Reformation, the emphasis shifted to the Hebrew text as source text for contemporary translations, and the Christian community joined the Jewish community again in the study of the Hebrew text (Cook, 1990: 258 and Deist, 1988: 2-3, 22-23). As the Hebrew text of the Bible again gained popularity in religious studies in the Christian community, it seemed that the LXX had outlived its usefulness. But, in fact, the study of the LXX is alive and well today.

⁷ For an exposition, see Tov, 1987a: 171-186.

1. The Present Relevance of the LXX for the Study of the Text of the Bible

Why would a Greek translation occupy so strong a position in the study of the Hebrew Bible today when the Hebrew Bible is also available in the original language? The problems inherent in translating a text (especially a religious text) into another language that is a member of a totally different family of languages are immense. In addition, the transmission history of the LXX, during which the Old Greek text disappeared in its original form, could only compound matters. Should it not then follow that the text in the original language, even if it has its own problems regarding development during its transmission, would probably be the best reflection of the original writing? The following will explain why the LXX is still very prominent in biblical studies today:

- It is not certain exactly when and why a movement to standardize the text of the Hebrew Bible came into being within the Jewish religious community, but during the intertestamental/early Judaic times this force was already powerful and the work well in progress. Even during the process of standardization of the text of the Hebrew Bible, however, different textual traditions were formed. In addition, two distinctly different schools were responsible for vocalizing and transmitting the Hebrew text in the Dark Ages of the common era.⁸

At the time during which the Greek translations of the Torah came into being, there was no single authoritative Hebrew text. Not only did different versions of the Hebrew text of some of the biblical books exist, but some of the books were still in the process of attaining their final literary form. The development process of non-finalized sections of the Hebrew text continued while some versions of that text were translated into Greek (Aejmelaeus, 1992; Tov, 1992, and Cook, 1993a).

The Hebrew manuscript(s) from which the Old Greek was translated constitutes only parts of the present *textus receptus*, called the Masoretic Text (MT). The precise identity and contents of these manuscripts are unknown, but the importance of intimate knowledge of these manuscripts was always suspected. When it was proved by the scrolls discovered at Qumran that the history of the text of the Hebrew Bible is indeed even more complicated than previously thought, the scholarly community gained more perspectives about the critical importance of information

⁸ These two schools, called the Masoretic schools, were located in Palestine and Babylonia (Deist, 1978: 52).

about the Hebrew manuscripts used for the original translation. These parent manuscripts are called the *Vorlage* of the Old Greek.

The importance of the *Vorlage* should not be over-estimated, as it was probably only one of several versions of the Law called "texts" in existence at that stage (Tov, 1992). Manuscripts from the era in which these texts took shape have been found in extensive form only at Qumran. However, if the *Vorlage* of the LXX could be reconstructed, and compared with the manuscripts discovered at Qumran,⁹ at least a notion could be gained of the ancient texts of the Hebrew Bible. Such knowledge would prove invaluable to the evaluation of present-day textual variants.

- The LXX was regarded as Holy Scripture by both Jews and Christians at some stage in history.

During the intertestamental/early Judaic period the Greek translation of the Torah played a very important part in the lives of a major constituent of **the Jewish religion**. Large Jewish communities were located outside Palestine, and used Greek and Latin as their lingua franca and home language. Some of these groups, not being able to understand Hebrew very well at all, made extensive use of the LXX in order to gain access to the Law.

Understanding the way in which the ancient translators regarded the Hebrew manuscripts before them and the way in which they were translated could contribute enormously towards our present understanding of early Judaism. It is unfortunate that very little literature from that era is still in existence. Whereas the knowledge of the earlier eras, e.g. the Babylonian era, can be founded on the discovery and excavation of entire cities, some with their libraries preserved intact, few such discoveries were made that could throw any light on the early Judaic era.¹⁰ Although Qumran and the Cairo Geniza undoubtedly give us a glimpse of the religious thoughts of those times, the manuscripts discovered do not cover the whole corpus of the present Hebrew Bible. In fact, it seems as if the discoveries at Qumran raised as many new questions as they solved old ones. Every little bit of knowledge about this very important time for Judaism, in which major changes took place in the interpretation of the Law and during which its Holy Scriptures attained their final form, is of extreme importance.

The LXX is not only to be studied as the product of translators. It can also be used as a means of getting a glimpse of the thoughts and customs of the ancient Jewish translators. The LXX is a

⁹ Ulrich (1978) did some excellent work in this regard.

¹⁰ The biggest collection of manuscripts of the time, the library in Alexandria, was regrettably burned down. It should also be kept in mind that the target area of research, Palestine and the other Mediterranean countries, has always been heavily populated since the eighth century BCE. New civilizations made use of the building materials of the older civilizations, and literally built upon them. Owing in part to these facts, few manuscripts dating from before the second century CE have been discovered.

Jewish-Hellenistic document (Cook, 1993a). As such, it contains a wealth of information about the Hellenistic world, and about the form of Judaism within that world.

When **Christianity** attained some form of maturity in the second century CE, its followers were mostly from the Greek and Latin-speaking nations. Their access to the Hebrew Bible would therefore be through the LXX. As their link to the Holy Scriptures, the LXX obviously played a very important role in the lives of the early Christians.

The intertestamental/early Judaic period can be termed the cradle of Christianity, and yet, as pointed out above, very little is known about this period. In this regard the study of the LXX could be of great help, as recensions and interpretations of the LXX by the ancient scribes would tend to reflect the thoughts and attitudes of early Christianity.

Both Christians and Jews made use of the LXX as Holy Scripture during some period in their history. Its influence was not lost, however, when other versions of the Bible became the authorized versions in daily use by the religious community. Instead, the LXX soon became an important tool in the textual criticism that was practised by both Judaism and Christianity in the search for an authoritative text of the Hebrew Bible.

It is obvious that the study of the LXX is also an important source of information about the cultures and history of two religions, Judaism and Christianity. In addition, the LXX is an important source of information about the history of the Holy Scriptures of both religions. In fact, the study of the LXX has become more and more relevant in present times.

2. The Translation Technique of the LXX

It is commonly accepted that the reconstruction of the *Vorlage* should form the basis of the study of the LXX (Aejmelaeus, 1987: 58 and Tov, 1981: 50). The most powerful technique available to accomplish a task of this nature is the determination of the translation technique followed by the original translators. When the translation techniques of sections of the text are known, the retroversion of the Hebrew from the Greek translation becomes possible and much more reliable. Upon these foundations can then be built the correct use of the LXX to evaluate the different variants in the Hebrew Bible.

2.1 Studies of Translation Technique of the LXX

The history of the study of translation technique has already been documented in an excellent manner, and no expansion was necessary for this research (Soisalon-Soininen, 1983a and 1987a; and Tov, 1987b).¹¹ It is sufficient to mention that the present study of translation technique is under the influence of two major schools based in Helsinki and Jerusalem (Tov, 1987b: 348-349).

The Helsinki school, founded by I. Soisalon-Soininen, is making a great contribution to the understanding of the translation technique of the LXX.¹² The work of Soisalon-Soininen and his students is unparalleled regarding the application of grammatical criteria to the problem of translation technique. In this way, not only has enormous progress been made in comparing the Hebrew grammar of the MT and the Greek grammar of the LXX, but a great contribution has also been made to the study of the grammar of the LXX as a Jewish-Hellenistic document.

E. Tov was modest when he asserted that "... only a modest beginning has been made..." (1987b: 349) regarding the comparison of the Hebrew and Greek texts using the computer. Although only a few articles have been published in this regard, the work of Tov and his CATSS team led to the creation of the CATSS data base. This computerized data base and its associated tools constitute the single most powerful instrument in existence that can be used in the research of the translation technique of the LXX. As more researchers begin to use, and scholars start publishing studies based on that data base, readers can expect to see more and more works based on the research embodied in the markers

¹¹ It seemed that an important work could be added to the bibliography, however, that of Wittstruck, 1972.

¹² Readers should note that one of Soisalon-Soininen's students, A. Aejmelaeus, moved to Göttingen recently. She was appointed to the chair vacated by R. Hanhart when he retired. In this dissertation her work will be treated as part of that of the Helsinki school.

used in the data base and/or using the parallel alignment of the data base.¹³ The data base will be discussed more extensively in due course. Some of the criteria formulated by the different schools are of such a nature that a computer simply has to be used to apply them to the texts. In particular, criteria that have to be applied to large volumes of text in order to render valid results, e.g. the criterion word order,¹⁴ spring to mind. The CATSS data base is particularly suited for tasks such as this.

These are by no means the only centres doing research on translation technique regarding texts of the Bible, however. The work done by S.P. Brock,¹⁵ J. Wm. Wevers and J. Cook,¹⁶ the dissertations of Wittstruck and Sailhamer, and the article of J.C. Lübke (1988) bear testimony to some of the other research centres and other approaches to the problem.

2.2 Unresolved Issues

This study does not intend to deal with all the unresolved issues of present research regarding the translation technique of the LXX. While concentrating on the problem of the translation technique of the person of the verb in Deuteronomy, however, certain fundamental problems and proposals to their solutions had to be examined.

While doing the preliminary reading necessary for the research contained in this dissertation, the author noted a number of problems regarding present research on translation technique of the LXX:¹⁷

- In order to study the translation technique of the LXX, the meanings of the terms translation technique and translation unit have to be clear. It must also be possible to incorporate these definitions in practical solutions.
- At present the problem of translation technique is being solved from two different angles, the more holistic perspective of Barr and Tov, and the grammatical approach of Soisalon-Soininen.

¹³ In fact, the present author would like to recommend, based on personal experience, to future researchers to save themselves a lot of time and effort by using this enormously powerful research tool.

¹⁴ G. Marquis (1986) started using the data base in this regard. Although the Jerusalem school uses the markers in the CATSS data base to their full extent, it is also possible to compare the two texts themselves, as will be shown later.

¹⁵ Brock currently concentrates on Syriac (e.g. Brock, 1984), but has done and is still involved in pioneering research in the field of the Septuagint.

¹⁶ Johann Cook does his research at the University of Stellenbosch, both in his personal capacity and as a member of the Research Unit for Computer Applications to the Language and Text of the Old Testament.

¹⁷ Some of the problems will be discussed at length in the next chapter.

Moreover, each of these schools employs several different criteria according to which the translation technique is analysed. These different criteria, when applied to the same portion of text, may render different results.¹⁸ There exists therefore a dire need to present the results of the different criteria in such a way that they can be compared with each other. In this instance, expressing the results in statistical format could aid the comparison of the different criteria.

- Not only is it necessary to determine the translation technique as reflected in the light of a certain criterion in a quantifiable manner, but the translation technique has to be described within certain translation units. The translation technique can vary from one section of the LXX to another (Thackeray, 1909: 10 f.). Traditionally, it was thought that each translator would have taken a book, or that a book could have been split between two translators. It was presumed therefore that the boundaries of the translation units would follow those of the books and/or scrolls. Each of these sections is then called a translation unit. However, the boundaries of these translation units need to be determined in a scientific way without relying on the presumptions indicated above.
- In view of the needs described above, it seems obvious that the art of statistics and the power of the computer should be utilized in order to aid the researcher as much as possible.

¹⁸ This is valid for the different types of criteria applied by the different schools, but also for different criteria within the same school. See, e.g., Aejmelaeus, 1982: 180.

3. The Aim of this Study

It is clear from the previous paragraphs that certain problems can be identified even at this stage of the study of the LXX and its translation technique. Almost all the problems deal with the methodology of research.

3.1 Methodology

It seems that a proposed methodology for measuring the translation technique of the LXX must incorporate the approaches of all the different schools, as the results of all the criteria would have to be compared with each other. The results of the criteria employed by the different schools may be regarded as different reflections of the same reality. The translation technique is being described in different ways by the different criteria, but it is still the same translation technique that is being described. None of the criteria at present identified can describe the translation technique in its entirety. Instead, the different depictions of the translation technique by the different criteria should be seen as complementary to each other, hence the need for a mechanism to depict all the descriptions using the same framework.

It is proposed that a methodology based on statistical analysis of the results of the different criteria should be used. Such an approach should fulfil most of the needs identified. Seen in the light of statistical analysis, these needs are as follows:

- It must be possible to calculate the **boundaries of the translation units** as reflected by a certain criterion in as objective a manner as possible.
- The **translation technique**, as indicated by the results of the implementation of a criterion, must be determined as objectively as possible.
- The results of a criterion must be expressed in such a way that the results of different criteria can be **compared** with each other.
- It should also be possible to use the results of a number of different criteria simultaneously in order to gain a more **comprehensive view of the translation technique** observed.
- The results of the implementation of a criterion must be **quantifiable**. That is, it must be possible to express these results reflecting the translation technique in statistics.
- If at all possible, the results should be **displayable in graphic format**, depicting both the translation units and the translation technique of the criterion.
- It should be possible to **utilize the results** when text-critical variants are evaluated.

3.2 Implementation

The proposed methodology must be implemented using a number of criteria. These criteria should represent the major groups of criteria below:

- **The Tov Criteria:** Five criteria were identified by Tov (1981: 54-66) as ways to measure the literalness of translation. These will be discussed in chapter 3.
- **The CATSS Criteria:** The markers or signs in the CATSS data base can be utilized as criteria that reflect translation technique.¹⁹ The criteria will be implemented and the results discussed in chapter 4.
- **The Grammatical Criteria:** This author would like to make use of grammatical criteria consisting of the different persons of the verb in the MT and in the LXX, and would like to compare the two texts on that basis. Different criteria will be determined using the person of the verb in chapter 5.

Having defined, implemented and discussed a number of possible criteria reflecting the translation technique of the LXX, the author feels compelled to include a chapter illustrating the use of the results in their statistical format. In chapter 6 it will be attempted to demonstrate the use of the results obtained regarding text-critical problems.

3.3 Grammatical Particulars of the Person of the Verb

Although it is not the main goal of this research, it was thought appropriate to comment on the experimentation done while determining the most suitable way of using the person of the verb as a criterion for translation technique. These discussions will form an integral part of chapters 5 and 7.

¹⁹ A marker is placed in the data base by the members of the CATSS research team to indicate that a certain text-critical phenomenon has been found at that spot in the alignment of texts (Tov, 1986: 7-10).

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CHAPTER 2: METHODOLOGY

The crucial importance of determining the translation technique of the Greek translation of the Bible was demonstrated in the previous chapter. Only when this translation technique is known can the LXX be used to study the Hebrew *Vorlage*. In this chapter the author will attempt to present a methodology according to which such research could be undertaken. In the second part of the chapter it will be explained how this approach can be implemented in practice.

1. Proposed Solution to the Problem

This author will propose a possible solution to the problem of determining the translation technique of the LXX. The methodology underlying this solution is based on the definition of the term translation technique.

The solution being proposed relies upon the use of the computer, the CATSS data base and statistics as tools that must be available in order to implement the solution in practice.

1.1 Defining Translation Technique

1.1.1 Previous Use of the Term

Many definitions of the terms translation and translation technique can be found in literature. This is to be expected when one deals with a phenomenon so complicated as to warrant the description "... probably the most complex type of event yet produced in the evolution of the cosmos" (Richards, 1953: 250).

Indeed, if this researcher had hoped for literature to present a clear and usable definition of the term translation technique, those hopes were dashed quite soon. The definitions given were mostly theoretical and/or not applicable to the subject of researching the ancient versions.

The author will not attempt to discuss all the definitions and interpretations given to this term since antiquity, but will concentrate on some of those more recently formulated. The ability of the suggested definitions to accommodate practical research will be examined.

At this stage the author would like to discuss the meaning as well as the theoretical and practical implications of the definitions of translation technique as formulated by individuals or schools of thought that directly influenced this research:

- James Barr
- The Helsinki School
- The Jerusalem School
- T.K. Wittstruck
- J.H. Sailhamer
- The measurement of modern translation

While it may seem obvious that the *Vorlage* and the Old Greek should be determined before the original translation technique can be examined as a relationship between these two texts, the reader should note that not all works discussed below followed this method.

1.1.1.1 Barr

In his work *The Typology of Literalism in Ancient Biblical Translations*, Barr defined the problem of measuring the translation technique of the LXX. He was very aware of the fact that the *Vorlage* was only one of many variant Hebrew texts in existence at the time, as can be seen from the first part of that work.¹ He went on to assert that the "... question of literalism in translation is seldom or never absolutely provable by the mere juxtaposing of two texts, say one in Hebrew and a rendering of it in Greek" (1979: 285), and proceeded to discuss the different solutions possible when two or more Greek variants for a word in the Hebrew Bible are encountered. He relied on the semantic path to indicate the more correct translation, while using other Hebrew texts to assist in the choice of variant to be chosen. In his treatment of the problem, he mentioned that there was a subjective and hypothetical element to the discussion. However, it seems that to Barr the subjectiveness could be kept in bounds by the experience of the investigator and by the application of many different skills to the problem.

¹ "If we start with a Greek text and set it against the Hebrew of the MT, we may discern substantial differences, to such a degree that the rendering seems very far from literal. There may, however, have been in existence a different Hebrew text, and in some circumstances, if the translation was made from that other text, it turns out to have been much more literal than at first sight appeared." (Barr, 1979: 284) and

"The modern discovery of variant Hebrew texts..." (Barr, 1979: 286).

The methods and intentions of the translators were very important to Barr (1979: 281). In the first section of his 1979 work, Barr definitely equated the intention and actions of the translator with the translation technique being followed.² One could safely say that, when Barr discussed translation technique in the context above, the focus was on the translator.

To Barr (1979: 281), ancient biblical translations were to be regarded from the viewpoint of literalness. To determine the character of the translation therefore, he proposed measuring the literalness of that translation. The original translation technique cannot, however, be measured today as accurately as it could have been just after the translation was completed due to the fact that neither the original Greek nor the original Hebrew manuscripts are at present available.³

In his 1979 work, Barr did not examine large portions of text. In fact, his examples all referred to a single line or verse in the Bible. Using this approach, the minute examination of each translation equivalent is possible, thereby allowing the scholar to examine the semantic path of the translation (Barr, 1979: 285 f.). In this fashion, the problem of the *Vorlage* was also addressed.

If one were to scrutinize his criteria for examining the degree of literalism in rendering the Hebrew Bible (Barr, 1979: 294 f.), however, a shift in emphasis can be detected. What was under investigation were not the motive and translation process of the translator anymore, but the effect these had on the translation. By studying these effects, Barr hoped to detect the style of translation followed by the translator. It cannot be denied that the primary objects of the study then were the present Hebrew and Greek texts, and the relationship between them. It also seems that, after Barr defined the six criteria, he then dropped the question of whether a certain translation equivalent in his examples stemmed from a different *Vorlage* or whether it was due to translation technique. In fact, when discussing one of the most obvious indications of another *Vorlage* - additions or subtractions of elements (Barr, 1979: 303 f.) - the question of another *Vorlage* was never mentioned. Instead, Barr noted "When large additions are made, these can sometimes be regarded as free composition." (1979: 304).

It would therefore seem that Barr measured translation technique using the present texts as object of research, and that translation technique was not described in terms of the intentions and actions of the translator, but rather in terms of the relationship between two texts. While, in the first part of his work, a lot of emphasis was put on the problems connected with the *Vorlage*, in the second part the emphasis seems to be on tracing the semantic path between variants of presently existing texts.

² "There is another reason why we should not rest content with the traditional vocabulary of 'literal' and 'free' (translation): many ancient *translators* of the Bible seem not to have had any clear or definite *policy*..." (1979: 280). (The italic typeface and the word in brackets are my own - BAN.)

³ For example, see his remarks on *Vorlage* above.

It may also be the right place to mention a problem with the implementation of the defined criteria by Barr himself: Barr (1979: 294) formulated his criteria for determining the literalism in such a way that it is obvious that large portions of text have to be examined simultaneously in order to apply the criteria in practice.⁴ His examples, however, all concern themselves with single words or verses. In this regard, the approach proposed by Tov (1981: 50), in which whole translation units are examined, and the subsequent implementation of that approach by the Jerusalem school, is more advanced than Barr's methodology.⁵

1.1.1.2 The Helsinki School

The Helsinki school, with its three great proponents, I. Soisalon-Soininen, R. Sollamo and A. Aejmelaeus, is well known for using grammatical criteria in researching the translation technique of the LXX. In this endeavour, the results were described using an elementary form of statistical analysis, viz. the creating of tables depicting the frequency of occurrence of phenomena in different books and in subsections of those books. In particular, the translation technique of the Pentateuch was thoroughly investigated.

It is quite clear that the translator and his style of translation were the primary goal of their studies.⁶ While the translator and even his intentions while translating were discussed intensively, it was in fact the product of the work of the translator in the forms that are available today that was being studied, as was admitted by Aejmelaeus (1991: 27).

At this stage it is clear that the Helsinki researchers were studying the present Hebrew and Greek texts and the relationship between them (Soisalon-Soininen, 1987b: 18). This relationship was influenced by a number of factors, two of which were the uncertain identity of both the *Vorlage* and the original translation. Some of the major influences on the shape of the relationship between the present texts are probably the style and intention of a single translator. Other influences, e.g. genre of the source text, different parts of a book being translated at different times, the condition of the original manuscripts, and, possibly, translation work done by students under supervision of the translator,

⁴ For example, how can "the division into elements or segments, and the sequence in which these elements are presented" and "the quantitative addition or subtraction of elements" be measured by using only a single line or verse of the text of the Bible? If only a small section is examined, that portion may be more or less literal than the rest of the larger extent of the section, as Barr affirmed in his viewpoint that a larger section can contain both literal and free translations (1979: 281).

⁵ For example, see the works of Galen Marquis in 1986 and 1987.

⁶ Aejmelaeus (1991: 34) pointed out, however, that the Greek text should not be interpreted according to the perceived intentions of the translator. The translator as a person continued, however, to play a major part in her reasoning (1991: 24-25).

should not be forgotten. All of these would leave their mark upon the form of the translation, yet only some could be counted as reflecting the style and intention of the translator. This author is therefore confused as to how findings could be claimed to relate to the intentions and style of a translator when it is dubious that the style of that person could positively be identified amongst the other factors contributing to the translation. In fact, in reading the work of this school, the author encountered no attempt to either define or identify the characteristics of a relationship between a source and a target text in a translation that would relate unequivocally only to the style of a translator.

A second problem experienced with the approach followed by this school is the identification of the different translation units. While excellent work was done on applying grammatical criteria to the study of the translation technique, the findings were described using the traditional units of the LXX. No attempt was made to progress beyond the classification of the LXX in different books and, maybe, the bisection of different LXX books. The researchers of this school contented themselves with proving or disproving old classifications of the different LXX books (e.g. Aejmelaeus, 1982: 168 f.).

Finally, the author would have liked to see a consolidation of the very comprehensive results published by this school. Aejmelaeus (1982: 163) in fact pointed out that some of the results obtained from different criteria within the grammatical approach differed, but did not use the data to come to some satisfactory solution. It could not be helped feeling that enormous benefit could have been gained from the advice and input of a qualified statistician in this regard. Then, too, the value of the results published by this school could have been enhanced enormously if some advanced statistical procedures had been used to describe the data published.

The way in which the grammatical aspects were researched within a context wider than just the morphology and choice of lexical equivalents stands as a good example to the rest of the research community. Soisalon-Soininen (1987a) argued in favour of combining the research fields of the translation technique and the syntax of the LXX. In this the author can only support him, but would like to suggest that the translation technique of the LXX should be viewed within a scope encompassing syntax, semantics, grammar, lexicography, morphology as well as the criteria used by Barr and the Jerusalem School. Such an approach is now possible using statistics, if the pioneer work of Andersen and Forbes could be repeated for translation technique.

1.1.1.3 The Jerusalem School

Tov (1987a: 153) clearly distinguished between the translation technique as a process and the Greek-Hebrew equivalents that were the results of that process. In fact, Tov (1987a: 154) described the translation technique followed, the vocabulary and the conceptual ability of the translator as only some of the attributes of the translation.

In a later work Tov argued regarding translation technique: "In the professional literature that term has become a *terminus technicus* denoting the special techniques used by translators when transferring the message of the source language into the target language. This includes the choice of equivalents, the amount of adherence to the Hebrew text, the equivalence of Greek and Hebrew grammatical categories and etymological exegesis. It also refers to some of the conditions under which the translation was written and about which information is included in the translation itself: cooperation between translators and use of earlier translations. In this definition revisional activity is not mentioned, although that, too, could be included under the heading of translation technique." (1987b: 339). It is therefore clear that in the definition of translation technique, Tov did not only refer to the activities of the translator. He also took into consideration the information in the translation itself and the subsequent transmission of the translation to the present day.

Tov (1981: 50-51) maintained his emphasis on the translation, rather than the translator, as the object of study. However, it must be pointed out that, in his discussion on non-literal translation units, the translator is still held responsible for any exegetical translations (Tov, 1981: 62). It is not clear how Tov would have separated the influences of the translator from that of the other contributing factors when possible exegetical translations were encountered. For instance, when studying a specific verse of the Bible, the researcher cannot be certain that either the source text or the target text of the translation of that verse is available in order that translation technique can be determined by measuring the relationship between the two original texts (Tov, 1981: 52). The separation of the intention and actions of the translator from the effects of textual recension and textual transmission using the text editions at present available remains one of the key issues in the study of the LXX. In defining his "five criteria for the characterization of literal renderings" (1981: 53-63), Tov definitely used the versions of the Hebrew and Greek texts in existence today as the main sources of information.

It seems therefore that in practice Tov used the definition given above. When he used the term "translation technique" in his 1981 work, the emphasis was on the relationship between the texts, and not on an attempt to identify the translator and his style. Not only did Tov not measure the translation technique by explicitly excluding factors other than the style of the translator, but he did not explain how the markers that indicate only the style of the translator could be identified either.

This trait was continued in his using the CATSS data base. In the manual to the CATSS data base, Tov (1986: 42) mentioned that the literalness of translation may be found in certain criteria. No mention was made in this work of any distinction between the intention and actions of the translator and the element of uncertainty introduced by the textual transmission process.

In the work authored jointly by Tov and Wright (1985: 149-150), the meaning of the term "translation technique" as used while examining a computer data set of the CATSS data base can be clearly defined: these two scholars pointed out that studies of the technique of translation and that of text-critical evaluation are closely connected in practice. It was argued that a knowledge of the character

of the translation will help a scholar to distinguish between the exegesis of the translator and a different *Vorlage* when a deviation of the LXX is being studied. They then continued: "It is necessary to know whether the translation⁷ is considered literal, or its opposite ..." The emphasis clearly was not on the intention of the original translator, but on the result of the translation and subsequent transmission process. It is this resulting text that was measured as to whether it is literal or free.

1.1.1.4 Wittstruck

In his Ph.D. dissertation, T.K. Wittstruck (1972: 3-4) used the term "translation style" regarding the translation technique of the LXX. He clearly mentioned two problems, viz. the identification of the *Vorlage*, and the translation style that had been used by the original translator to create the Old Greek. Only when the correct translation style had been identified could the scholar use the LXX to retrieve the *Vorlage*.

The translation process was discussed, with the emphasis on the decisions the translator had to make regarding the style of translation, lexical equivalents, grammatical equivalents and idiomatic translation of sections of the Hebrew text (Wittstruck, 1972: 7-13). That these selections by the translator were seen by Wittstruck as conscious decisions can be seen by his choice of words when describing the activity of the translator: "decide" and "treat" (1972: 13 and 17). These decisions supposedly had a direct influence on the form of the resultant translation.

It was, so it may seem, important to Wittstruck (e.g. 1972: 42 f.) that the *Vorlage* be determined before the translation technique could be assessed. In his discussion from page 13 to 16 of the dissertation, however, Wittstruck made no attempt to distinguish between possible differences between the MT and the LXX caused by the transmission of the versions and those caused by translation technique. In fact, it appears as if the two concepts of the actions of the original translator and the changes occurring in the translation during its transmission were merged. Although Wittstruck (1972: 3) clearly acknowledged that the *Vorlage* of the LXX is an unsolved issue, the translation style was directly attributed to the decisions and actions of the original translator. He discussed the translators and their styles and, directly afterwards, discussed the classification of the LXX books on the basis of translation styles observed in the present versions of the books (Wittstruck, 1972: 17-18).

An additional problem was experienced with the 1972 dissertation: from page 389 onwards the relative value of the different Greek manuscripts was evaluated using the translation technique observed by Wittstruck. While it cannot be denied that the value of the different manuscripts can be measured, this should not take place in the way described by Wittstruck. The translation technique was measured by Wittstruck (1972: 42-43) by assuming that the Old Greek could readily be identified. According, however, to a previous chapter in his dissertation (Wittstruck, 1972: 3-4), determining the translation

⁷ This author's underlining.

technique should lead to the correct *Vorlage* being determined. So which should come first? Wittstruck was forced to assume that he was able to determine the correct Old Greek text, after which the translation technique was determined, leading, in turn, to the identification of the most authoritative manuscript(s). This is clearly an error of *petitio principii*, probably caused by the issues mentioned above being confused. The interactive fashion in which conclusions regarding both the *Vorlage* and the translation technique **should** be reached was described by A. Aejmelaeus (1987: 60, 61 and 89).

1.1.1.5 Sailhamer

Another doctoral dissertation that deserves attention is that of John Herbert Sailhamer (1981). As in the previous studies discussed above, Sailhamer made no major effort to establish the text of either the *Vorlage* or the Old Greek before an attempt was made to identify the translation technique of the LXX.

In his introduction Sailhamer mentioned the importance of the quest for the "... reconstruction of the earliest stage of the text of the Old Testament." (1981: 8). He proceeded along the now familiar path of pointing out the necessity of finding the "... practice and technique of each of its translators" (1981: 9).⁸

The original translation technique can only be recovered if the texts used to identify the translation technique are representative of the texts originally used in the translation process. At no stage, however, could this researcher find an attempt by Sailhamer to identify elements of the *Vorlage* and the Old Greek **before** attempts were made to determine the translation technique of the verb in the relevant Psalms. Moreover, the methodology to be followed when doing research on the LXX was formulated as two points: the translation technique had to be determined first (presumably by comparing Greek and Hebrew texts), after which the study could proceed towards evaluating the non-agreements with the MT (Sailhamer, 1981: 6-7). This author does, however, agree with Sailhamer that these two examinations should never be isolated from each other.⁹ Instead they should take place simultaneously.

In the conclusion Sailhamer expounded at length about the style of the translator (1981: 213 f.). At no time, however, did he explain how the Old Greek (the product of the work of the translator) is to be linked with the texts that he examined in order to determine the translation technique. Neither did he

⁸ The user should note, however, that Sailhamer (1981: 9) presumed a single translator, and a single translation technique, for the book of Psalms. No attempt was made to identify different translation units in the book of Psalms. This is in contrast to his statement that "Each book and each section of each book must be assessed and described on its own." (1981: 9).

⁹ Strangely enough, Sailhamer (1981: 7) recognized this fact, but then chose to formulate his methodology in such a way as to give preference to determining the translation technique. In his 1981 work, however, he never practised the "hermeneutical circle".

exclude from his data those elements that could possibly reflect a Hebrew *Vorlage* differing from the MT.

1.1.1.6 Examining the Study of Translation Technique in Modern Texts

In the quest for methods to analyse translation technique, the author thought that it might be productive to look at some of the work done in linguistics in general regarding the measuring or quantification of the style of authors. Unfortunately, neither of the two directions investigated could offer a solution for the problem at hand.

- This author is of the opinion that the translation of a document is an activity that is just as complex and creative as that of an author of an original work.¹⁰ Is it then not possible to utilize the instruments that are used to identify the style of different authors to measure the translation technique of a specific translation unit? Readers of journals such as the *Journal of the Royal Statistical Society* and *Literary and Linguistic Computing* would have noticed frequent attempts to identify an author of a specific work by seeking a certain characteristic that was unique to the author's style of writing.¹¹ In these attempts much emphasis was placed on those criteria that could be measured by quantitative methods.¹² In particular, different researchers attempted to identify those characteristics of an author's writing over which he/she was supposed to have had no control. These characteristics should be determined in the subconsciousness of the author, and are supposed to be unique to the work of the author. Examples are the length of sentences, length of words, choice of vocabulary etc.

However, the student of the translation technique of the LXX is primarily interested in the style/nature/character of the translation itself, not in the identification of the translator as a person. As was pointed out above, the translation is all that is left to the student of the translation technique of the LXX. The primary search is for the extent and character of the translation unit in order to allow retroversion of the translation. A translator may have used more than one translation technique,¹³ and, especially if schools had been established to translate texts, more

¹⁰ "(The translator) cannot only simply match words from a dictionary; he must in a real sense create a new linguistic form to carry the concept expressed in the source language." (Nida, 1964: 145).

¹¹ See, for example, Smith, 1987.

¹² B. Fischer (1970: 297, 301 f.), with some justification, took exception to the criteria being chosen on the basis of their results being interpretable by computers.

¹³ For example, J.B. Casagrande proposed that the purpose of the translation can determine the translation technique and stated: "... the same material approached with different aims may yield somewhat variant translations" (1954: 337).

than one translator could have followed the same translation technique. Passages that have the same translation technique could have been translated by 10 different translators. The retroversion of the Old Greek in order to identify the *Vorlage* does not depend on the identification of the translator as a person, but on the identification and complete description of the translation technique.

In addition these approaches do not give a full description of the style of the author, but identify the one uniqueness of that style that would allow the scholar to identify the author as a person. As a complete description of the style of translation is needed for the researcher of the LXX in order to do retroversion, these techniques could not be utilized in this study.

- Secondly, this author investigated some attempts to evaluate the correctness of present-day translations.¹⁴ It was found that different evaluation techniques are used, e.g. back translation,¹⁵ bilingual responses,¹⁶ and item response theory.¹⁷ All these approaches have one common denominator: both the source text and the target text of the translation remained available for comparison. However, in the case of the study of the translation technique of the LXX the precise identity of **both** those texts is unknown, and cannot be taken for granted, as in the case of modern translation. Ultimately, this approach was deemed barren.

In the final analysis, none of the publications consulted were as relevant to the problem at hand as those of R.E. Bee or the joint work of F.I. Andersen and A.D. Forbes.

1.1.2 A Different Approach

It may seem as if the author discussed all the shortcomings of previous works without making any concrete proposals himself. A different approach to the problem will therefore be proposed. Most of the previously discussed works had problems when the definitions had to be implemented in practical

¹⁴ One of the most relevant articles in this regard is the one written by E. San Juan in 1990. Also see Casagrande, 1954: 337 f.

¹⁵ The translation is translated back again to the original language, after which the original and the target of the retroversion process are compared. The closer the two are, the better the original translation. (If, of course, the original translation was done well, but the retroversion was done badly, this will reflect negatively on the standard of the original translation!)

¹⁶ The original and the translation are commented upon by bilingual examiners using the same standard tests on both documents. The results of the tests are then compared. The more identical the results, the better the translation is deemed to be.

¹⁷ In this regard, see Hulin et al. 1983: 185 f. This work was based on a practical project and is, as such, of great value. It took into account the different cultures involved in the translation process and made use of both modern linguistics and advanced use of statistics in the analysis.

research. An attempt will therefore be made to formulate definitions in such a way that they can be applied in practice, not only regarding the present research, but also when simple searches are done on the CATSS data base by other researchers.

Should the researcher endeavour to examine the intentions and actions of the translator, the methods discussed in section 1.1.1.6 should be used. The methods in that section require, however, that both the original source text and the original translation be available. When the translation technique of the LXX is examined today, however, all that is in fact available to the scholar are two groups of texts of which can only be said that unidentified parts of the *Vorlage* and Old Greek are contained within them. Even where the Old Greek can positively be identified, the *Vorlage* must also be identified before a comparison can be made between the two. Identification of the original translation technique is dependent on such a comparison. Researchers have a lot of problems identifying the complete texts of both the *Vorlage* and the Old Greek of even a single chapter of a book of the Bible. Recovering both texts of a whole book of the Bible seems to be an almost unobtainable goal.

If the two texts cannot be identified in their totality, representative data must be obtained in order to gain a reliable impression of the translation technique.¹⁸ The obvious solution is to turn to that which is available, viz. the present MT and LXX texts, and to use a method that could identify a representative sample data set. It is possible to examine the MT and the LXX, and to determine the relationship between them.

When "translation technique" is measured using the CATSS data base, as it is in this study, it should be mentioned in all fairness that it is in fact the **relationships between the two texts** in that data base that are being measured:

- The researcher could never be quite sure what caused a certain Hebrew word or phrase to be translated in a certain way. **Different catalysts** could have acted upon the translation process, of which the conscious translation technique of the translator is only one. Many factors, including conscious translation technique, subconscious translation technique, transmission history of the Greek text, and the transmission history of the Hebrew text (including the vocalization of the text by the Masoretic schools), contributed to create the present texts.

¹⁸ "Representative data" implies that the sample of data used should accurately reflect the original data set in all its facets. A lot of care should be taken when compiling the sample, as the translator can vary his translation technique, and all the variations and frequencies of their occurrences have to be represented. (In this regard, see Barr, 1979: 281; Gooding, 1975: 116; Tov, 1981: 50-53 and Tov and Wright, 1985: 149-151.) This implies that large segments of the Greek and the Hebrew texts have to be identified as respectively the Old Greek and the *Vorlage* - quite a daunting task, if possible at all.

- It is not at all certain that the **Hebrew text** used in the CATSS data base is in fact the source text of the translation of the LXX. In view of the amount of research taking place to reconstruct the original source text, and in view of the subjective nature of this research, it can be said with some impunity that the identification of the source text of the Old Greek translation is very far from being accomplished. In fact, the extent and letter of the source text are major goals of most of the text-critical research projects at this stage.

Whether this goal could be reached at all is doubted by as august a researcher as Anneli Aejmelaeus. She went as far as to say "... it is a text that is lost to us for good and all." (1987: 58). She argued that in order to restore the *Vorlage*, both the original Greek translation and an acquaintance with the translation technique used are required.

It should be noted that the *Vorlage* of the LXX was unvocalized, as is the MT column in the CATSS data base.

- Fortunately, the present-day researcher has access to some excellent tools when dealing with the search for the **original Greek translation**. In this regard, one can make good use of the Göttingen edition, the Rahlfs edition and the Brooke-McLean edition. There can be no question, however, that the text of the original translation has not been identified in a conclusive manner for an extensive corpus. The Greek text used in Column A in the CATSS data base cannot be called the Old Greek by any stretch of the imagination (Tov, 1985b: 232 and 1986: 16).
- The researcher using **statistics** to do research on the translation technique of the LXX has to deal with a catch-22 situation: 1. If the source text of the translation and the original translation can be identified accurately, it may be possible to identify the translation technique.¹⁹ 2. If the translation technique and either the Old Greek or the *Vorlage* are known, it may be possible to reconstruct the original version of the other text from the information available. Unfortunately, all three contributors²⁰ to a possible solution are unknown, leaving us with quite a problem. In the

¹⁹ Working with approximate texts is making do, but is not always satisfactory. It is quite clear that, in order for a researcher to do an accurate retroversion of a specific word or phrase, the translation technique should have been determined very accurately, as free translation equivalents could sometimes be found in the middle of the most literal translation (Gooding, 1975: 116). And a very accurate translation technique is in turn dependent on accurate texts.

When one is working on the level of whole books, small variations in translation technique do not matter that much, but retroversion per definition takes place on element level. And on this level oscillations in the literalness of a translation may very easily lead to a wrong retroversion if only the broader translation technique is taken into account.

²⁰ That is, the translation technique, source text of the translation and target text of the translation.

research of translation and translation technique in modern languages, two of the variables (the source and target texts) are available.²¹

In short, the CATSS data base contains one Hebrew and one Greek text, placed in different columns in a parallel alignment.²² The relationship between the two texts has been defined in such a way that the translational source-target aspect is only one of the perspectives described in the alignment, and that other perspectives, e.g. the transmission history of the texts, can also be accommodated.

For this study, the author had to define the term **translation technique** as follows:

- The term translation technique in this study describes the way in which the translator rendered the Hebrew *Vorlage*, creating the Old Greek in the process. The present measurement of translation technique, however, takes place after both texts underwent substantial change during their transmission. The texts used in the analysis are the end results of the whole transmission process.
- It is therefore clear that, although it may predominantly be the case, it is not to be taken for granted that the source text of the translation, the *Vorlage*, is the same as the Hebrew text used in the CATSS data base in all aspects.
- It is also clear that it is not assumed that the target text created in the translational activity, the Old Greek, is exactly the same as the text contained in the Greek column of the data base.
- Finally, it must be clear that a new (target) text, created during a translational process, is influenced in many ways, of which conscious translational technique, subconscious translational technique, mistakes, shifts in technique, different translators for different parts of the book and the possible passing of a considerable amount of time between the translation of different parts of the book are only a few of the factors that could determine the character of the translation.

To conclude, the term translation technique as used in the rest of this dissertation should be seen as encompassing all of the above. The author will attempt to describe the complex relationship between the two texts contained in the CATSS data base, and will use this term to designate this relationship. From this statement, it follows that the terms MT and LXX, when original research in this study is described, should also be regarded as nomenclatures for the texts in the CATSS data base.

It should be obvious from the preceding discussion that the definition of **translation unit** may be formulated as follows:

²¹ See section 1.1.1.6.

²² Important variants to these texts are also indicated in the data base. See Tov, 1986: 7-10 regarding the markers G and {v}.

- It is that unit of text that seems to reflect a homogeneous translation technique or style of translation, as measured by a specific criterion.
- This automatically implies that different criteria may indicate different translation units in the same portion of text. Should different translation units be indicated, future research should also try to determine the reason behind both differences and similarities in the indication of translation units.
- A major change in translation technique, indicating a new translation unit, can be caused by a number of factors. Amongst them are change of translator, change of genre of the source text (Casagrande, 1954: 335-337 and Aejmelaeus, 1982: 167) and different sections being translated at different times.

Is everything then lost? Should the scholarly community give up on the quest for the identification of *Vorlage* and the Old Greek? Fortunately, if the definition above is accepted, one of the most powerful tools of modern science, statistical analysis, can lend a helping hand. In order to use statistical analysis, however, it is always necessary to make the sample data sets used in the analysis as large and representative as possible.²³ It also proved to be necessary to feed the statistical program different versions of the same data set and to experiment in order to identify the version of the data set, and the manipulation of that data set, that supply the most valid answers.

1.2 Using the CATSS Data Base and the Computer

While some criticism has been levelled at this and associated research regarding the fact that the CATSS data base is used to supply the data for the study, the following should be kept in mind. In 1987, when this study commenced, the CATSS data base was the only computer data base in existence in which the Hebrew text and the Greek text were both in computer-readable form and in which the two texts were aligned with each other according to a strict methodology. This data base also had some annotations and explanations describing different text-critical phenomena.

²³ The accuracy of statistical analyses depends on the data on which the calculations are performed:

1. The data, if they cannot include all the instances (the "whole population" or "universum") of occurrences, must reflect the character of that population accurately (Sprenst, 1977: 59).

2. Valid data must be available in order to do accurate computations. For example, if one would like to establish which country in the world plays the best gridiron football, the answer would be obvious - the United States of America. However, if the answer could be deemed valid, the question could not. The USA is the only country in the world with such a massive infrastructure for gridiron. Gridiron in other countries cannot be measured on the same scale. To come to the point, one should be very careful about not comparing apples with pears. In the research regarding translation technique, this turned out to be a very important methodological point.

The author duly recognizes that, using only one text from every version, as in the case of the CATSS data base (Tov, 1985b: 222), may imply that the texts used may not represent the *Vorlage* or Old Greek in the best way possible. However, this data base is a very important tool for text-critical research, and was, at that stage, the only one available.²⁴

In order to use statistical programs, and in order to use data sets of the extent and complexity of the CATSS data base, it is imperative to use the computer. Not only do the statistical programs run on computer, but the calculations involved in the evaluation of each one of the criteria²⁵ would have taken this author literally years to complete by hand.

1.3 Using Statistical Analysis

When statistical analysis was first used to unravel the mysteries of the biblical texts,²⁶ it was sometimes thought to be the solution to most of the problems encountered in the study of biblical texts, and a lot of other problems in the sphere of biblical studies into the bargain. This led to statistical analysis being used in every which way. The scientific basis of some of these studies is highly suspect, and many studies did not bother to formulate or follow a good statistical methodology before commencing with research.²⁷

Some valid questions were subsequently asked about the applicability of statistical analysis to biblical studies. In particular, Fischer criticized the analysis of style using the computer and statistical analysis.²⁸ He does, however, deem the use of computer and statistical analysis in the compilation of

²⁴ It is the author's opinion that the CATSS data base and data bases derived therefrom (see the work done by Cook and Nieuwoudt in Stellenbosch) are still the most powerful computer tools available in this field of research.

²⁵ See section 2 of this chapter for all the calculations involved in evaluating each of the criteria.

²⁶ One of the best-known publishers of research based on statistics is R.A. Martin. However, the present author would like to include word counting and the comparisons of the results thereof as examples of basic statistical analysis. This implies that statistical analysis relating to biblical texts may be very old indeed!

²⁷ As will be explained and demonstrated later in this work, even such supposed innocent activities as word counting may deliver very misleading results when a good statistical methodology is not followed. For example, presuppositions by researchers must be accommodated by the statistical methodology, or it may lead to false results. An example in this field of study is the acceptance that the work of translators and borders of translation units should coincide.

²⁸ B. Fischer (1970: 300, 301) was not, however, completely correct. It seems as if he confused the issues of statistics and computers in this article. Much of the criticism levelled at the computer

text-critical apparatus and the structuring of the hierarchical dependencies of different families of manuscripts upon one another as important.

The study of the translation technique of the LXX using statistical analysis could benefit from the acquaintance of the researcher with the modern research done on the style of authors. It is submitted that the style of a translator is just as complex, with as many interwoven aspects, and as difficult to analyse comprehensively as is the style of the original author (Nida, 1964: 145). The translator is also working creatively, although he has the text of another author according to which he may work. It is his prerogative alone to translate literally or non-literally, using his own choice in the selection of lexical, semantic, syntactic and grammatical equivalents of the original text. It is this comprehensive newly created entity (of which the quality and nature has been described using "instinct" by researchers in the past) that must now be described in a quantifying manner using statistical analysis.

It is readily acknowledged by this author that the segmentation of translation style into different factors that could be analysed by statistical analysis may be the most difficult aspect of using statistical analysis for determining translation technique.²⁹ Not only will a researcher have to define these factors in such a way that the style of the translator is comprehensively covered, but it must also be possible to compare the different results of the different factors. The results have to be presented in such a format that it is possible to combine them in order to render them comprehensible and usable in future research. While the author in this study depends mainly on the identification of factors by other researchers, an attempt will be made to supply a possible solution to the problem of measuring these factors and using the results of different factors simultaneously.

It is suggested, however, that the solution to the question of the style of the translator could not be attained without using statistical analysis, owing to the massive amounts of data that have to be processed, and to the need for the results to be presentable in a measurable and quantifiable way. It is our opinion that, when a sound statistical methodology is followed, statistical analysis can play a crucial part in the study of translation technique. By using an approach that utilizes the results of the different relevant factors, it will be attempted to curb the fragmentation of the subject field into different subdisciplines that function in isolation from one another. It is the contention of the author that, when determining translation units and translation technique, it should be possible to accommodate all possible input, as each of the different approaches can render a unique contribution to possible solutions.

It is important, however, to realize that this statistical methodology should be planned with the aid of a statistician who is well versed in linguistics in general and the problem of biblical studies in particular.

should have been addressed to the use of statistics. The use of a computer does not automatically include the use of statistics, and vice versa.

²⁹ In reply to the article of B. Fischer of 1970.

The success of the work by Anderson and Forbes (1986) illustrates that this is indeed possible.³⁰ In the rest of the study, it will be attempted to make a case in point.

It may even be possible that, by approaching the questions of *Vorlage*, Old Greek and translation technique using statistical analysis, much more could be learned of the first two subjects than now thought possible by this author.

³⁰ It should also be kept in mind that, for social sciences in general, such interdisciplinary teamwork could render results not otherwise possible.

2. Methodology Followed in this Study

In this section the aids employed to conduct this study, as well as the method according to which they were employed, will be discussed in detail. The first two sections will deal with the computer and statistical methodology of the study, and are intended for the curious. The third and fourth sections will explain exactly how the results were obtained. As it is one of the major objectives of this study to make a contribution to the methodology of research, those sections may contain some of the most important results of this research project.

2.1 The Computer and the Data

A number of technological aids were used in this research project. The reasons for using the computer, statistical analysis and the CATSS data base have been outlined above.

2.1.1 The CATSS Data Base

The author visited the CATSS project at the Hebrew University of Jerusalem in 1987. At that stage the data of the CATSS project were manipulated mainly using the mainframe computer of the university.³¹ The data consist of three main files, containing respectively the parallel alignment, the Hebrew morphological analysis of Maredsous and the Greek morphological analysis compiled in Philadelphia and Jerusalem (Tov, 1985b: 221-223). The parallel alignment consists of three columns in a text file, containing respectively the Hebrew text, the Greek text and Column B (Tov, 1987: 96 f.).³²

All research for this project took place, however, on an IBM-compatible personal computer (or PC), with corresponding software. The three main files of Deuteronomy were downloaded to the PC and restructured.³³ The full account of this restructuring has already been published (Nieuwoudt, 1989b: 255-256), and will not be repeated in detail.

It was decided to convert the format of the data to that of a relational data base structure in order to use the power inherent in such a structure. In this structure, the MT, LXX and Column B columns of

³¹ For more information, see Nieuwoudt, 1988b, 1989a and 1989b.

³² Column B is used for remarks, suggestions, text-critical markers or signs and suggestions for retroversion.

³³ In the conversion process, the author depended heavily on aid rendered by Ronit Shamgar and Galen Marquis.

the original data base file were separated and put into different fields in one file. The words or elements of both the Hebrew and Greek texts in the parallel alignment were linked to the corresponding morphological analyses, kept separately in other files, using relational technology. As many of the lines in the parallel alignment consist of more than one Hebrew element and more than one Greek word, most of the possible relational relationships discussed below had to be utilized.

A relational data structure allows the linking of elements in different data files to be done between the different files on a one-to-one, one-to-many, many-to-one, or many-to-many basis (Nieuwoudt, 1989b: 256). This advanced level of manipulation of the data was necessitated by the fact that one line ("row" in computer jargon) in the parallel alignment of the CATSS data base often contains more than one word in both the Hebrew and Greek columns. The fact that the Hebrew and Greek words (or phrases - whatever the case may be) appear on the same line in the original data file indicates a relationship of formal equivalence between the relevant words/phrases in the two languages. By presenting these multiple word equivalents in the two languages in a single line of the alignment, the CATSS team indicates that it is impossible to break down the formal linguistic unit any further. Instead of specific Greek words being proffered as translations of specific Hebrew elements therefore, one often finds that Greek and Hebrew phrases have been aligned with each other on a single row of the parallel alignment. The relationships between the different words/elements on the same line of alignment may therefore be of quite a complicated nature.³⁴

The final data base on the PC consists of the three files, containing respectively the parallel alignment, the Hebrew morphological analysis and the Greek morphological analysis. All the files were subdivided into specific fields, and indexed. The indexes of the different files serve as relational links between the files.

³⁴ The reader should keep in mind that much of the research done in biblical languages takes place on word level. For example, the grammatical analyses of both the Greek and Hebrew texts, as appended to the parallel alignment, are based on single words or elements.

This anomaly (the main alignment sometimes being phrase-based and the grammatical analysis always being word or element-based) would prove to be a major problem for the researcher in chapters 3 and 4.

Reference Hebrew	Column B	Greek
0229 K/) \$R		KAQW\ S
0229 (&W		E) POI/HSA/N
0229 L/Y		MOI
0229 BNY		OI(UI(OI\
0229 (&W		HSAU
0229 H/Y\$BYM		OI(KATOIKOU=NTES
0229 B/&(YR		E)N SHIR
0229 W/H/MW)BYM		KAI\ OI(MWABI=TAI {?}
0229 H/Y\$BYM		OI(KATOIKOU=NTES
0229 B/(R	=:B(RW(R .w	E)N AROHR
0229 (D) \$R		E(/WS
0229) (BR		PARE/LQW
0229)T H/YRDN		TO\N IORDA/NHN
0229)L		EI)S
0229 H/)RC		TH\N GH=N
0229) \$R		H(\N
0229 YHWH		KU/RIOS
0229)LH/YNW		O(QEO\ S H(MW=N
0229 NTN		DI/DWSIN
0229 L/NW		H(MI=N

Figure 1: A Printout of a Verse in the Parallel Alignment of the CATSS Data Base³⁵

NO	VERB-TYPE	PN	KQ	RT	POS	LEM	GRAM	NU	TIME	PERS
<u>STAT</u>										
1028						W K*:/K*:M,W%				
1028						W):_\$;,R				
1029	10				(&H	V (=&=,H	K		PER	3P

³⁵ The transliteration system used is that of the CATSS data base. See Appendix 1 and Appendix 2 for the transliteration tables.

1030			W L:/L=M,W%				
1031		BNH	S B*&,N	M	P		C
1032		M	S (&&=,W	M	S		
1033 50			A H_				
1033 50		Y\$B	V Y=\$_,B	K		PAA	MP
1034			W B*:				
1034		M	S ?				
1035			Z W:				
1035			A H_				
1035		M	F MW%)=B.,Y	M	P		
1036 50			A H_				
1036 50		Y\$B	V Y=\$_,B	K		PAA	MP
1037			W B*:				
1037		M	S (=,R				
1038			(DH W (_,D				
1038			W):_\$_;,R				
1039 20		(BR	V (=B_,R	K		IMF	1S
1040			W)&,T				
1040			A H_				
1040		M	S Y_R:D*&,N				
1041			W);,L				
1042			A H_				
1042			)RC S);,R;C	B	S		
1043			W):_\$_;,R				
1044		M	S YHWH	M	S		
1045			)LH S);;L%H.,YM	M	P		
1046 50		NTN	V N=T_,N	K		PAA	MS
1047			W L:/L=M,W%				
1048			Z W:				
1048			E L%,)				

**Figure 2: A Printout of the Enhanced File of the Hebrew Morphological Analysis
of Deut. 02:29³⁶**

³⁶ The author added the "Time" and "Person" of the verb to the Hebrew morphological analysis, as these aspects had not yet been documented in 1987.

NO	VERB-TYPE	POS	A	B	C	D	F	LEMMA	
1028		C						W(S	KATA
1029	AIf	VAI	A	A	I	3P		POIE/W	
1030		RP	D	S				E)GW/	
1031		RA	N	P	M			O(
1031		N2	N	P	M			UI(O/S	
1032		N	G	S	M			HSAU	
1033	PP	RA	N	P	M			O(
1033	PP	V2	P	A	P	NP	M	OI)KE/W	KATA
1034		P						E)N	
1034		N	D	S				SHIR	
1035		C						KAI/	
1035		RA	N	P	M			O(
1035		N1M	N	P	M			MWABI=THS	
1035		O							
1036	PPc	RA	N	P	M			O(
1036	PPc	V2	P	A	P	NP	M	OI)KE/W	KATA
1037		P						E)N	
1037		N	D	S				AROHR	
1038		C						E(/WS	
1039	ASk	VB	A	A	S	1S		E)/RXOMAI	PARA
1040		RA	A	S	M			O(
1040		N1M	A	S	M			IORDA/NHS	
1041		P						EI)S	
1042		RA	A	S	F			O(
1042		N1	A	S	F			GH=	
1043		RR	A	S	F			O(/S	
1044		N2	N	S	M			KU/RIOS	
1045		RA	N	S	M			O(
1045		N2	N	S	M			QEO/S	
1045		RP	G	P				E)GW/	
1046	PI	V8	P	A	I	3S		DI/DWMI	
1047		RP	D	P				E)GW/	

Figure 3: A Printout of the Greek Morphological Analysis of Deut. 02:29

It should be noted that the conversion process of the parallel alignment of Deuteronomy, including the enhancement and checking of the data, took the most of three months to complete. Owing to this fact,

no updates on the data were downloaded, as the whole process would then have to be repeated. All the data used therefore date from May 1987. Since then, some of the shortcomings of the data that will be mentioned in the rest of the dissertation have been corrected, the data files have been updated to a considerable extent, and a lot of new information has been added.

The three data files were enhanced with annotations by the author. Using the technology of Implied Fields,³⁷ a single data base file³⁸ was created, containing all the relevant information about the verb in Deuteronomy. The new data base consists of three fields: No (line number in the parallel alignment of Deuteronomy), Ref (text reference - the first two figures indicate the chapter and the last two figures the verse) and TC (this field contains all the other data structured in Implied Fields). The three main components of the original data bases were incorporated within the TC field. That field now contains the columns of the CATSS data base, "Hebr", "Greek", "Col B", while an additional field, "TC"³⁹, was added.

³⁷ The author has already published an article (Nieuwoudt, 1991) in the computer domain regarding the use of Implied Fields. This format of storing data has four major advantages: the data is stored in a very compact way on a magnetic disk, the fields can be of variable length, and the user can insert his/her own fields in the data structure simply by using the name of the field and two square brackets. Finally, these fields can be nested, as is the field LEXICAL in the example (figure 4) within the superfields TCNOTE and TC.

The TC field is a memo field within a dBASE data base file. Using a user-defined function called `CLAUSE()`, the contents of any of the implied fields, even including subordinated subfields, can be extracted from the memo field.

³⁸ A single data base file is a lot faster to use and to search than a relational structure containing three data base files. In order to create this single file, however, the information in the original CATSS files had to be linked with relational technology. Only after this linking of data was it possible to create the file.

³⁹ The subfield "TC" was used to accommodate some comment fields and work fields.

```

No: 5481
Ref: 1215
TC:
Hebr[HeWord[Y]KL/NW], HeRT[ ]KL], HeLem[ ]=K_,L], HeV[Ka01;  ],
HeP[3MS]]
Greek[GrWord[FA/GETAI AU)TO\], GrLem[E]SQI/W], GrV[FIC],
GrP[3S]]
Col B[ ]
TC[ Problem[], TCNote[Function[], Lexical[], Syntactic[],
Genre[], Textual[]]
PERS[ PUse[], PPers[], PAGree[]]
TIME[ TUse[], TTime[], TAGree[]]]

```

Figure 4: A Record from the Merged Data Base⁴⁰

The reader who is intimately acquainted with the CATSS data bases will notice that some of the data in the figure above do not seem familiar. The data structure in which information regarding the Greek and Hebrew verbs is stored was altered to provide quick answers to searches, and data not required for this study, e.g. the *Vox* of the Greek verb, were deleted.

The author also added some information to the existing data bases, specifically regarding syntactical and grammatical data. The morphological analysis of the MT was enhanced by adding the "tenses" of the Hebrew verb and the person of the verb. Some elementary syntactical work was also done on both data bases. Notes indicating the constructions and lexical elements that occur in the same sentence as the verb were added to the description of the relevant verb,⁴¹ e.g. the **a01** indicated alongside the Hebrew verb in figure 4 indicates an Imperfectum with a *Waw* used in a copulative structure in the same sentence. The **c** alongside the Greek verb in the same figure reveals that the copulative *DE* was used in the same sentence as this verb.

⁴⁰ The bold typeface indicates the names of the physical fields in the data base, and the underlining the beginning and end of the main implied fields within the TC-field.

⁴¹ At first, it was planned to utilize the syntactical aspect in a more comprehensive description of the translation technique of the verb. Unfortunately, it appears as if that objective would only be attained after a lot of additional work has been done regarding the statistical methodology. That aspect was therefore abandoned as a goal of this study. The data remain available, however, for future research.

The files were not only used as they were defined, however. For each criterion, the most effective way of using the data had to be determined by way of experimentation. All the main data files were used, sometimes in isolation, sometimes in relational structures. Some experiments even required changing the structure of the data files. However, the experimentation usually paid off, sometimes rendering results far beyond the expectations of the author.

2.1.2 The Computer

After the three main data files of Deuteronomy were downloaded from the mainframe computer at the Hebrew University of Jerusalem, all the research was conducted on IBM-compatible PCs running MS DOS as operating system.⁴²

The computer used to do most of the data processing was an Intel 8086-based Olivetti M21 with a 20MB hard disk and 640KB of RAM. Later the author upgraded to an Intel 80386SX-based computer with 1MB of RAM and a 51MB hard disk.

Printing was done on a Hewlett Packard LaserJet III, and some of the graphs were plotted on a Hewlett Packard 7574 plotter.

2.1.3 The Software⁴³

Four software programs were utilized during the course of this research:

- All data manipulation, data processing, searches of the data base files, and related activities were performed using dBASE III Plus and dBASE IV version 1.1.⁴⁴ These software programs proved to be quite capable of handling the maltreatment they were subjected to. The data base files are large and complex and the search filters are equally complicated. Yet the programs normally completed tasks much quicker than expected, sometimes outrunning similar tasks on a crowded mainframe computer.

⁴² MS DOS is a trademark of Microsoft Inc.

⁴³ Most of the software packages used are licensed to the two educational institutions the author was studying at, viz. the University of Stellenbosch and the University of Pretoria. The other software was bought by the author.

⁴⁴ dBASE is at present a trademark of Borland International Inc.

- The data sets resulting from the searches done with dBASE were used for statistical analysis using Statgraphics versions 4.0 and 5.0.⁴⁵ This program can import and export dBASE data base files. Statgraphics was used for all the statistical analyses, excluding the generation and analysis of the random data sets,⁴⁶ as well as the generation of the graphs. It was found to be an extremely friendly and powerful program, and an excellent companion for dBASE.
- The dissertation was typed and formatted using MS Word versions 4 and 5.⁴⁷ This program was also used to generate indexes, tables etc.
- Finally, the reader will realize that a project such as this, with multiple copies of each data set, can consume prodigious amounts of hard disk space. This problem was overcome using ARC, a file compression utility that saved the day whenever programs ran out of disk space.⁴⁸

⁴⁵ Statgraphics is the trademark of Statistical Graphics Corporation. Portions of the software are licensed to STSC Inc., while the graphics drivers are copyrighted by Graphics Software Systems.

⁴⁶ The generation and analysis of the random data sets were done using dBASE IV. See section 2.3.2 of this chapter.

⁴⁷ MS Word is a trademark of Microsoft Inc.

⁴⁸ ARC is a trademark of System Enhancement Associates. It is available as shareware from most bulletin boards.

Other, more recent, compression programs proved to be more powerful than ARC. Two of the most popular are PKZIP and Stacker.

2.2 Statistics

The author attempted this study under the impression that it would be possible to educate himself in the use of statistics in linguistics.⁴⁹ While some progress was made, some key issues could not be resolved. One of the most important problems was to separate significant trends and the normal variation of a data set from each other.⁵⁰

Only when some help was sought from professional statisticians was it discovered how rare it is for statisticians to work in the field of linguistics. Discussions were held with academic personnel at the Hebrew University of Jerusalem, the University of South Africa, and the University of Stellenbosch. The author experienced major problems with the statistical analysis while working at the University of Pretoria, and approached a statistician of the Department of Statistics at that university.⁵¹ H.T. Groeneveld was so kind as to listen to the problem, study literature piled on his desk by the author, and suggest a number of possible approaches. Only when he warned about certain inadmissible methods used in this study and suggested much more valid and productive avenues did the author realize the full value of having a statistical expert on the research team of a project of this nature. Even taking into account the expert knowledge needed to utilize statistics correctly, it is still the opinion of the author that statistical analysis, when used in the study of translation technique in compliance with a scientifically based methodology, could render results not obtainable in any other way.

2.2.1 The Data

2.2.1.1 Dealing with the *Vorlage* and the Old Greek

Having discussed the problems of the identification of the *Vorlage* and the Old Greek, the author could be expected to come up with a solution to that problem before attempting to identify the translation technique. Unfortunately, no easy solution can be suggested, even using the seemingly magical tool of statistical analysis.

⁴⁹ While busy with his B.A. studies, the author took an elementary course in statistics in human sciences. In preparation for doctoral studies, an additional course in statistical methodology for postgraduate studies was attended. In this course the emphasis was on obtaining the correct data sets, using the correct statistical methods to analyse the data, and on the use of Statgraphics.

⁵⁰ Most data sets contain some degree of randomness (or variation). This problem is one of the key reasons for the development of statistics in the first place. (See Sprent, 1977: 11 f. for a more exhaustive explanation of the problem.)

⁵¹ See the Acknowledgements for more information about the services rendered by this Department.

The author had to resort to a well-tested statistical technique called representative sampling. This technique is based on a solution to the problem of working with very big data sets, e.g. the whole population of a country. Instead of doing polls using that whole population, the statistician will attempt to identify a much smaller group of people that reflects the ideas and opinions of the whole population accurately. If this could be accomplished, some insolvable problems could be avoided, e.g. polling the whole population on the outcome of a general election in the two days before the election.

The same problem was encountered in a different form when the author attempted this study. As has been repeatedly pointed out above, the character of the translation technique is unknown, as is the identity of both the source and target texts of that original translation. If a solution to two of the problems can be obtained, a serious attempt can be made to solve the third. With all three factors being unknown, however, the problem becomes very sticky.

If, however, the researcher can obtain a representative sample of the *Vorlage* and Old Greek, that sample can be used to calculate the translation technique. A serious attempt can then be made to establish the letter of the two original texts. Following this methodology, the chicken-and-egg problem of translation technique and original texts can be solved. This approach is also within the parameters suggested by Aejmelaeus (1987: 60) and Sailhamer (1981: 7) when they discussed this problem.

Either a bigger sample or the universum of the MT and the LXX may contain a lot of text-critical problems and impure data, that is data elements not originating from the *Vorlage* or the Old Greek. It is argued that it is best to use a smaller sample that is a good reflection of the true nature of the two original data sets. After eliminating from the sample all possible problematic words or elements, the statistical processes may be able to conjure up an image of the original texts and the relationship between them.

Valid samples of the Hebrew and Greek texts would be those samples that have the biggest chance of reflecting the *Vorlage* and the Old Greek. This author proposes that a sample that excludes all variants found in the same text tradition as the text being investigated should be a representative sample of the original text. In this way most of the problems originating from the transmission of the text should be excluded from the sample data sets, i.e. the sample data set of a text tradition should contain only those elements of the text on which all the manuscripts agree. When applied to the CATSS data base, it should consist of selections from the MT and the LXX columns of that data base.

A number of approaches could be suggested to exclude the variant readings from the sample data set. The two approaches mentioned below are the easiest to implement using a computer, statistics and the CATSS data base:

- The most complete results may be obtained from a search of all the manuscripts of the specific text family. If there is any indication that a word or element could have variants in other texts in the same text family, that word or element should be excluded from the sample. In order to keep

the sample as large as possible,⁵² it is suggested that variants that very obviously stem from transcription or transmission errors should not disqualify the word or element in the data base, but that the obvious element/word should be used. Using this approach, sample data sets of both the MT and LXX can be compiled.

- The second approach also utilizes the theory of obtaining a representative sample of the original texts.

Instead of examining each word of both the Hebrew and Greek texts, however, the researcher could use the annotations contained in the CATSS data base. If a variant, rather than the text in the relevant column in the data base, possibly represents the original text, that line of the parallel alignment is marked by the CATSS team.⁵³ Lines of the parallel alignment that contain these markers should therefore be excluded from the data sets used for statistical analysis.

- As it is not one of the goals of this study to recover the original texts involved, and as the CATSS data base is used as the basis for the data processing, the second approach will be used. It should be noted by future researchers, however, how easily the research into the original texts can become an integral part of this methodology.

Representative sample data sets were used consistently throughout the study. This holds some implications for the research described in chapters 3 and 4. In those chapters, the author attempted to use and evaluate respectively the text-critical criteria defined by Tov, and criteria described by markers that had been inserted into the CATSS data base by the CATSS team. The data to which those criteria were applied, were obtained from the CATSS data base, but were subjected to the filtering process described above. In addition, the statistical methodology used made it necessary to specify that the results of the applications of the criteria to the filtered data sets had to be of a binomial nature.⁵⁴ This forced the author to exclude some more data from the data sets used. It is therefore possible that the results recorded in those chapters may differ from results obtained by other researchers using the same criteria.

In chapter 5 this author attempted to make a contribution regarding the formulation of new criteria by applying the methodology described in this chapter to the translation of the person of the verb. By using grammatical criteria, an attempt was made to accommodate the type of criteria used by the Helsinki school as well. If it should prove possible to use the results of the criteria of chapters 3, 4 and

⁵² Even though a smaller, more accurate, data set is desired, one should take care that the data set does not become too small. Too small a data set will not contain enough information for statistical analysis, as was experienced in some regards in this study.

⁵³ A {v} is used if the LXX is affected, and a G if it is the MT. These markers are to be found in the MT and LXX columns of the CATSS data base.

⁵⁴ More about the binomial nature of results in section 2.2.1.2.3 of this chapter.

5 simultaneously, the point will have been made that, using the methodology proposed in this study, different criteria, even from different research schools, can be used simultaneously. The criteria in that chapter have been formulated in such a way that prerequisites regarding both representative sampling and the binomial nature of results can be met.

2.2.1.2 Analysing the Data with the Aid of Statistics

The statistical analysis of the data sets is based on a number of presuppositions and requirements.⁵⁵ These principles will be discussed below in more detail:

- It must be possible to obtain a representative sample from the data set, i.e. the sample must reflect the nature of the data set as a universum, and must still be large enough to be an accurate reflection of the universum. The base line of all relevant graphs must then be adjusted according to the size and nature of the sample data set in order for the statistical analysis to be performed correctly.
- It is presupposed that it had been possible for the translator to render a perfectly literal translation. The statistical methodology uses the deviation from the theoretically perfectly literal translation as point of departure.
- The results provided by the data set in response to the criterion according to which it is measured must be binomial in nature.
- The results must be plotted on an accumulative scale.
- The statistical analysis must render two results: the identification of the translation unit and the description of the translation technique within the translation unit.

2.2.1.2.1 ADJUSTING THE BASE LINE OF THE GRAPHS

After the sample data set has been identified using the method described above, the base lines of the graphs must be adjusted according to the nature of that sample data set.

Sample data sets can alter the ratio of data points in the different chapters of Deuteronomy from that of the original data set. If the data in chapter 20 constitute about 2% of the original data set, that ratio can be changed by the sampling process. For example, it is possible that very few lines of the parallel alignment are disqualified from the sample data set in the first 30 chapters of Deuteronomy, and that a lot of text-critical problems are found in the rest of the book. Should the original base line of 14 320 lines of parallel alignment be used at the bottom of a graph, such a graph will not accurately reflect the nature of the sample data set. If the base line is not adjusted, the following may occur: because fewer

⁵⁵ The reader will do well to follow the discussion while using the criteria in chapter 3 as examples. Because the examples in that chapter are discussed in some detail, the author will dispense with examples in this section.

data points will be retained in the last part of the book relative to the rest of the book, and those data points will be depicted according to the density of the original data set, they will be spaced further apart on the graph than the data points in the first part of the book. That will lead to any trend indicated by the sample data set in the last part of the book being under-evaluated, as this trend will seem to be less severe than it is. It should be taken into account that the distance between the data points on the graph is of cardinal importance to the statistical methodology used. If an adjustment is not made, the validity of the statistical analysis may be null and void. The distribution of data points on the X-axis of the graphs will therefore be based on the sample data sets, and not on the originals.

The necessity to represent the sample data sets correctly unfortunately forecloses any possibility of the data being presented in another way on the X-axis. Therefore readers have to follow the verses indicated when the translation units are discussed.⁵⁶

It may seem as if the author is making an academic point, but when it is taken into account that the sample data set is sometimes less than 50% the size of the original data set, it is clear that such an adjustment may be crucial to the interpretation of the graph.

2.2.1.2.2 DEVIATING FROM AN ABSOLUTELY LITERAL TRANSLATION

The literalness of a translation has been used before as an indication of translation technique. J. Barr (1979: 281 f.) noted that literal translation was the way in which a correct translation was ensured in ancient times, and that this approach had been actively pursued by certain translators. In fact, measuring translation technique as a deviation from a theoretically 100% literal translation was the foundation of the approaches of both Barr (1979) and Tov (1981: 50 f.). This approach also makes for easy measurement using statistical analysis.

If, however, it had not been possible for a translator to translate 100% literally, the foundation of this approach would be invalid, statistically speaking. While the translation of Aquila seems to prove the case that an absolutely literal translation is possible, it was thought prudent to investigate this matter a little further.

⁵⁶ The original line numbers of the parallel alignment were stored with the different data points. This allowed the author to refer to the original data set and to obtain the verse references of all the important data points in the data set. This was only done **after** the translation units were determined, thereby precluding any possibility of the present researcher meddling with the cut-off points of the translation units in order to make results tally.

For the list of text references and the corresponding record numbers of the original parallel alignment, see Appendix 3.

Is it possible, for instance, to render all aspects of the Hebrew syntax and grammar in Greek in a completely literal fashion?⁵⁷ In some aspects, the answer to the question is very simple, e.g. regarding word order. As the Greek language uses the case of the noun to determine the syntax of a sentence (an aspect of the language exploited to the full by the classic Greek poets - to the chagrin of undergraduate students of those works), word order can be adjusted any which way.⁵⁸ While it sometimes made for "peculiar" Greek, it was still intelligible to the average Greek-speaking individual in intertestamental/early Judaic times.

Where grammar is concerned, however, it cannot be taken for granted that it is theoretically possible to translate all aspects of the Hebrew language into Greek in a consistent manner. For example, while some facets of the Hebrew verb can be rendered completely literally, e.g. the person of the verb,⁵⁹ the matching of for instance the "tense" of the Hebrew verb with the "tense" of the Greek verb may take some doing. In fact, some aspects of the Hebrew verb cannot be reflected by the inflection of the Greek finite verb, e.g. the gender.

When discussing the consistency of the translation of an aspect of the Hebrew verb, one should take into account that, in order to measure this consistency, the "mapping" of the original translator should be determined.⁶⁰ This mapping is not obvious even in the case of the person of the verb.⁶¹ It can be

⁵⁷ J. Barr (1979: 296) pointed out that a translation takes into account all aspects of the language at the same time, e.g. Aquila did not only adhere to the word order in an absolute way, but he also stereotyped translation equivalents on a lexical level.

⁵⁸ Whether it was possible to change the more acceptable Greek word order while still calling the language Greek, was a big bone of contention in the whole debate about the Semitic nature of New Testament Greek. When it was eventually proved that some of the Semitic nature of the New Testament can also be found in Koinê Greek in general (Kruger, 1975: 30-39), a more lenient approach to the Greek language of the Hellenistic period became possible.

⁵⁹ The "person of the verb" is to be interpreted literally. In this dissertation, this term is used to indicate the person only, i.e. first, second or third. The gender and the number are excluded from the semantic sphere of the term. The combination of the person, gender and number of the verb will be called the inflection of the verb.

⁶⁰ "Mapping" is the table of equivalents (in the broadest sense of the word) the translator used, if any. For example, the following problem may confront the researcher: one may find that the verb is not translated very literally as far as the "tense" of the verb is concerned. When the verb is considered as a unit incorporating form, "tense", and inflection, however, consistency in translation may be found on another level. It is therefore necessary to incorporate all possible data when a comprehensive statistical analysis is attempted. The researcher should then attempt to find, with the aid of statistical methods (see for example the methods employed by Andersen and Forbes in their 1986 work), the combination of constituents that will indicate the highest possible level of literal translation.

imagined how complicated the whole question of the "tense" of the verb may get.⁶² The aim of this study is primarily to propose a methodology, and not to attempt an identification of the mapping concerned. However, in chapter 6 it will be attempted to show how the results of different criteria, even from different schools of research, could be combined to address problems regarding a problematic variant.

The criteria for literalness outlined by Barr and Tov can, however, accommodate this problem. When considering the literalness of a translation, it is not the mapping of certain verbal aspects in the two languages that is to be measured per se, but the consistency of that mapping (Tov, Wright, 1985: 153).

2.2.1.2.3 BINOMIAL ANSWERS

Each criterion used in this study has been applied to the sample data sets. The criterion should be formulated in such a way that for each line of the parallel alignment the question posed by the criterion can be answered with only "Yes" or "No". This type of answer is called binomial (Sprent, 1977: 44).

The statistical methodology depends on the answer being a binomial probability. If a non-binomial answer is possible therefore, that line of the parallel alignment has to be discarded from the sample data set.⁶³ If, for example, the criterion word order is applied and there are so many elements on a single line of the parallel alignment that it cannot be determined by the computer program whether the LXX follows the word order of the Hebrew or not, an "Uncertain" answer is given. Such an answer does not comply with the standard of the binomial probability and that whole line of parallel alignment would therefore have to be disregarded.

Not only will this result indicate the level of literalness of the translation, but the researcher could also gain an idea of the table of equivalents used. The identification of this table may be one of the biggest aids possible to the student of textual criticism.

⁶¹ It was discovered that some regularities could be found in the non-literal translation of the third and first persons of the verb in Deuteronomy. In particular, when God, Moses, or Israel is the subject of the verbs, some exegetical (Tov, 1981: 61) non-literal translations may be found. The author intends publishing on this issue later.

⁶² It may still be possible to unravel that complexity if an approach similar to that of Andersen and Forbes is used. The author should warn all attempting to undertake that project, however, that such an endeavour may prove to be even more complex than that of spelling.

⁶³ This is a major reason for the small size of some of the sample data sets in chapters 3 and 4.

2.2.1.2.4 ACCUMULATIVE PLOTTING MECHANISMS

How then are the data points plotted on the graphs? Each valid line of the parallel alignment constitutes one data point in the sample data set and each data point is indicated on the X-axis of the specific graph. Equal distances are maintained between data points.

Each data point in the sample data set renders a single "Yes/No" answer to the criterion being applied. These criteria will all measure literalness. The "Yes" answers will be disregarded, but the "No" answers (indicating non-literal translation) will be added accumulatively.⁶⁴ That is, the first "No" answer will be plotted against the value "1" on the Y-axis of the graphs, the second against the value "2" and so forth. This approach was suggested by R.E. Bee (1973: 259 f.) in order to generate a gradient for the data set. Such gradients can be measured and, moreover, be compared with each other. It is also easier to analyse the results of a regression analysis using gradients.

2.2.2 Some of the Tests Used

In this study, the reader will find that the same tests have been conducted for all the criteria, and that the results of these tests have been provided, usually in a footnote.

The results of only some of the tests performed have been used in the arguments:

- The simple⁶⁵ linear⁶⁶ **regression analysis**,⁶⁷ the basis of all the statistical calculations in this study, measures simultaneous changes of two variants in a relation where the change in one variable is dependent on the change in the other. As the independent variable is, in this case, the number of the data points in the sample data set, one is able to trace the change of the dependent variable, in this case the accumulative number of deviations from a literal translation. The change in the dependent variable is depicted as an ascending line on the graph of the regression analysis.

⁶⁴ As explained above, it is presumed that a 100% literal translation is possible. While it is very difficult to prove a literal rendering (Barr, 1979: 286 f.), it is easier to find the instances where the LXX does not agree completely with the MT. This study therefore measures the non-literalness as exposed by the different criteria.

⁶⁵ Only two variables are used.

⁶⁶ The calculations describe the relationship between elements of the paired X/Y variables on an elementary one-on-one basis.

⁶⁷ The simple linear regression analysis was chosen because it produced the required results, and is reasonably easy to implement and understand. It must be mentioned, however, that this instrument is only one of the many tools available to the statistician.

A simple linear regression analysis produces a number of results, viz. the standard error of estimation, the slope, the correlation coefficient, the R^2 value and the intersection.

- The test used to identify the translation units is called the **standard error of estimation**. The standard error of estimation indicates the coherency of the data set around the regression line. That is, the degree to which the changes in the dependent variable is explained by the changes in the independent variable is depicted. If the standard error of estimation is high, it serves as an indicator that the data set does not have a homogeneous translation technique in its present scope, and has to be subdivided into units that should individually represent a homogeneous translation technique.
- The **slope** of the graph is one of the most important results, as it portrays the density of the accumulative non-literally translated data points on the graph as reflected by the particular criterion. These results translate directly into the translation technique found in the particular translation unit, e.g. if one encounters a slope of 0.018, that will translate into 18 non-literal translations in every 1 000 translation elements.

The results of other tests are supplied as well in order to allow readers of this study to do some tests of their own:

- The calculation normally used to indicate the degree of intensity of the cohesion between the two variables is called the **correlation coefficient**. The correlation coefficient was indicated for each translation unit, but was not used in the statistical analysis, as it was typically very high for all the criteria.
- The R^2 on the other hand, serves to indicate how much of the variation in the values of the dependent variable is explained by a linear relationship with the independent variable. The result of this test is expressed in percentage format.
- Finally, the **intersection** (or intercept) indicates the value on the Y-axis (the vertical axis on which the accumulation of the deviations is depicted) at which the graph should cross the axis if the trend observed in the present section of the graph is extended to the Y-axis ($X = 0$). This value is based on the general trend of the particular portion of the graph, and the undulations of the graph are evened out when these calculations are done.

2.2.3 Explaining the Graphs

2.2.3.1 Regression Analysis

The graph of a regression analysis is composed of the normal X/Y axes (i.e. it is two-dimensional), with some additional lines. These lines depict the results of the regression analysis tests as described above.

The X-axis depicts the data points of the sample data set. On the Y-axis are indicated all the instances where the LXX did **not** render the Hebrew literally. These data points, indicating non-literality, are plotted accumulatively, and will appear as little squares on the graphs.

In addition to the data points, five lines may be observed on all the graphs of regression analyses:

- The centre line is called the line of best fit (the term regression line will be used for this line in this study), and is calculated using the method of least squares. In layman's terms this means that, if all the data in the data set are taken into account, this line depicts most accurately the relationship between all the values of both the dependent and the independent variables should that relationship be depicted by a single straight line.
- The two broken lines nearest the centre line indicate the confidence limits. When calculating the regression analysis, it is also possible to calculate how accurate the original calculation could be judged to be.

The confidence limits can be set by the user of the statistical program Statgraphics. In this study the limits were set on the 95% mark. That is, the author specified that the statistical program should calculate the confidence limits in such a way that it is possible to see which data points fall within the 95% margins. It will be seen on the graphs that the lines indicating the confidence limits normally are very close to the regression line. These confidence limits were not used directly in this study.⁶⁸

- A second pair of lines also appears on the regression analysis graphs, viz. the prediction limits. Should one want to make predictions using the present data set, one could require the statistical program to define the degree of confidence with which predictions can be made.

These prediction limits have been calculated using a 95% interval in this study. Again, these limits have not been used except for lines on the graph.

2.2.3.2 Residuals of the Regression

In chapters 3 and 4 it can be seen that the regression analysis was often calculated using a very dense data set. Not only are the prediction and the confidence limits in these cases very near the regression line on the graph, but the plotted values are so near the regression line that trends and undulations of the plotted values cannot be seen clearly. In order to rectify this problem, an alternative plotting method called the residuals of the regression is used.

⁶⁸ Confidence limits and prediction limits were, however, used in an article (Nieuwoudt, 1992) written while the statistical methodology of this study was still in limbo. In that study the limits were used to calculate the extent and identity of the translation units. The values obtained therein were also used to set up the maximum standard error of estimation allowable in this study. More about that later in this chapter.

On the graph depicting this method, the regression line is shown as a straight horizontal line near the centre of the graph. The total vertical height of the graph is then utilized to plot all data points that deviate from the line, indicating the distance of the deviation of the data points from the regression line. The result, as can be seen in the examples in chapter 3, is that the nature of the deviations from the regression line is much more visible.

It is important that the researcher should be able to observe the nature of the undulations, as they are used to determine the boundaries between the different translation units.

2.3 Determining Translation Units

2.3.1 Introduction

It always struck this researcher as curious that scholars would stipulate that the translation technique should always be described within the relevant translation unit (e.g. Tov, 1981: 49), but give very little attention to the method used to identify and demarcate these units in the first place (e.g. Tov, 1981: 60-61).

One often finds that researchers described the translation technique using the most advanced criteria available. However, the boundaries of the translation units were generally determined by entering into the very old debate as to whether a single book had been translated by a single translator, or whether two translators had translated the book (e.g. Aejmelaeus, 1982: 169, 174-181; Wittstruck, 1972: 17-42 and 387-388).

In the opinion of this author, this approach stems from the information contained in the Aristeas Letter being regarded too literally. There is very little additional support for the traditional adherence to boundaries of books when translation technique of the Pentateuch of the LXX is discussed. Little mention could be found in literature about the validity of discussing translation units in the context of translation technique in terms of biblical books, parts of books or chapters of books. This author would like to point out that a change in translation technique could take place anywhere, and that different styles of translation technique can often follow closely upon one another.⁶⁹

In this regard readers should keep in mind the work of Gooding: "But (the observations) do mean that non-literalisms of all sorts and kinds can suddenly occur without warning even in the most sober and straightforward parts of the LXX such as the Pentateuch." (1975: 116). A. Aejmelaeus supported Gooding when she found that: "By and large, the differences found between chapters in the various parts of the Pentateuch are considerable. No clear division in the translation technique of successive chapters can, however, be distinguished." (1982: 165). In addition, Aejmelaeus (1982: 180) mentioned that the different criteria could present different results regarding translation technique. (This argument is supported by the author's own research in this dissertation as well as in the 1992 publication.) She also encountered the phenomenon that different types of narration can result in translation technique differing from chapter to chapter within a book.⁷⁰

⁶⁹ It has already been pointed out that it is invalid to argue about translators at this stage of the research into the translation technique of the LXX.

⁷⁰ "All the chapters listed, which represent the freest translation in the Pentateuch as far as our material is concerned, contain narration..." (Aejmelaeus, 1982: 165); and

It is still an open question as to whether different criteria only illuminate different aspects of the same translation technique (as Aejmelaeus suggested), whether different criteria measure different translation techniques (which will play havoc with the present search for a single translation technique - even though it may be composite in nature), or whether (as this author suspects) the nature of translation technique is multifaceted and so complicated that it can only be measured in its totality by advanced statistical processes.

It is the contention of this author that, before the translation technique can be described in a scientifically responsible manner, the limits of the translation unit that is being described must also be determined as objectively as possible. In this regard it is suggested that the research into the translation technique should ignore the segmentation of the LXX into verses, chapters and books, and that the LXX should be regarded as one translation unit, except where proven differently.⁷¹

2.3.2 Identifying Translation Units

In this study, the different translation units were tentatively identified using the statistical results of the application of the different criteria to the sample data sets. The criterion was first applied to the sample data set of the whole corpus under investigation. Using the results obtained, the sample data set was subdivided (if necessary) until the translation units were positively identified. Only then is the translation technique, as reflected by the specific criterion, determined for each translation unit using only the data within that translation unit. The whole process is repeated for each criterion.

The author has to agree with Aejmelaeus (1982: 165-167, 180) that different criteria applied to the corpus will probably indicate different translation units. This type of result is of little value if the researcher wants to locate the translator. The result is valid, however, if the researcher is satisfied with describing the translation units for each criterion individually.⁷²

"To conclude, clear divergences in translation technique (sic) are found between the various parts of the Pentateuch and between the different parts of various books. The employment of free renderings seems to be influenced by the text type concerned and even by the contents of the text." (Aejmelaeus, 1982: 167).

⁷¹ Readers are reminded of the definition of the term LXX used in this study.

⁷² This author strongly suspects that the identification of the translation technique is the most that can be uncovered regarding translation technique using present methodology. However, translation technique alone will not help to solve questions regarding the doctrine and customs of the translators. (See section 1 of chapter 1.) In order to learn more about the translators, the question will have to be studied in a much broader perspective. Translation technique is only one small contribution to the questions regarding the identity and thoughts of the original translators. Identification of the translation technique should not be equated with the identification of the translator.

The results obtained by following the methodology in this study are not meant to contribute on a macro-level to the debate regarding the relative literalness of the different books of the LXX. Instead, the results are intended to supply the researcher with information needed to solve a particular text-critical problem on micro-level.

The graphs (see, for example, chapter 3) indicate the deviations from a rigidly literal translation for the whole sample data set, which, in turn, represents the whole corpus under investigation. When the graphs indicating the residuals of the regression are examined, different trends in translation technique will be obvious to the reader. The question is, however, whether each and every trend in deviation from the regression line is to be regarded as a significant change in translation technique. It is obvious that such an approach can lead to the book being subdivided into minute parts, each with its own translation technique.

In a previous study (Nieuwoudt, 1992), this problem was solved by accepting a trend as a change in translation technique only when that trend crossed the 95% prediction lines. This was an ad hoc solution, and, although it worked quite well, it had very little statistical foundation.

During discussions with H.T. Groeneveld, he pointed out that the research was not so much in need of a method to identify the translation units on a graph as of a way to determine when a trend is **not** significant. In all big data sets, one tends to encounter some form of randomness. In fact, one of the big advantages of analysing the data sets using statistical analysis is the ability of these methods to identify significant trends amongst all the insignificant trends. The insignificant trends are then called the randomness of the data set, and can be compared to the background noise one encounters when listening to a radio. H.T. Groeneveld also suggested a practical way in which to identify the significant trends. One should do the opposite to what has been done in the past by this author, and try to identify the nature and the extent of the randomness. A trend should only be considered significant if the boundaries of the normal randomness of the data set are exceeded. The goal would be, therefore, to identify the probable randomness of a particular data set in a quantitative manner.

In each data set one has a base line comprising the number of data points in the sample data set, as explained above. In addition to the base line, a number of those data points were identified as deviating from a literal translation, and were marked as such. The author therefore knew the minimum and maximum values on each of the axes of the two-dimensional graph of the regression analysis of the results of the specific criterion as applied to the sample data set.

Using the known values on each of the two axes, a random data set was generated. A random number generator was used to generate values between 0 (the minimum value) and the maximum value on the X-axis without exclusion of repeated values.⁷³ As many numbers were generated as there

⁷³ The random number generator used, creates a table of uniformly distributed random values.

were deviating data points in the original data set. These values were then ordered from small to large and numbered accumulatively, with the smallest value as 1, the second smallest as 2, etc. Each of the randomly generated values now had an additional attribute that indicated its position on the Y-axis. The result: a random data set compiled within the parameters of the real data set. The random data set had the same maximum and minimum values on both axes, the same number of data points on both axes, and the Y-axis the same accumulative nature, as the original data set. A regression analysis of the random data set was subsequently calculated and the standard error of estimation recorded.

This process was repeated 1 000 times.⁷⁴ The standard errors of estimation of these 1 000 random data sets were then ordered in size from small to large, and the 900th instance in this ordered table was recorded.⁷⁵ This value is called the 90th percentile of the ordered table.

The 90th percentile of the standard errors of estimation of the 1 000 randomly generated data sets (called the cut-off value) is used to determine the extent and limits of the different translation units. The real sample data set is used and the standard error of estimation calculated. If this value is bigger than the cut-off value, the data set has to be subdivided. If not, the meanderings of the plotted values of the data set around the regression line are deemed to be caused by the natural randomness of such a data set. Whenever the standard error of estimation of a data set is below the cut-off value, that data set should not be subdivided.

Should the value be above the cut-off point, however, the researcher will have to subdivide the data set. Using the graphs and the accompanying statistical tables, the trend in the data set that forms the most serious deviation from the regression line will have to be located, and separated from the rest of the data set. The resulting multiple subsets have to be analysed again, and the standard errors of

After the study had been completed, the accuracy of some computerized random number generators was challenged (Rubenking and Morris, 1992): not only do some random number generators use algorithms not totally random (algorithms are always predictable to a certain degree), but, as computers use binary logical systems in their processors, the numbers that can be generated are limited. Eventually, "repeated calls to the Random function will always produce the exact same pseudo-random series". This statement was borne out by investigations into the workings of the random number generator used in this study.

The author was relieved to discover that the work done in this research did not approach the limits discussed in the article mentioned above. Future researchers using the approach outlined in this study would do well, however, to avoid problems in this regard by checking that truly random numbers are generated.

⁷⁴ It is quite obvious that such an approach to the problem cannot be attempted without the researcher having access to a fast computer and programming skills.

⁷⁵ The standard error of estimation is a very good measure of the uniformity of a data set.

estimation recorded. Each subset that has a standard error of estimation bigger than the cut-off value has to be subdivided until all the divided segments of the main sample data set have standard errors of estimation smaller than the cut-off value.

Groeneveld suggested that the 90th percentile should be used as an experiment, as this value is commonly used. This value was used to examine data sets already analysed in previous research (Nieuwoudt, 1992). In the previous analyses the 95% prediction lines were used to identify translation units, as described above. When the standard error of estimation was used to perform the same task, results similar to those of the previous study were obtained. It was therefore decided to use the 90th percentile as cut-off value. It must be mentioned, however, that using the 95% value for the prediction lines and the 90th percentile as cut-off value introduces an element of subjectiveness, as the researcher can elect which values to use. The values used above are commonly used in research, however.

If a trend of the data set is regarded as containing a significant change in translation technique, it should be separated from the main data set and described as an independent translation unit. When deciding upon the trend of the data set to be separated, the researcher will have to make use of the table of the residuals of the regression, and the graph of this table.⁷⁶ The decision made in this regard is again subjective, and the researcher will have to keep in mind not only the data points that deviate the most from the regression line, but also the length and severity of the trend that led to that data point being that far separated from the line. In addition, the different subsets of the data set have to be kept as large as possible, and the number of subsets as low as possible. Only when the standard error of estimation of an existing segment of the data set is higher than the cut-off value should the segment be subdivided.

The reader would have noticed that the text of Deuteronomy was treated as a unit in this approach, without deference to the traditional chapters and verses. It is impossible to calculate the exact borders of the translation units indicated. As it is highly improbable that those borders would coincide exactly with the beginning or ending of verses, the borders were presumed to be within verses. Borders of translation units in the middle of Deuteronomy were therefore indicated as overlapping in verse reference with previous and/or following units.⁷⁷

By using the biggest possible units and subdividing the data set only when absolutely necessary and dictated by the statistical method, it is possible to identify the different translation units of the data set

⁷⁶ This table contains the values plotted on the Y-axis of the graph of the residuals of the regression analysis and will show conclusively which data point deviates the most from the regression line.

⁷⁷ For an example, see paragraph 2.1.2.2 of chapter 3.

as reflected by the specific criterion. In this way a semi-objective method can be employed to identify translation units, while the number of translation units can be kept as low as possible. The researcher can now start to identify the nature of the translation technique represented in each translation unit.

2.3.3 Interpreting Translation Units

If it is possible to identify different translation units, how does that tie in with the identification of translators? Unfortunately, there is no one-to-one relationship between translation units as depicted by the different criteria, and translators.⁷⁸

If there is a change in translation technique to such an extent that a translation unit can be identified positively, it would be a fallacy to argue that this automatically indicates a change in translator. This change could be caused by a number of factors: as pointed out by Casagrande (1954) the aim of the translation influences the nature thereof. In addition, the *Vorlage* (Tov, 1981: 50) or the literary type of Hebrew passage (Aejmelaeus, 1982: 167) may have played a role. In fact, the statistical methodology employed in this study cannot presume to give any answer to the question as to **why** the translation technique changed.⁷⁹ That is a subject for another study.

The reader should remember that, using this approach, the translation unit will be determined as reflected by the criterion used at that stage. There is no guarantee that the translation units as indicated by different criteria will concur with each other.

⁷⁸ The reader should keep in mind the definitions of translation unit and translation technique used in this study.

⁷⁹ As was also the case with the research of Bee (1973: 257-258).

2.4 Determining Translation Technique

2.4.1 Judging the Relative Level of Literalness of Different Books of the Bible

It has been established earlier in this chapter that the two objectives of determining the translation technique and establishing the letter of the original texts should go hand-in-hand. The results of the research done in the one sector must therefore be usable in the other. On the one hand, identified elements of the original texts can be used to good effect in the research into the translation technique. On the other hand, however, up to the present day few of the results obtained regarding the translation technique of the LXX could be used to establish the original texts involved in the translation process.

When consulting recent research papers dealing with translation technique, the reader finds that the translation techniques of different translation units are described in terms of their level of literalness **relative** to each other. Some of the most respected researchers in the field, e.g. H. ST. J. Thackeray (1909: 13) and Soisalon-Soininen (1965: e.g. 186), tend to describe the translation technique of different LXX books in subjective terms regarding their literalness. The books of the LXX are also grouped by comparing the different translation techniques found. This trend is followed by some contemporary researchers, e.g. T.K. Wittstruck (1972: 22-41; 387-388) and A. Aejmelaeus (1982: 159 f.).

It is interesting to note that, even with all the statistics published in their studies, the Helsinki researchers did not use these statistics to supply the researcher struggling with studying the *Vorlage* or the text-critical evaluation of different texts with statistical aid. The two subject fields were kept apart. Instead, the researchers used findings regarding translation technique mainly to group together the different books of the LXX that have the same translation technique.

It is to be doubted, however, whether an approach of this nature will help a researcher wrestling with the evaluation of a variant reading of the MT contained in the LXX. Knowing that Deuteronomy was on **average** translated more idiomatically than Leviticus will not help a researcher to decide whether to accept or to reject an LXX variant.

2.4.2 Translation Technique as Style

The translation process is as complicated to analyse as original writing, and translation technique may be compared to the style of an original author (Nida, 1964: 145). As such, it may be possible to measure translation technique using the same instruments as are used in measuring the style of an author. Styles of both authors and translators are influenced by a combination of many factors, some of which may be very difficult to measure statistically.

As was pointed out above,⁸⁰ the techniques developed to measure the "signature" or unique style of an author cannot be utilized in this study. Those techniques are intended to determine only certain aspects of an author's style that he/she cannot disguise or alter. These approaches do not intend to describe the total style of an author or translator.

In the study of the translation of the LXX, however, the aim is to describe the translation style of a certain portion of text as comprehensively as possible. The researcher must be able to evaluate variants, and even to make some suggestions as to the possible nature of the *Vorlage* and/or the Old Greek using the description of the translation technique. The description of the translation technique must be formulated in such a way as to directly assist the retrieval of the original texts, and should preferably be of a statistical nature.⁸¹ Unfortunately, the author could not find an existing method that describes the work of either author or translator in such a fashion.⁸²

It is the contention of this author that the researcher can hope to gain a comprehensive overview of the style of the translation only if all relevant factors, including those not yet discovered, are taken into account simultaneously. At present, the Helsinki school is using grammar, Barr and the Jerusalem school are using measurable aspects of the translation technique itself, and J.C. Lübke (1988) started with promising work regarding semantics.

Present techniques of analysis are in need of some enhancement, however: the different aspects of the translation technique should be describable in some quantifiable format. In addition, the results of the tests must be unambiguous, and it must be possible to utilize those results in the evaluation of variants.

The following problem will serve as an example of what may be possible: suppose that a manuscript of the MT contains a variant reading regarding the person of the verb and that the manuscript is in agreement with the LXX reading. Suppose statistics rendered by the representative sample data set indicate that, in the translation unit in which the verb occurs, the LXX and the MT agree in 98% of the

80 Compare section 1.1.1.6.

81 It was found that the non-statistical descriptions may be vague and subjectively formulated. For example, "(the translator) did not translate merely on a one-to-one basis but rather according to the meaning of the word in each instance." and "The translator also displays an awareness of the various genres of literature and their differences". (Both quotations are from Wittstruck, 1972: 387-388.) Although this author agrees to some extent with this evaluation, this description of the translation technique does not help to solve a specific text-critical problem on a micro-level. However, when an aspect of the verb is described as "translated literally in 90% of the cases in this translation unit", that figure is expressed neutrally, and is firm.

82 Researchers of translation technique will do well to take note of all attempts to describe the style of an author or translator. For instance, the "item response theory" described by C.L. Hulin et al. (1983) holds some promise.

occurrences of that person of the verb, indicating a 98% literal translation of that aspect of the verb. Suppose that the homogeneity of the translation technique, as reflected by this criterion, is high in the specific translation unit. A researcher could then use these figures in favour of the argument that the variant Hebrew reading may reflect the *Vorlage*.⁸³

At no stage does the author want to suggest that either the comprehensive description of the translation technique in quantifiable terms or the solving of text-critical problems will be easy. Even an elementary subject, such as the person of the verb, should be researched in its full context, including literalism, semantics, lexical value, grammar and syntax. That is, the full style of the translation technique must be taken into account. This approach, comparable to that of Andersen and Forbes, is, however, completely beyond the scope of a doctoral dissertation. This author will attempt only to define the broad methodology within which such research should take place.

2.4.3 Describing the Translation Technique in this Research⁸⁴

This author will attempt to describe some aspects of the translation technique in quantifiable format using a number of basic criteria. Two results will be expressed in quantifiable format:

- The homogeneity of the character of the translation technique within a translation unit, which can be measured using the test of standard error of estimation.
- The character of the translation technique can be described using the slope of the accumulative number of non-literal translations (or deviations). The slope will indicate how many non-literal translations there are in a specific translation unit for every 1 000 possible literal translations.

⁸³ A lot of other factors will also have to be taken into consideration, of course. All input into such a decision should be considered and weighed carefully.

⁸⁴ See section 2.2.2 of this chapter for a description of the different tests used.

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CHAPTER 3: THE TOV CRITERIA

1. Methodology

1.1 Aim

Tov pointed out that translation technique should be described according to the "full range of the translators' attitudes to their task" (1981: 53) and not only according to the lexical choice of the Greek equivalents of certain Hebrew lemmas. In this respect he obviously based his own research at least in part on Barr's work.¹ Tov (1981: 50) indicated that research criteria should reflect the translation technique in a more complete way than has been done in previous works. It seems as if he wanted to go beyond merely researching the lexical equivalents chosen by the translator for certain Hebrew words and/or constructions. The criteria proposed should reflect the nature of the translation technique in a more complete way.

Tov proceeded to distinguish between two different types of translation, viz. free and literal. In order to characterize the translation technique of a translation unit as either free or literal, Tov defined five criteria for literalness. Translation units in which these criteria performed poorly, were then described as free.² He recognized the need for these criteria to be expressed in statistical terms (Tov, 1981: 53), but pointed out that the five criteria for literalness could only partially be expressed in statistical terms.³

This chapter aims to use the Tov criteria for statistical research on translation technique as extensively as possible. Each of the criteria will be evaluated as to the feasibility of implementing it in a statistical investigation using the CATSS data base as the source of data. If a criterion does lend itself to

¹ Compare the criteria outlined by Barr (1979: 294) with those proposed by Tov (1981).

² According to Tov (1981: 61), the criteria according to which the freeness of a certain translation technique can be investigated cannot be expressed statistically. When in need of statistics to examine the translation technique of a freer translation unit, the negative of the five criteria for literalness will have to suffice.

³ The "five criteria for literalness" will henceforth be called the Tov criteria.

implementation as a statistical research criterion, it will be implemented as described in chapter 2. Each of the criteria will be annotated regarding the data selected for the criterion, and the method followed in manipulating the data.

A criterion will be deemed suitable for implementation if it is possible for a computer program to search the data in the CATSS data base using that criterion, and if the result of the search can be expressed in statistical terms. That is, it must be possible to utilize computer programs to find those records that are needed by the current criterion. In addition, it must be possible to express the results of this measurement statistically using the methods described in chapter 2: enough records have to be found in order to offer a good representation of the data set as a whole. Also, the measurement of each record has to offer only a "Yes" or "No" answer.

At the end of the chapter, conclusions will be reached regarding the usability of the Tov criteria for statistical research using the CATSS data base, and the extent of the different translation units and the nature thereof, as described by the combined Tov criteria.

1.2 Data Used

The CATSS data base is used as a source for data in this chapter. The reader is reminded that the data in the data base consist of three columns containing respectively the MT, the LXX and Column B. Elements of the MT and the LXX are aligned with each other on the basis of "formal equivalence of the Greek and Hebrew" (Tov, 1985b: 223).

In chapter 5, where the person of the verb is used as a criterion, only the verbs are used in the data set.⁴ In contrast, **all** the data in the CATSS data base will be used for the research described in this chapter, with certain exclusions, as will be described in the case of each particular criterion. One of the objects of the chapter is to test the usability of the CATSS data base, including its morphological files, for research using computer programs. As such, the data bases should be used "as is" for research. The only alterations allowable should be those that can be coded in a computer program.

⁴ Additional culling of the sample data set also proved to be necessary. Please see chapter 5 for details.

2. Criteria Examined

2.1 Consistency

It seems that Tov (1981: 54-57) defined consistency of translation as the inflexible rendering of certain Hebrew lexical values by certain Greek lexical values. In the past the choice of lexical equivalents practised by the translator was used to a great extent in researching translation technique.⁵ Hampered by the lack of facilities for electronic data processing, however, most of the researchers had to concentrate on only a few lemmas in Hebrew, if they could manage at all to use more than one simultaneously.⁶

In this study, however, it will be attempted to use all the lemmas in both the MT and the LXX of Deuteronomy. Such an endeavour is clearly impossible without the aid of an electronic data base and a computer. Before searches can be done, the data base has to be cleared of records that will present problems and/or confuse the statistical analysis. The most popular Greek translation has to be determined for each Hebrew lemma, after which it will be possible to determine which Greek renderings do not reflect the most prevalent translation equivalent. As is done with all the other criteria, all the deviations from the norm are then plotted accumulatively. The resulting graph can be used to determine the nature of the translation technique as reflected by this criterion.

It must be mentioned that the implementation of this criterion presented considerable problems, especially when all the lemmas were used simultaneously, and the results reflect many weeks of intensive programming. It was, however, possible to surmount the problems in part, resulting in what may be the first successful attempt to handle all the lemmas in an extensive corpus simultaneously.

2.1.1 Methodology

In order to allow other researchers to duplicate these searches, the method followed, the problems encountered and the methods used to circumvent certain problems have to be explained. As this is the first example of the application of the methodology proposed in chapter 2, the process will be described in some detail:

- The criterion was based on the lexical choice of the translator for each Hebrew word/element. In the data base the lexical value of each element had to be found in the most unambiguous way.

⁵ See, for example, the work done by A. Aejmelaesus, W.J. Aerts, J. Cook, M.L. Margolis, R.A. Martin, T. Muraoka, I. Soisalon-Soininen, R. Sollamo, E. Tov and B.G. Wright.

⁶ Even with the aid of the electronic computer, Tov and Wright had to make a selection of lemmas in their 1985 study.

For both the MT and the LXX, the lemma of the word, as described in the grammatical analysis, served this purpose. The Greek lemmas were provided by the CATSS project, and the Hebrew analysis by the project of Poswick.⁷ The morphological analysis of both the MT and the LXX was done by computer, and post-edited by hand. Although this method allowed for some errors to sneak in, the errors normally were made everywhere the word occurred. This implied, that, even if the wrong lemma was assigned to a word, the "mistakes" will be distributed over the whole corpus. The division of the corpus under investigation into different translation units should therefore not be affected.

- It is natural to assume that, before the lemmas of the Hebrew and Greek word could be used, the words of the different versions first had to be matched up on a one-to-one basis. In this regard serious problems were encountered in the CATSS data base. In the data base the alignment occurred on the basis of "formal equivalences" (Tov and Wright, 1985: 155). While this normally implied that each Hebrew word was represented by a Greek word, one would often find two or more Hebrew and Greek words in one instance of formal equivalence.

0140 H/MDBR/H

EI)S TH\N E) /RHMON

Figure 1: Example of Multiple Words/Elements in One Record

It was not possible to disregard all lines of the parallel alignment in which multi-element phrases were to be found, as the sample data set would then become so small as to be unusable. It was therefore attempted to align the elements of the Hebrew with the corresponding Greek words. As can be seen in figure 1, it was not so easy to align the Hebrew and the Greek texts element by element. In this case, the Hebrew word order was article, noun and directional indicator. The Greek word order was, however, directional indicator, article and noun. The order of the words in the MT was therefore not the same as in the LXX, and the word order could not be used to align the Hebrew and Greek on element/word level.

After experimentation, it was decided to make use of the part of speech indicated in the morphological analysis of each word. A table was drawn up with the possible Greek grammatical equivalents for each part of speech in Hebrew. The data base program dBASE IV was used to

⁷ One would have liked to use the root field rather than the lemma in the grammatical analysis of the Maredsous data base, the reason being that the root field consists of consonants only, whereas the lemma field is augmented with vowels. (The *Vorlage* of the LXX was unpointed, and an unpointed text would therefore be nearer the *Vorlage*.) However, in the Maredsous data base, more words are supplied with lemmas than with roots, and it was decided to use the more complete data field.

manipulate the data.⁸ The main data bases were copied to temporary files, as to allow the manipulation of the data. The text and grammatical data files of both the MT and the LXX were converted to contain only one word per record (chapter 2 and Nieuwoudt, 1988b: 403), while retaining a marker that pointed to the original line of parallel alignment. The morphological analyses of the Hebrew and the Greek word(s) of each line of formal equivalence in the CATSS data base were brought into alignment and compared. If the Greek part of speech occurred in the table of Greek part of speech equivalents that matched the part of speech of the specific Hebrew element, the two words were then matched.

Some words had to be disregarded by the search programs, however. Words for which the Greek part of speech was not found in the Greek morphological analysis could not be used, as it was then impossible to determine the Greek equivalent of the Hebrew element. In addition, where a certain part of speech occurred more than once in one line of parallel alignment, the Hebrew-Greek equivalents could not be established by the computer program with certainty. Again these words, in this case the whole line of parallel alignment, had to be disregarded by the search programs. At first it was expected that the data base would be rendered so small by these restrictions that it would become unusable. However, only about 5% of the data base had to be discarded in this way.⁹

- Another section of the data base had to be discarded because no single prevalent translation could be found for certain Hebrew lemmas. If no Greek lemma was used in more than 49.99% of the cases as translation for a specific Hebrew lemma, it was deemed impossible to ascertain a definite prevalent rendering. All the Hebrew lemmas showing evidence of these problems were discarded. In the end, however, only 64 lemmas were affected in this way.
- Hebrew lemmas that only occurred once in the data base had to be discarded as well. These lemmas would, of course, be translated 100% consistently. In fact, however, the lemma occurred in such a way that it was impossible to judge the consistency of the translation technique, hence these being discarded from the data set.

⁸ See chapter 2 for the nature and structure of the main data bases on the PC.

⁹ It should be kept in mind, however, that previous studies indicated that Deuteronomy was translated rather literally. (See, for example, the discussion in Aejmelaeus, 1982: 178 f.) This allows for the matching of the parts of speech on a productive scale. In corpora where a freer translation technique is followed this matching of elements using the morphological analysis may not occur with any degree of ease.

Regarding the validity of the parts of speech translation table, the small number of lemmas that had to be discarded due to lack of matching of the parts of speech in Hebrew and Greek may be an indication of the correctness of that table. (The table of equivalents and the programming required for this chapter will be discussed more comprehensively in a future publication.)

- Two part of speech indicators in the Maredsous data base (the Hebrew morphological analysis) were so ambiguous that it proved impossible to use them. All lemmas with the indicators "Z" ("Ambiguous other than ambiguous noun/adjective") and "?" ("Doubtful") were therefore disregarded.

Even after all this refining of the data base, some problems still remain:

- Some words are not supplied with lemmas in the morphological data bases, or are analysed incorrectly. The same lemma is even sometimes assigned to different words.
- Where a Hebrew lemma is translated with two Greek lemmas and the two Greek lemmas occur an equal number of times, they will both be assigned a 50% success rate. The search program will, however, regard the lemma that occurs first in the alphabet as the more prevalent rendering.
- It can be argued, quite correctly, that there is no one-to-one matching between the Hebrew and the Greek elements. In fact, the data base consists of 19 877 Hebrew elements and 23 780 Greek words. The searches took place with the MT as primary key, so that some information in the LXX is not adequately represented.
- The amount of information that had to be excluded from the searches and statistical calculations may have a detrimental effect on the accuracy of the calculations, as it led to a small sample data set. Of the 19 877 elements in the MT, only 10 127 could be used, and of the 1 423 lemmas, 656 remained after the culling. As about half the data base has been eliminated from the sample data set, the integrity of the results must be compromised to some extent.

After the data base was defined, the search programs (also written in dBASE IV) were activated using the temporary data base files. For each Hebrew lemma a list of Greek equivalents was compiled by the search programs. Each Greek equivalent was annotated with the percentage it represented of the total renderings for the Hebrew lemma. The Greek lemma with the highest percentage was picked, and all the occurrences of the Hebrew lemma that was not rendered by the prevalent Greek lemma were marked as deviations from the norm.

All the statistical analyses were then performed using the statistical program Statgraphics. The deviations were plotted on an accumulative scale,¹⁰ after which regression analyses were performed. The accumulative plot of the deviations was analysed as the dependent variable and plotted against the number of records remaining after the culling - the independent variable.

As is required by statistical methodology, 1 000 random data sets were also generated using the parameters of the real data set after the selection process took place: 1 537 deviations in a data set containing 10 127 records. The standard errors of deviation were calculated for each of the random data sets, and a new data set was created using these values. The distribution of these values was

¹⁰ See chapter 2 for the statistical basis of this method. In addition, see Bee, 1973: 259 f.

worked out, and plotted.¹¹ The 90th percentile was calculated to be used later as a cut-off value, below which the standard error of estimation of a data set had to fall in order to qualify as a homogeneous data set.

2.1.2 Results

Eventually the data set consisted of 10 127 records, which will constitute the X-axis of the graph. Some 1 537 deviations from the norm were found.

The combined random data sets have a minimum value for the standard error of estimation of 4.14153, a median of 8.88311, a maximum of 21.2437 and a 90th percentile of 13.2157.

2.1.2.1 Interpreting the Graphs

In figure 3 the regression analysis of the accumulative deviations against the records processed can be seen, calculated using 95% confidence limits and prediction limits. The regression line, on the average slope of 0.14369 (about 143 deviations for every 1 000 records), reveals three major deviating trends from the regression line. As this is a very dense data set, the deviations cannot be seen clearly. In figure 4, however, where the residuals of the regression analysis are depicted, these trends can be seen clearly. The most extreme deviating data points are, from the biggest to the smallest deviation, at Deut. 34:12, Deut. 17:03 and Deut. 01:18.

On the plot of the residuals of the regression analysis, several conspicuous trends (relative to the regression line) can be identified:

- Ascending from record 1 to 1 022
- Even from record 1 022 to 3 727
- Descending from record 3 727 to 5 233
- Even to slightly ascending from record 5 233 to 8 633
- Ascending from 8 633 to 10 127

2.1.2.2 Identifying the Translation Units

Statistical analysis of the whole data set returned a standard error of estimation of 19.0853. It was therefore necessary to subdivide the data set, as it is more than the 90th percentile of the random data sets. In the previous paragraph, it seems that five different sections of the graph can be identified.

¹¹ See figure 2.

The data point at record 10 127 deviates the most from the regression line, and the section of the graph to which it belongs was first detached from the main part of the graph. The section from record 1 to 8 633 returned a standard error of estimation of 13.6247, and the section from 8 633 to 10 127 a value of 5.78864.

It was clearly necessary to subdivide the first section, as the maximum value that may be accepted is 13.2157. The section containing the data point that deviated the second most from the regression line was therefore dissected from the first section. This divided the first section into three new sections: records 1 to 3 727, the deviating section from 3 727 to 5 233, and the last section from 5 233 to 8 633. The three sections returned standard errors of estimation of 8.91705, 3.84831 and 6.21918 respectively.

The main data set is now divided into four parts, all of which display standard errors of estimation of much less than the stipulated maximum. At this stage the value of working with a cut-off point generated by the 90th percentile of the standard errors of estimation of the random data sets can be seen clearly. Although it would seem as if the section from record 1 to 1 022 should also constitute a separate section of the data set, the standard error of estimation of the section which contains this first inclination of the graph is much less than that of the maximum value allowed. The figures therefore indicate that, although there is some variation in the section from record 1 to 3 727, this can be interpreted as non-significant deviations. Interestingly enough, this verdict is backed up by the approach followed in the first publication dealing with this method (Nieuwoudt, 1992). In that article sections were considered deviations when they crossed the 95% prediction lines. This does not, in fact, happen with this first section.

Finally therefore, the data set can be divided as follows:

Section 1¹²

This section stretches from record 1 to before record 3 727 (Deut. 1:1 to Deut. 11:25). The translation technique of the section is varying in nature, as can be seen on the plot of the residuals, and as is reflected in the standard error of estimation of 8.91705, which is higher than that of the other sections. The general trend of the translation technique indicates slightly more deviations than the average for the main data set. The main data set has a deviation ratio of about 143 per 1 000 records, and this data set a ratio of about 150 per 1 000 records. In fact, the slope of this section is the nearest of any of the sections to that of the whole data set.

¹² The full figures: non-literal renderings = 577; correlation coefficient = 0.998571; R^2 = 99.71%; standard error of estimation = 8.91705; slope = 0.150667; intersection = 20.8607.

Section 2¹³

Section 2 is one of the deviating sections, stretching from record 3 727 to 5 233 (Deut. 11:25 to 17:03), and has a descending character compared to the regression line. The ratio of deviations is about 188 per 1 000 records. The section is quite uniform in nature, as can be seen from the low standard error of estimation of 3.84831.

Section 3¹⁴

The second non-deviating data set can be found between records 5 233 and 8 633 (Deut. 17:03 to Deut. 29:09). The set is not very uniform in character, and has a standard error of estimation of 6.21918. This is also borne out by the undulating nature of the plot of the residuals at this point. More deviations occur than in the main data set: about 151 deviations per 1 000 records.

Section 4¹⁵

This section contains the data point that deviated the furthest from the regression line and is a deviating section. It extends from record 8 633 to 10 127 (Deut. 29:09 to Deut. 34:12). It is not totally uniform in character, as can be seen by the rather average standard error of estimation of 5.78864. It does have the highest ratio of deviations from the regression line of all the smaller data sets: about 191 per 1 000 records.

2.1.2.3 Reliability of the Results

When considering the results of this criterion, it should be kept in mind that misgivings were expressed regarding their accuracy, because the data set is somewhat restricted. Much of the value of these results will depend on how these results contradict or are in agreement with the results of the other Tov criteria.

¹³ The full figures: non-literal renderings = 164; correlation coefficient = 0.996731; R^2 = 99.35%; standard error of estimation = 3.84831; slope = 0.188739; intersection = 130.873.

¹⁴ The full figures: non-literal renderings = 509; correlation coefficient = 0.999107; R^2 = 99.82%; standard error of estimation = 6.21918; slope = 0.151064; intersection = -43.4915.

¹⁵ The full figures: non-literal renderings = 277; correlation coefficient = 0.997395; R^2 = 99.48%; standard error of estimation = 5.78864; slope = 0.191014; intersection = -400.324.

Standard Error of Estimation of 1000
Random Data Sets: Consistency

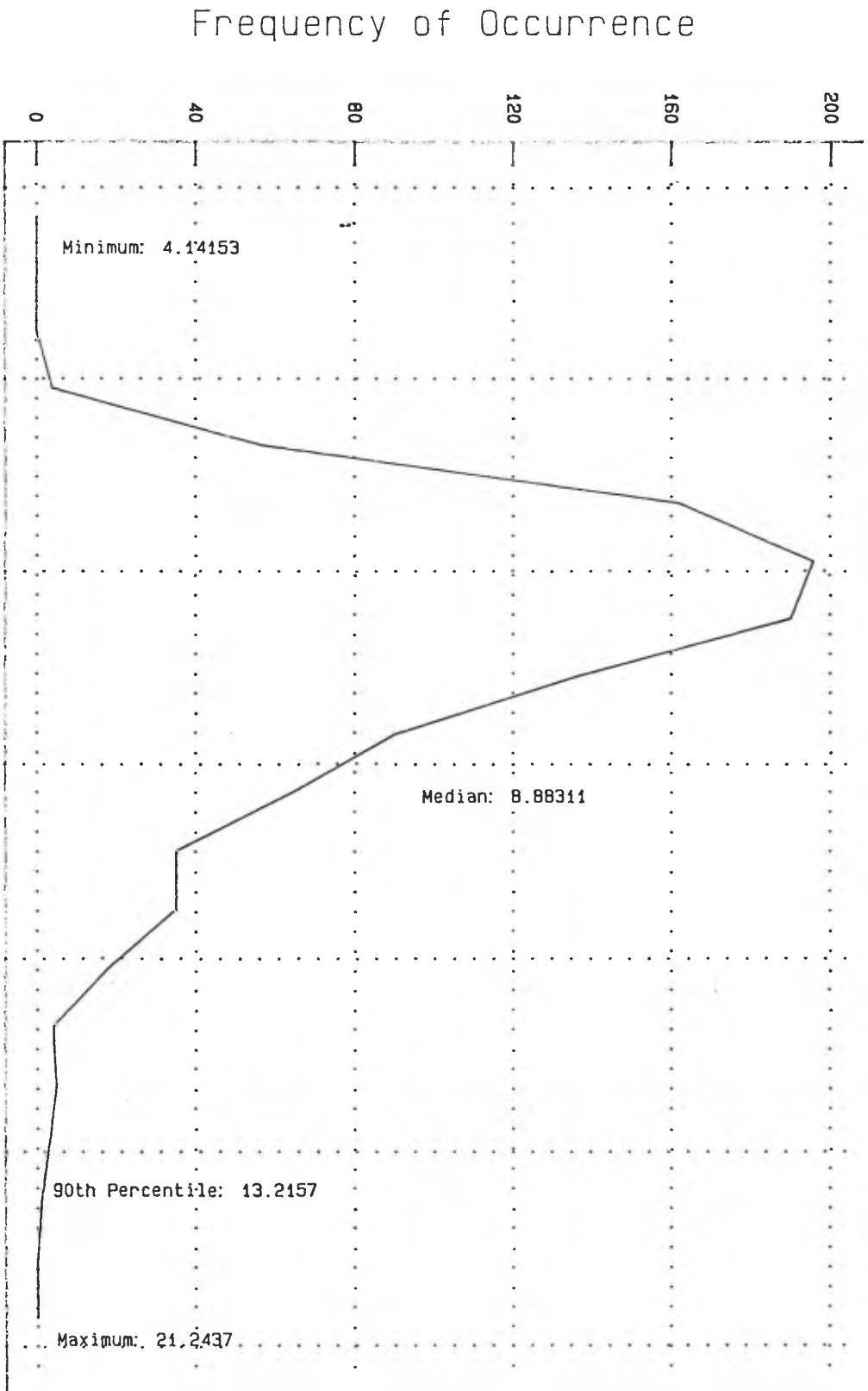
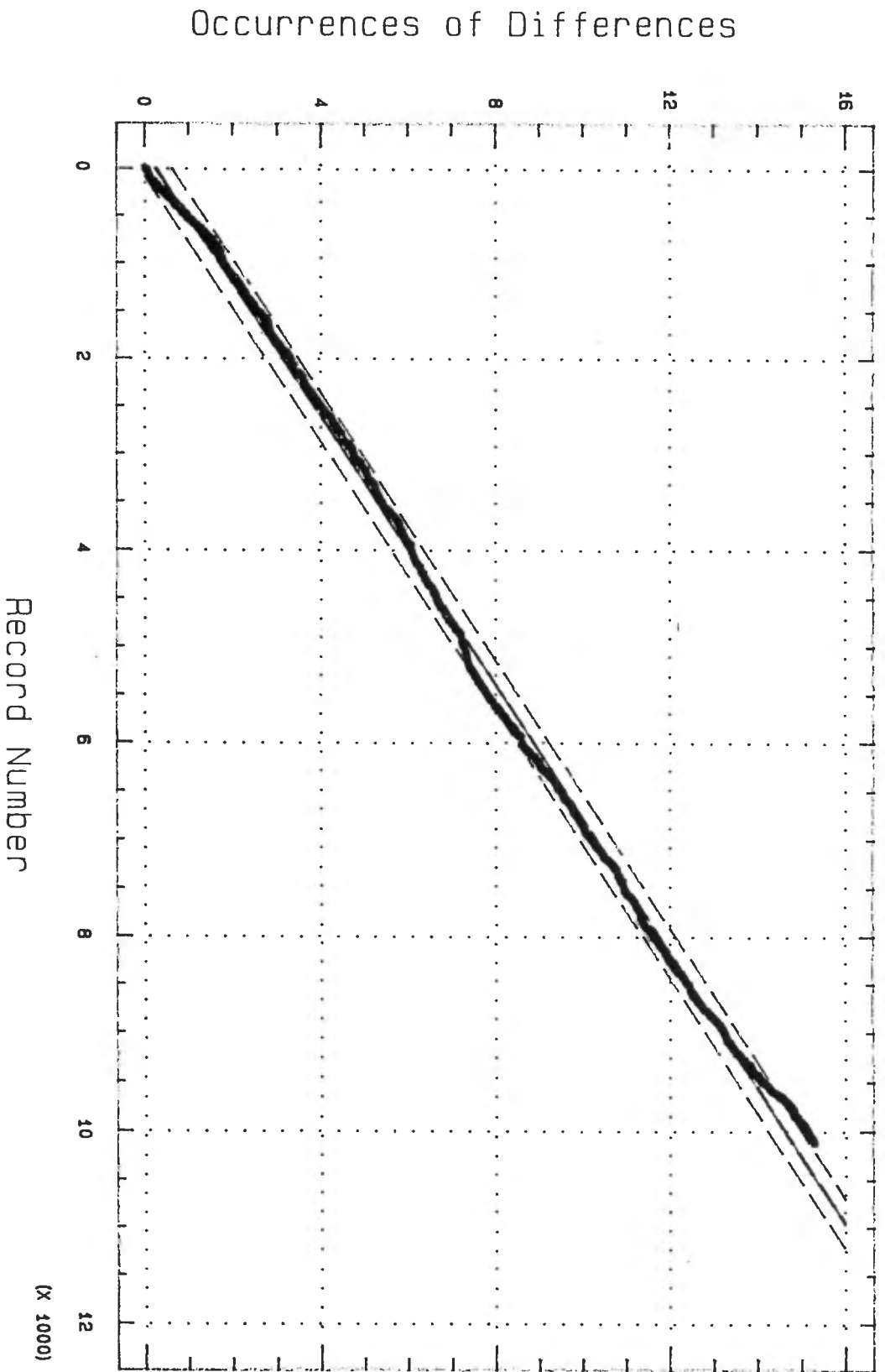


Figure 2

Standard Error of Estimation

Regression of Differences in Consistency

(x 100)



Record Number

(x 1000)

Figure 3

Consistency: Residuals of the Regression

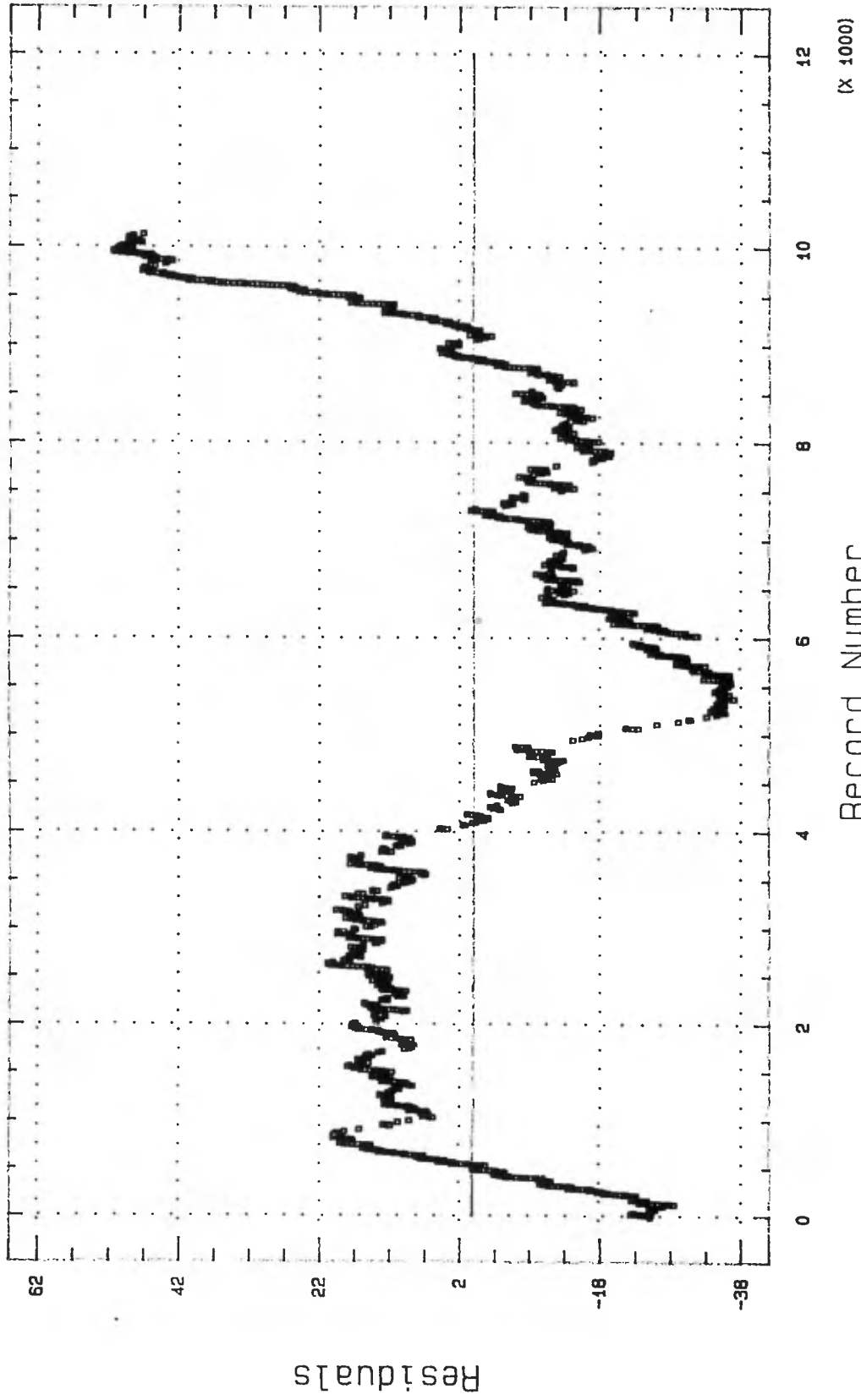


Figure 4

2.2 Representation of the Constituents of a Hebrew Word by Individual Greek Equivalents

2.2.1 Methodology

Tov's second criterion aims to measure the inflexibility with which the translator rendered different parts of composite Hebrew words with separate Greek words (Tov, 1981: 57-58).¹⁶ Certain styles of translation technique attempt to render each element of a compound Hebrew word with a separate Greek word. Tov interpreted this tendency as an indication of a literal translation.

0108 L/)BT/YKM

TOI=S PATRA/SIN U(MW=N

Figure 5: Example of a Compound Hebrew Word and the Greek Translation

In contrast to some of the other criteria, it proved to be extremely difficult to obtain valid data for this criterion from the CATSS data bases. The instances of formal equivalence that could be considered for the application of this criterion had to contain composite words in the MT. The records also had to be structured in such a way that the search programs would be able to isolate the composite Hebrew word and the specific Greek word(s) with which it was translated from the rest of the line of formal equivalence. This is not always simple, as can be seen in the example in figure 7.

Not all the lines of the parallel alignment in the CATSS data base of Deuteronomy complied with these specifications. In addition, some special instructions had to be given to the search programs in order to generate the correct results:

- Obviously all minuses and pluses have to be eliminated:¹⁷ when a plus or a minus occurs in a record as the only element of either the MT or the LXX, it is obviously impossible to measure the nature of the representation of constituents, as one of the columns lacks an equivalent with which it can be compared. These records have to be excluded from being evaluated by this criterion.

¹⁶ An example of how different parts of a composite Hebrew word are rendered by multiple Greek words can be seen in figure 5.

¹⁷ See Tov, 1986: 51-56 for an explanation of the terms.

10:13	---+	TOU= QEOU= SOU
-------	------	----------------

Figure 6: Plus in Alignment

On the other hand, one can find that the plus or the minus is only part of the alignment in one of the columns. The question then remains: which element in the other column of the alignment does the plus or minus refer to? As can be seen in the next figure, it is nearly impossible to instruct a computer program to recognize the equivalence of the plus or minus.

12:04	W/)T	TRWMT	YD/KM	KAI\	TA\S	A)PARXA\S	---	U(MW=N
-------	------	-------	-------	------	------	-----------	-----	--------

Figure 7: Minus as Only Part of the Alignment

- In practise, it also proved necessary to eliminate all records with markers indicating text-critical problems of some nature.¹⁸ All these records contain a "{" in one of the columns, depicting a change in word order, doublets, repeated elements in the translation etc.

Even the mainframe search programs of the CATSS project are instructed to ignore some of these records for indexing, as the equivalents really occur elsewhere in the text. In practice it proved impossible to identify the Hebrew word (whether compound or simple) and the corresponding Greek word(s) in these records with any accuracy using computer programs.¹⁹

- All the records where the MT does not contain a "/" were excluded.²⁰ This symbol is used to indicate the breaks between the different elements of a complex Hebrew word. If the Hebrew word does not contain this symbol, it means that the Hebrew word is a simple one, thereby falling outside the scope of this criterion. If the whole alignment in the Hebrew column consists only of a simple word(s), that line of the alignment cannot be evaluated regarding this criterion.
- All proper names were excluded, as these tend to be spelled differently in Hebrew and Greek. These different spellings do not, in fact, have any bearing whatsoever on whether the translator wanted to preserve the number of elements in a single Hebrew word or not. In translating proper names the translator did not have any choice to make.

¹⁸ See Tov, 1986: 7-10 for an explanation of the markers used in the data base.

¹⁹ In order to grasp the complexity of the problem, the reader is referred to the examples in Tov, 1981: 39-63.

²⁰ This is the marker with which the composite Hebrew words have been parsed in the CATSS data base (Tov, 1986: 6).

0101	W/DY ZHB	KAI | KATAXRU/SEA
------	----------	-------------------

Figure 8: Translation of Proper Names

- It was also found to be necessary to exclude all records in which the MT column consists of more than a single composite word. As there is no indication in the data base which word(s) in the LXX is a translation of which element(s) in the MT in a single record, search programs are unable to count the Greek word(s) which relates to a specific Hebrew element.

0324	W/) T YD/K	KAI | TH | N XEI=RA
------	-------------	---------------------

Figure 9: Examples of the Rendering of Multiple Compound Hebrew Words

A good illustration of this problem can be seen in figure 9. The Hebrew contains four elements, but the Greek only three. The discrepancy is not, however, in the rendition of the second composite Hebrew word (see below regarding the rendering of the Hebrew definite article and the pronominal suffixes), but in the translation of the first (the Hebrew particle) *T* was not translated). A search program could not be instructed to cope with all problems that could arise from such combinations. After protracted experimentation in trying to cope with this phenomenon, it was eventually decided to exclude all records in which the MT consists of more than a single composite word.

- The definite article in Hebrew posed a problem when it is used in conjunction with the prepositions *B*, *K* and *L*. In these cases, the existence of the article is not noted in either the MT column in the CATSS data base or the grammatical analysis of Poswick. The search programs were therefore instructed to add one to the element count of any Hebrew word prefixed with the prepositions mentioned above, and for which the LXX has a definite article.

Although it must be admitted that this is an ad hoc decision on the part of the author, it is also true that the rules of Hebrew grammar are in favour of such a decision. The solution should not pose any serious problems to the integrity of the generated data set. The alternative was to discard all the records containing one of the above-mentioned prepositions. However, then the data set would have been so small that it would have been impossible to deduce reliable figures.

- A major problem was encountered regarding the noun with pronominal suffixes, as such nouns are normally regarded as having the definite article for the purposes of translation. Consequently, the search programs added one element to the element count of a Hebrew noun that has a pronominal suffix, and for which the Greek translation added an article.

- The Hebrew particle *L)MR*, normally translated with the participle of *LE/GW*, was incorrectly parsed as *L/)MR* in the CATSS data base. The search programs were instructed to regard *L/)MR* as one element for counting purposes.
- Likewise, *LPNY* was parsed as *L/PNY*, and again the search programs were instructed to regard it as a single unit.

The main data files of Deuteronomy were copied to temporary files and the purge process was carried out, as described above. The generated data set consisted of 6 420 records. Per record, each element in the Hebrew word was counted, as was each Greek word. If the two totals did not agree, that record was marked with a special marker. The statistical analysis was done by plotting these inconsistencies against the record number in an accumulative manner.

As with the previous criteria, 1 000 random data sets, each of which conforms to the parameters of the data set for this criterion, were generated. The standard errors of estimation were calculated for each of the data sets and these values merged in a new data set.

2.2.2 Results

The generated data set is extremely dense, with 2 371 differences in 6 420 usable records. Deviations from the regression line would therefore have to be pretty severe before they would be able to deflect the plotted line of values. This is also indicated in the high value of the maximum standard error of estimation allowed. The random data sets indicated that the maximum cut-off value to be allowed is 16.62231, that being the value of the 90th percentile.²¹

2.2.2.1 Interpreting the Graphs

In the graph of the regression line one can observe the density of the graph, and the closeness of the prediction lines.²² Because of the density of the data set, however, it is nearly impossible to calculate the intersection of the plotted line with these lines, or to see the nature of the plot depicting the occurrences of differences in representation of constituents. On a second graph depicting the residuals of the regression, the different elements of the distribution of the differences can clearly be seen.²³

²¹ Other values of the table of the standard deviations of the random data sets are minimum 5.17979, median 11.2271 and maximum 31.9282.

²² See figure 10.

²³ See figure 11.

The four major deviations from the regression line occur, in order of severity, at Deut. 17:15 (with a residual value of -35.88), Deut. 20:09 (with a residual value of -25.13), Deut. 33:17 (with a residual value of 22.65), and Deut. 4:23 (with a residual value of 21.59).

It would seem possible to divide the data set into different sections according to the following record numbers:

- 0 to 891 (ascending)
- 891 to 3 341 (descending)
- 3 341 to 3 628 (normal to ascending)
- 3 628 to 3 762 (descending)
- 3 762 to 5 238 (normal to ascending)
- 5 238 to 6 317 (ascending)
- 6 317 to 6 420 (descending)

2.2.2.2 Identifying the Translation Units

Unfortunately, none of the possible sections identified above can be implemented. The standard error of estimation of the whole data set is 12.0193. This value is well below the maximum for a homogeneous unit of 16.623. Therefore the main data set cannot be subdivided using the standard error of estimation as criterion.

The homogeneity can reflect one of the following:

- The data set is so uniform as to present a good homogeneity figure in statistical tests.
- The data set is random and therefore has a tendency towards a straight line.

In either case the data set can only be described as a unit:

Main Section²⁴

The data set stretches from Deut. 01:01 to 34:12 and has a varying character, as can be seen in figure 11. The deviations occur fast and furiously, in an average ratio of about 368 for every 1 000 records processed.

2.2.2.3 Reliability of the Results

Owing to the nature of the parallel alignment of the CATSS data base, the nature of the parsing and grammatical analysis of specifically the MT, and the difference in grammatical structures between

²⁴ The full figures: non-literal translations = 2 371; correlation coefficient = 0.999846; R^2 = 99.97%; standard error of estimation = 12.0193; slope = 0.368769; intersection = -9.17174.

Hebrew and Greek, a lot of changes had to be made to the data, and a lot of data had to be discounted as unsuitable. In fact, of the 14 320 records in the data base, only 6 420 could be used. Therefore the author does not feel comfortable with the integrity and consistency of the data set, to put it mildly.²⁵ Even if the statistical results of this criterion should agree with those of the other criteria, these results should be regarded with some misgivings.

²⁵ This remark was written **before** any statistical analysis was done.

Regression of Differences in
Representation of Constituents
(x 100)

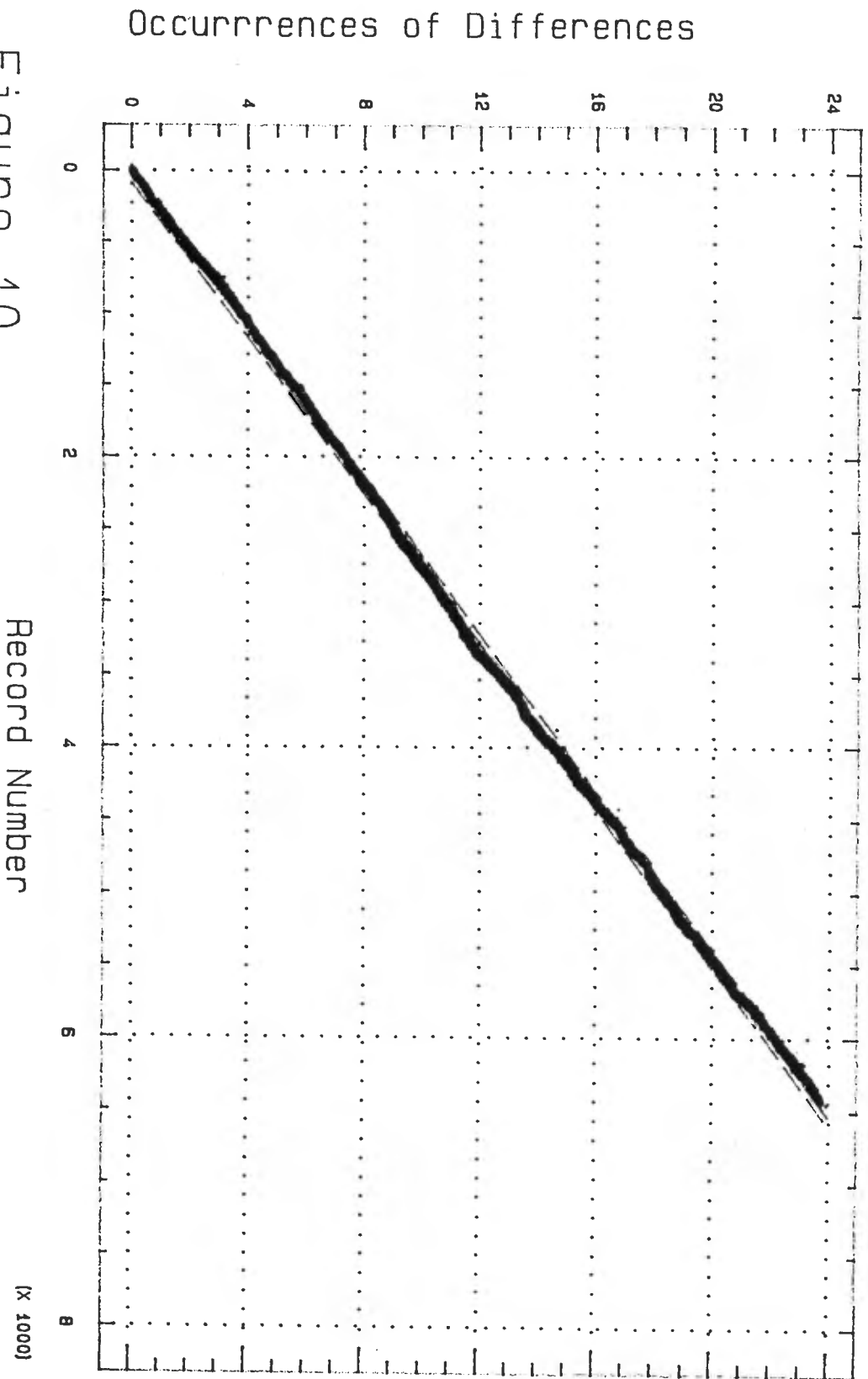


Figure 10

Residuals of Regression: Representation of Consituents

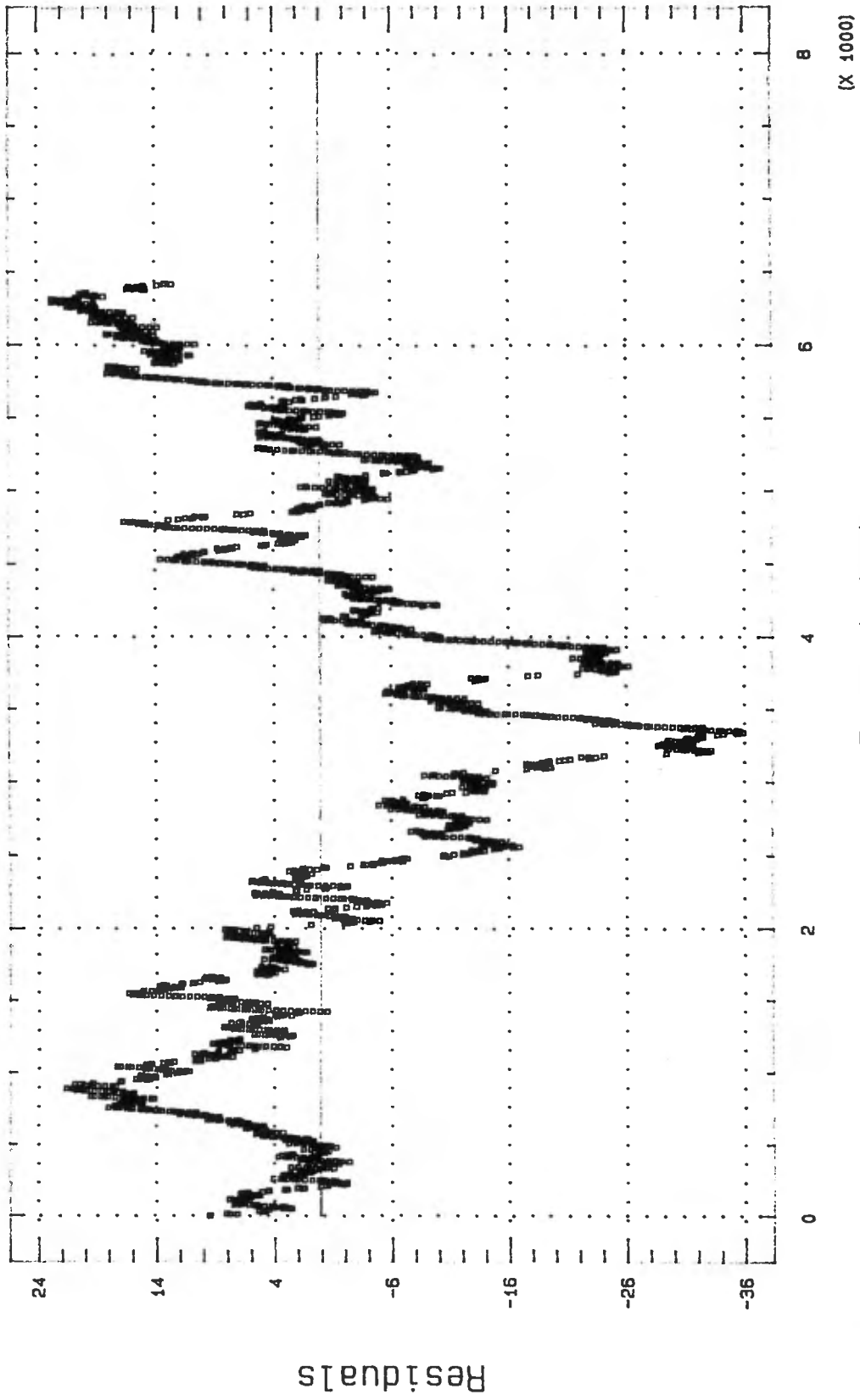


Figure 11

2.3 Word Order

Unfortunately, Tov (1981: 58) did not give much attention to the word order criterion. In fact, Tov only referred the reader to the works of D.W. Riddle (1932), J.M. Rife (1933), and S. Talmon (1975). These works only pointed out that the word order in Greek is flexible to such a degree that the Semitic word order can be followed almost completely.

Greek is able to represent the Hebrew word order.²⁶ Differences in word order should therefore be laid at the door of the translator, recensions of texts or different *Vorlage*, and are not due to the inability of the Greek language to reflect the word order of the Hebrew. This fact makes word order a very valuable tool to measure the translation technique. In addition, it is possible to represent word order rather accurately using statistics.

In addition to the problem above, Tov did not explain what type of word order is meant: that of the semantic units, or that of the syntactic units.²⁷ Are we to compare the order of the units in the different texts according to the semantic value of the phrase, or according to the syntactic value, for example the verb, subject and object order? Eventually, the author took it for granted that this criterion is to be based on the semantic value of the phrase, as are the other criteria.

2.3.1 Methodology

The problem was examined from two view-points, viz. via the markers indicating differences in word order in the CATSS data base, and programmatic searches of the data bases:

2.3.1.1 Markers in the CATSS Data Base

In the CATSS data base, word order can be measured on two levels:

- The annotations in the data base itself mark serious differences in word order with "{...}", "~ ~ ~" and "{.~}" (Tov, 1986: 42-80). These differences normally cover several lines of the parallel alignment.

²⁶ Certainly, sometimes it is a most unusual Greek that ensues from an attempt to translate the Hebrew element by element. (The church father Erasmus mentioned in his *Annotatio* to Acts 10:38 that the Greek is sometimes *non solum impolitus et inconditus verum etiam imperfectus et perturbatus*. It is to be wondered what he thought of the Greek that came from the pen of Aquila.) Enough examples can, however, be given that, even if the Greek language is totally mutilated by these translations, it is possible to render the Hebrew word order element by element in Greek!

²⁷ Rife (1933: 246 f.) discussed the word order regarding the general order of parts of speech, as well as the order of the verb, subject and object (the sov/svo problem).

- The differences in word order on a single line of the parallel alignment are indicated with a single "~" (Tov, 1986: 42-80).

Before a search could be launched, however, the data base first had to be filtered of certain records:

- Records containing proper names were deleted. In rendering the proper names, the translator had no choice as to the order in which the different components of the proper names are to be rendered.

The temporary data set generated by eliminating the records mentioned above was examined, and all occurrences of the markers mentioned above were numbered accumulatively.

2.3.1.2 Programmed Searches

In an endeavour to add to the list of differences in word order indicated in the CATSS data base, an elaborate set of search programs was written and executed using copies of the original data bases. It was planned that the matching of Hebrew elements with specific Greek words would be done on the basis of the matching of the parts of speech of the two languages, as was done in section 2.2:

- All records containing a "{" without a "~" had to be deleted, as differences in word order would be extremely difficult to detect in these records.²⁸
- As could be expected, the proper names were excluded from the search, owing to the same reasons as in the search for markers.
- Again, corrections had to be made to the Hebrew morphological data base with regard to the parsing of the Hebrew particle *L)MR*, which was parsed as two separate words in the Hebrew morphological analyses.²⁹
- Likewise, all renderings of *LPNY* were corrected.

²⁸ A "{" is inserted in records where certain textual problems are to be found as part of an annotation regarding the nature of the problem (Tov, 1986: 7-9). These problems tend to alter the number of words in the alignment, as well as to confuse the word order rather radically.

An example of the problems experienced can be found in Deut. 09:27 where the participle *W/)L* is translated by *KAI\ { . . . dE)PI \}*. Although it would seem as if the two Hebrew elements are rendered by the correct two Greek words in the correct order, it must be remembered that the second Greek word is not represented in the data base containing the Greek morphological analysis. As it is this data base that is used to determine the word order (as will be explained in a later section), the correctness of the word order cannot be determined.

²⁹ See section 2.2.1.

- The order in which the parts of speech of the remaining records occur in the Hebrew morphological data base was then compared to the order in the Greek morphological data base, allowing for the conversions as indicated in section 2.2.
- If a difference in word order was found, the corresponding record in the parallel alignment was marked.
- Eventually, the data base of the parallel alignment consisted of the consecutively numbered remains of the main parallel alignment after the deletions described above. All the records in which a difference in word order was found were marked with a tag.
- However, all the programming in this regard turned out to be to no avail. When the results of the searches were examined, a lot of differences in word order were indicated where, in fact, no differences occur. On closer examination of the raw data it was discovered that the word order in the data base containing the Hebrew morphological analysis does not always follow that of the text. For example in Deut. 01:22 the parts of speech for *W/) T H/ (RYM* were given in the order particle, particle, noun, article. The list of differences produced by the search programs could therefore not be used to add to the list of differences as indicated in the CATSS data base.
- The work was not done in vain, however, as these lists were used to check the list of differences in word order indicated by markers in the CATSS data base.

2.3.1.3 The Results

In the end, it can be said to the credit of the CATSS team that a cursory examination of the lists of differences created by the two separate approaches did not turn up any errors in the CATSS data base.

As the CATSS data base was found to be quite accurate in the indications of the word order, these indications were used to compile a list of differences in word order.

2.3.2 Results

Of the 14 320 lines in the original parallel alignment, 12 355 remained after the purging of the data bases. These records form the base line of the graph. However, only 628 indications of differences in word order could be found in the data bases.³⁰ The total data set is relatively dense and has a slope of 0.050.³¹ That translates to about 50 indications of differences in word order for every 1 000 words processed.

³⁰ The full figures: differences in word order = 628; correlation coefficient = 0.997255; R^2 = 99.45%; standard error of estimation = 13.519; slope = 0.050; intersection = -24.4244.

³¹ See figure 12 for a graph of the regression analysis.

The 90th percentile of the regression analyses of the 1 000 random data sets indicated that the cut-off value for a homogeneous data set is 8.51198.³²

Before proceeding with the interpretation of the graphs, a note regarding the notation of differences in word order seems appropriate: as explained above, the difference in word order can be accommodated within one single line of the parallel alignment, or it can extend over several lines of alignment.³³ The number of markers found should therefore not be taken literally, but should, perhaps, be divided by two to arrive at the correct number of real differences in word order. In order to avoid confusion, though, all the figures are kept as they are to be found in the data base.

2.3.2.1 Interpreting the Graphs

Using the graph of the residuals of the regression analysis,³⁴ it would seem that the data set could provisionally be divided into seven parts (according to record numbers) using the major deviations from the regression line as an indication:

- 1 to 311 (normal)
- 318 to 754 (ascending)
- 754 to 4 388 (descending)
- 4 389 to 7 456 (normal)
- 7 457 to 8 693 (ascending)
- 8 694 to 10 090 (normal)³⁵
- 10 091 to 12 355 (ascending)

The deviating parts are, in order of severity of the deviation, parts 2, 3, 7 and 5.

2.3.2.2 Identifying the Translation Units

The standard error of estimation for the whole data set is 13.519.

³² The other values of the standard errors of the random data sets are minimum 2.93737, median 5.78376 and maximum 15.66366.

³³ See Tov, 1986: 44-46 in the section marked "Inversion of clusters of two or more adjacent elements" for examples of one instance of change in word order generating three or more markers in the data base.

³⁴ See figure 13.

³⁵ See section 2.3.2.2 for the reasons why this data set, which descends relative to the regression line, is counted as having a normal distribution.

The most severe deviation, from 1 to 754, was detached from the data set, resulting in the data set having two parts:³⁶

- The deviating section, 1 to 754 (with a standard error of estimation of 4.23571)
- 755 to 12 355 (with a standard error of estimation of 11.802)

It is obvious that the second part (755 to 12 355) should again be subdivided by isolating the data set that exhibited the second most severe deviation:

- The deviating section, 755 to 4 388 (with a standard error of estimation of 3.30564)
- 4 389 to 12 355 (with a standard error of estimation of 8.776)

The second part of the subdivision above (4 389 to 12 355) again has to be subdivided. The third most severe deviation, 10 091 to 12 355, had to be detached, resulting in two additional data sets:

- 4 389 to 10 090 (with a standard error of estimation of 8.904)
- The deviating section, 10 090 to 12 355 (with a standard error of estimation of 4.29374)

As the standard error of estimation of one of the parts (4 389 to 10 090) is still above the cut-off value, the last major deviating section had to be detached as well:

- 4 389 to 7 456 (with a standard error of estimation of 5.59725)
- The deviating section, 7 456 to 8 693 (with a standard error of estimation of 5.01249)
- 8 693 to 10 090 (with a standard error of estimation of 1.77146)

The result of the subdivision (with the standard error of estimation in brackets) is therefore as follows:

- 1 to 754 (4.23571)
- 755 to 4 388 (3.30564)
- 4 389 to 7 456 (5.59725)
- 7 457 to 8 693 (5.01249)
- 8 694 to 10 090 (1.77146)
- 10 091 to 12 355 (4.29374)

³⁶ Ideally speaking, the first part of this section should be detached from the rest, as it clearly does not have the same trend relatively to the regression line. Again, that part can only be detached if the standard error proves to be higher than allowed, which it does not.

Section 1³⁷

The section from Deut. 01:01 to 02:20 rises sharply in relation to the regression line. The first part of the graph, as explained above, should be seen as part of the normal variation of the data, and not as a deviation. The tendency begins well above the regression line, leading to the added ascent topping out well above the prediction lines. This deviation is the most severe of the whole data set, and has a ratio of about 70 indications of differences for every 1 000 words processed.

Section 2³⁸

This section encompasses the data set from Deut. 02:20 to Deut. 11:30, and is counted as a deviation. It descends relative to the regression line in a rather mild manner, but this trend continues for nine chapters. The section begins with the values right at the highest point of the graph and plummets to far below the regression line. In fact, if the sections were to be compared regarding the biggest difference between starting values and ending values, this section is the one that deviates the most from the regression line. Visually, the trend is the most marked on the graph as well. The section has about 37 indications of differences for every 1 000 records processed.

Section 3³⁹

The section from Deut. 11:30 to Deut. 21:14 could be seen as a section that is normally distributed around the regression line. It exhibits some undulating trends, but keeps below the regression line. The ratio of this section is about 54 indications of differences in every 1 000 records. This compares well with the ratio of 50 indications for every 1 000 records for the whole of the data set.

Section 4⁴⁰

This section, Deut. 21:14 to 25:07, exhibits a short but very steep ascending trend. The set is very uniform in character and, as could be expected from the graph, has a high incidence of differences in word order. The ratio is 85 indications of differences in every 1 000 records, which is the second highest ratio in the complete data set.

³⁷ The full figures: differences in word order = 46; correlation coefficient = 0.950069; R^2 = 90.26%; standard error of estimation = 4.23571; slope = 0.0695818; intersection = -11.6585.

³⁸ The full figures: differences in word order = 127; correlation coefficient = 0.995991; R^2 = 99.20%; standard error of estimation = 3.30564; slope = 0.0368; intersection = 11.1868.

³⁹ The full figures: differences in word order = 162; correlation coefficient = 0.9929; R^2 = 98.59%; standard error of estimation = 5.59725; slope = 0.0535; intersection = -50.9771.

⁴⁰ The full figures: differences in word order = 101; correlation coefficient = 0.985407; R^2 = 97.10%; standard error of estimation = 5.01249; slope = 0.08455; intersection = -299.854.

Section 5⁴¹

This section starts at Deut. 25:07 and ends at Deut. 28:57. It is regarded as a section with normal distribution, but does exhibit a descending trend. It only has 26 indications of differences for every 1 000 records processed, which is little more than half that of the complete data set. The data set is still regarded as having a normal distribution, because it is small, does not exhibit extremes of deviation from the regression line, and falls within the prediction limits of the regression of the main data set.

Section 6⁴²

In contrast to the previous section, this section (Deut. 28:57 to 34:12) has a ratio of indication of non-literal translations of about 63 per 1 000 records, which is much nearer the ratio of the main data set. It is counted as a section that deviates from the regression line in an ascending manner, however, because the trend ends far from the regression line, crossing the prediction lines of the regression analysis. In this case, the severity of the ascending trend was not that serious, but the trend continues for about 2 500 records, leading to the section being regarded as a deviation.

2.3.2.3 Reliability of the Results

As mentioned above, word order is a very valuable criterion, having properties that make it easy to describe its results in statistical terms. Reliable results from this criterion would be an enormous benefit to the study of the translation units and translation techniques of this book.

The author regards the results of this criterion as quite reliable:

- Very few records were excluded from being considered, allowing 86.27% of the main data set to be used in calculations.
- No mistakes were found in the indications in the CATSS data base when the markers were compared with the results of the programmatic searches.

As mentioned above, care should be taken with interpreting the slope (or ratio of occurrence) of differences in word order, as one difference in word order could be described by more than one marker. This fact does not alter the reliability of the division of the data set into different sections, as the problem would have an equal influence on all the sections of the data set.

⁴¹ The full figures: differences in word order = 37; correlation coefficient = 0.986895; R^2 = 97.40%; standard error of estimation = 1.77146; slope = 0.02545; intersection = 216.999.

⁴² The full figures: differences in word order = 155; correlation coefficient = 0.995445; R^2 = 99.09%; standard error of estimation = 4.29374; slope = 0.06333; intersection = -161.07.

Regression of Differences in Word Order

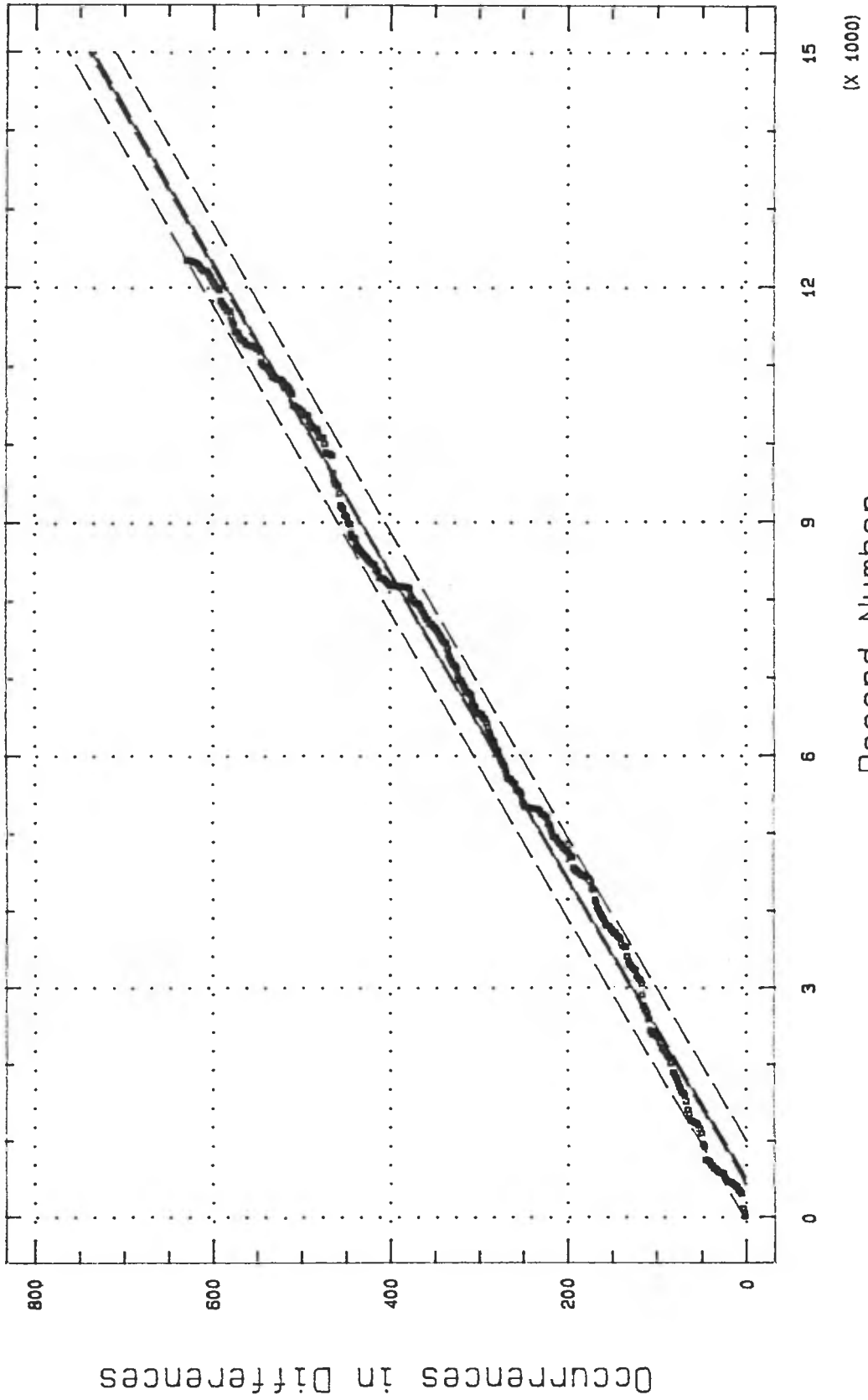


Figure 12

Residuals of Regression: Differences in Word Order

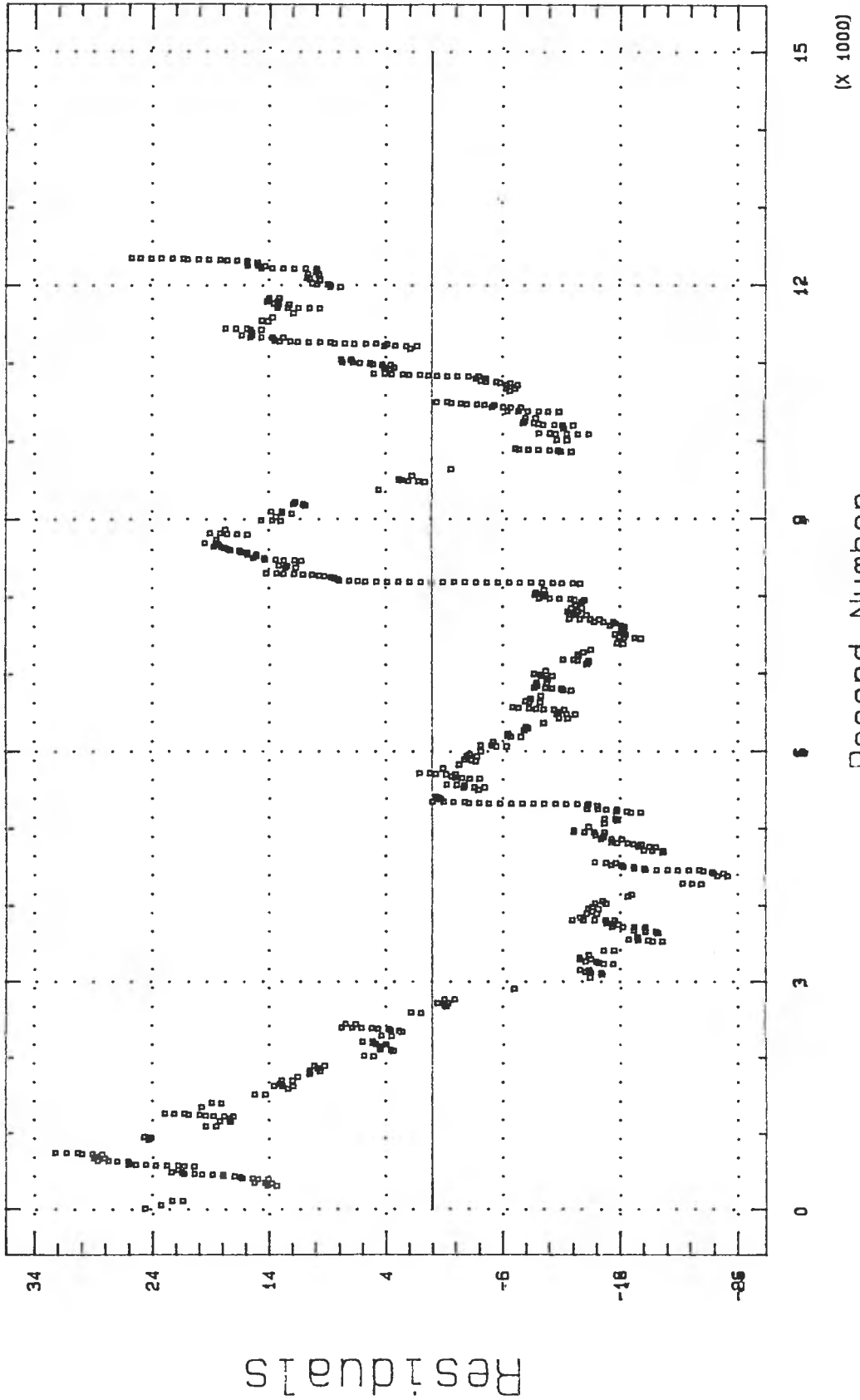


Figure 13

2.4 Quantitative Representation

There was some confusion in the mind of the author as to what E. Tov meant with quantitative representation. This term could have two meanings: it could mean that each element of each Hebrew word should have a separate Greek equivalent, as should each simple Hebrew word. On the other hand, it could also mean that each Hebrew element should be represented in the LXX, not necessarily by a separate Greek word. In addition, all words in the LXX should be represented in the MT in some way.

On the one hand he said "... literal translators did their best to represent each individual element in MT by one equivalent element in the translation." (Tov, 1981: 58) and "The more literal translators aimed at a 1:1 representation of the words in the MT." (Tov, 1981: 59). The impression was created that the rendering of each Hebrew element by a separate Greek element is to be measured. Some overlap would, however, then occur with the second criterion.

On the other hand Tov (1981: 82-86) quoted some examples that made it quite clear that he meant something else. The headings of the examples are "Additions", "Omissions" and "Substitutions". All the examples that fall under these headings deal not with the 1:1 representation of all Hebrew elements, but with additions and/or omissions. This interpretation is also borne out by an examination of Barr's criteria, on which Tov founded some of his work in this regard. Barr's (1979: 303 f.) second criterion is "the quantitative addition or subtraction of elements". As a final argument in this regard, it should be noted that, when Tov (1986: 51) discussed minuses and pluses, he called it a quantitative relation, and proceeded to describe what is meant.

It can therefore be concluded that the quantitative representation criterion of Tov does not deal as much with the 1:1 relationship of elements as with the representation of the Hebrew word(s) in the Greek without any additions and/or omissions.

Before proceeding to the implementation of this criterion in practice, it should be noted that the author is not entirely satisfied with using both minuses and pluses as a combined criterion. These two characteristics of the translation could have different text-critical origins and should, as such, be treated separately. In a previous study it has already been shown that the minuses and pluses are distributed differently in Deuteronomy, adding incentive to describing them separately (Nieuwoudt, 1992). This could not be done in this chapter, however, owing to the definition Tov gave to his criteria. However, they will be discussed in the next chapter, which will deal with other criteria based on markings in the CATSS data base.

2.4.1 Methodology

The additions and omissions are well marked in the CATSS data base with the markers "----" and "-+". In the beginning it was thought that a plus or minus could not occur in the same record as other

text-critical phenomena. This would imply that certain records could not contain a minus or a plus, and could not be evaluated according to this criterion.⁴³

To be specific, it was thought to be impossible that the marker for a plus or minus could occur on the same line with the marker for a sequence difference, doublet, distributive rendering, or notation of repetition of Hebrew words. In fact, this turned out to be completely false due mostly to the fact that more than one word/element can be accommodated in each record. (See the examples below.) The one element in the alignment can then exhibit the one text-critical trait and the other, another trait.

24:20	--+""	<i>SOI ~ E)NTE/LLOMAI</i>
-------	-------	---------------------------

Figure 14: Plus Occurring in the Same Record as a Sequence Difference

02:31	<i>L/R\$T {d}</i>	---
-------	-------------------	-----

Figure 15: Minus Occurring in the Same Record as a Doublet

It was therefore found that a plus or a minus can occur in any record in the data base and in combination with other text-critical phenomena. In that case the main data base could be used without any additional programming. The search programs were instructed to copy all the records with these markers to a temporary data base. All the instances of minuses and pluses were numbered accumulatively, after which the regression analysis was done. Using the profile of the temporary data base, 1 000 random data sets were again generated.

2.4.2 Results

Eight hundred and thirty non-literal translations were found in 14 320 lines of alignment, and these two values were used as the dependent and independent variables in the regression analysis.

The procedure dealing with the random data sets returned a 90th percentile of 9.96221.⁴⁴ All homogeneous data sets should therefore have a standard error of estimation smaller than this value.

⁴³ That is, the relevant line of the parallel alignment would **have** to answer "No" to the question asked, destroying its potential for an answer of a binomial nature.

⁴⁴ The other values for the standard error of estimation of the random data sets are minimum 3.20477, median 6.62526 and maximum 16.89220.

2.4.2.1 Interpreting the Graphs

The data set is very dense, as is also reflected by the denseness of the plot of data points around the regression line.⁴⁵ The graph also shows that the prediction limits are very close to the regression line. Owing to the density of the graph, however, it is very difficult to see the major features of the data set. On the graph depicting the residuals of the regression analysis it can clearly be seen that the distribution of the data points makes for an undulating line, except for one major feature.⁴⁶ The graph of the residuals of the regression analysis sinks to a low of about -27.5 at Deut. 29:25, and then rises very steeply to a highest point of about +40.8.

The general slope of the data set is 0.057, which correlates with about 57 pluses or minuses per 1 000 records.⁴⁷

2.4.2.2 Identifying the Translation Units

The single most obvious deviating trend in the data set is the section from 12 197 onwards. The methodology dictates that the biggest possible unit should be detached, and that it should be subdivided only if the standard error of estimation is above the cut-off value.

In this case, the section from 12 197 to 14 320 was detached. The standard errors of estimation for the first and second parts are 8.87992 and 8.07797 respectively, making it unnecessary to do further divisions. The small descending break in the ascending trend of the second section and the descending nature of the graph at the end of this section should therefore be regarded as normal variation within a data set.

Section 1⁴⁸

The graph of this section (Deut. 01:01 to 29:25) has an undulating nature, parts of which could be interpreted as major trends.⁴⁹ However, subdivision of this section is not allowed, as the standard

⁴⁵ See figure 16.

⁴⁶ See figure 17.

⁴⁷ The full figures: non-literal translations = 830; correlation coefficient = 0.998184; R^2 = 99.64%; standard error of estimation = 14.4512; slope = 0.057; intersection = -19.6742.

⁴⁸ The full figures: non-literal translations = 649; correlation coefficient = 0.99888; R^2 = 99.78%; standard error of estimation = 8.87992; slope = 0.055; intersection = -10.5077.

⁴⁹ See again the graph depicting the residuals of the regression analysis.

error of estimation is below that of the cut-off value. This section should therefore be regarded as having a normal distribution, as the ratio of 55 pluses or minuses per 1 000 records would support.⁵⁰

Section 2⁵¹

This section, ranging from Deut. 29:25 to Deut. 34:12, has a very strong ascending tendency relative to the regression line. It peaks at Deut. 32:52, but, again, no subdivision is allowed due to the fact that the standard error of estimation is too low. The data set depicts two deviations from its upward course, but these are to be seen as random variation within the data set. The section has, on average, about 88 pluses or minuses per 1 000 records, which is markedly more than those of the main data set.

2.4.2.3 Reliability of the Results

While the author is not satisfied with grouping pluses and minuses together in one data set, the fact that the whole data set could be used could be of great value in determining the translation units in Deuteronomy.

It is of great significance that all the records in the data set could be used by this criterion. This is the only criterion in this chapter that could be used without some of the records being excluded. As the filtering of data, though necessary, does alter the data set to some extent, it is done only when really necessary. As the results of this criterion are free of any such influence, they should be considered carefully.

To conclude, though the author feels that the integrity of the data set is compromised by the combination of two separate criteria, the results can be considered very reliable for this combined data set.

⁵⁰ Compare that with the ratio of the total data set of about 57 per 1 000 records.

⁵¹ The full figures: non-literal translations = 181; correlation coefficient = 0.98811; R^2 = 97.64%; standard error of estimation = 8.07797; slope = 0.0875; intersection = -407.702.

Quantitative Representation:
Regression Analysis
(x 100)

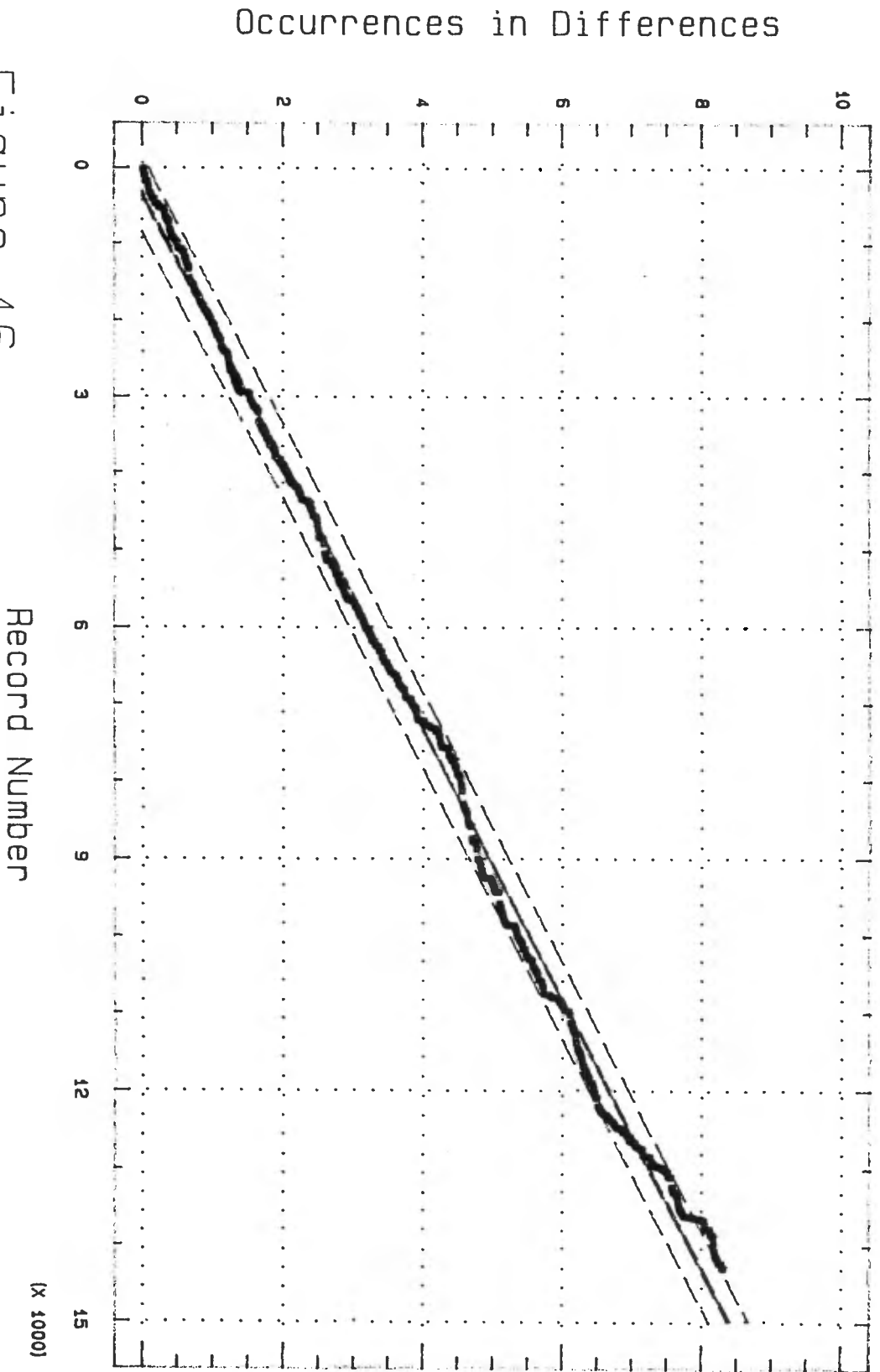
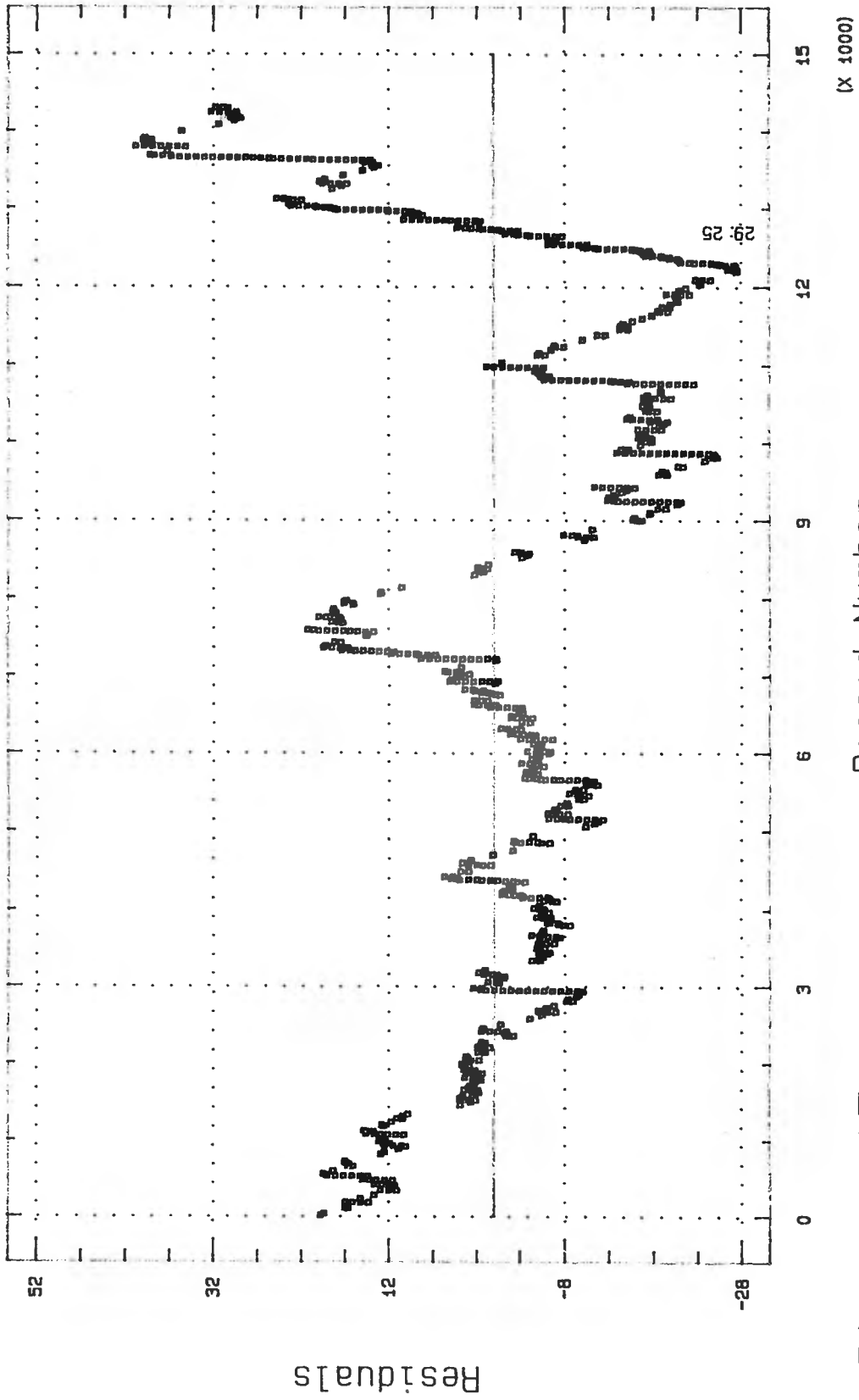


Figure 16

Quantitative Representation: Residuals of Regression



Record Number

Figure 17

2.5 Linguistic Adequacy of Lexical Choices

As was also remarked by E. Tov (1981: 59), this criterion cannot be used in any objective fashion whatsoever. It would be next to impossible to reconstruct the understanding of the text by the translator at the time of translation using the methodology followed in this study. Equivalents that the present-day researcher may deem inadequate may even have been literal in antiquity. In short, the lexical choice reflects the semantic value of both the Hebrew and Greek words as understood by the translator, as well as the translation technique, whether conscious or subconscious. The present research is concerned with the translation technique only. It proved to be impossible to separate the influences of the two factors mentioned above. The influence of translation technique can therefore not be judged, resulting in this criterion not being usable for statistical research.

3. Conclusion

While it may seem presumptuous to adjudicate the usability of the Tov criteria using the CATSS data base, it is necessary:

The computer, electronic data bases and statistical calculations are used very successfully to study the translation techniques and translation units of the Old Testament.⁵² It is important that it should be possible to apply the defined criteria to the texts in searches of electronic data bases. In addition, it should be possible to interpret the data generated by these searches in statistical terms and/or to use the data for statistical calculations. It is clear that Tov understood this issue when he claimed that the five criteria "can be partially expressed in statistical terms" (1981: 53). However, if the results of research criteria should prove not to be statistically usable, one would have to re-evaluate their definition and use.

The CATSS data base is one of the most powerful tools available for the text-critical work on the LXX. It was therefore chosen to be the source of data for this dissertation. Another factor that recommended its use was the fact that one of the directors, and one of the greatest contributors to the data base, is Emanuel Tov, the scholar whose criteria the author wanted to implement in this study. It was an assumption, but a reasonable one, that these two parts of the work of Tov on the LXX would act as supplementary to each other.

When problems are experienced while a certain criterion is implemented using the CATSS data base, it is very difficult to confer the problem to either the definition of the criterion or the nature of the CATSS data base. Distinctions in this regard in the next paragraph should therefore not be regarded as absolute.

In addition, it should be mentioned that the most modern programming techniques, e.g. artificial intelligence and semantic mapping, were not used in this study.⁵³ Though these techniques are beyond the scope of this study, the procedural type of programming used in the study was pushed to the limits.

Regarding the boundaries of the different translation units, these boundaries are determined by examining the graph carefully. However, differences in interpretation of the starting or ending points of

⁵² For examples of use of these aids, see Cook, 1987; and Tov, 1979, 1985a: 110-115, and 1989.

⁵³ It must be mentioned that the application of the more advanced techniques mentioned above could have alleviated the need for the culling of data from the data sets. In addition, the criteria may have matched the data base much better. The author is, though, not optimistic in this regard.

a trend on the graph concerning only a few data points can represent a change in the boundaries of the unit to the extent of several verses or even a chapter. The process of determining the boundaries is a very subjective one, and the boundaries determined should not be regarded as absolute.

The conclusion will take the following format:

- In the first section, it will be attempted to combine the results of the Tov criteria regarding the translation units in Deuteronomy. A pattern in the identification of translation units, as described by the combined Tov criteria, will be identified. If possible, these patterns could also serve to compare the results of the Tov criteria with those of the CATSS criteria and the criteria of the verb at a later stage.
- In the second section, the practical problems that were experienced with applying the Tov criteria to the CATSS data base will be discussed.
- A conclusion will be reached in the third section, taking into account the findings in the previous two sections.

3.1 Combined Translation Units for Tov's Criteria

In order to compare the results of the four applied criteria, a table was drawn up depicting them side by side.⁵⁴ The major entries depict the translation units as they were defined in the previous section. However, in order to show the tendencies of the graph, parts of which may not be reflected in the translation units, these tendencies are described in parallel entries. In this way, it is attempted to overcome certain limitations that the definition of the base line of certain criteria imposed on the identification of the translation units.

It must be reiterated that the conformity or not of the Tov criteria with each other does not validate or invalidate the results of a specific criterion. This exercise is only undertaken in an attempt to find common characteristics of the Tov criteria.

⁵⁴ See figure 18.

Criterion A	Criterion B	Criterion C	Criterion D
01:01	01:01	01:01	01:01
NORM.asc.	NORM.desc.	ASC.asc.	NORM.asc.
NORM.norm.	NORM.asc.	02:20	NORM.desc.
NORM.norm.	NORM.desc.	DESC.desc.	NORM.desc.
11:25	NORM.desc.	11:30	NORM.asc.
DESC.desc.	NORM.desc.	NORM.asc.	NORM.asc.
17:03	NORM.asc.	NORM.asc.	NORM.asc.
NORM.asc.	NORM.asc.	21:14	NORM.desc.
NORM.asc.	NORM.asc.	ASC.asc.	NORM.desc.
NORM.asc.	NORM.asc.	25:07	NORM.desc.
NORM.asc.	NORM.asc.	NORM.desc.	NORM.desc.
29:09	NORM.asc.	28:57	NORM.desc.
ASC.asc.	NORM.asc.	ASC.asc.	NORM.desc.
ASC.asc.	NORM.asc.	ASC.asc.	29:25
ASC.asc.	NORM.asc.	ASC.asc.	ASC.asc.
34:12	34:12	34:12	34:12

Figure 18: The Comparative Table of Translation Units Identified by the Different Criteria⁵⁵

The following major trends are visible in the comparative table:

- The other criteria agree well with the graph of the word order criterion. The results of this criterion are regarded as rather dependable due to the reasons given in section 2.3.2.3.
- The translation units of the second criterion - the representation of the constituents of Hebrew words by individual Greek words - are not in line with those of the other criteria. Still, the general trends of the graph may be taken into consideration when the other criteria are examined.

General trends:⁵⁶

- **01:01 to 02:20 ascending:** This trend is explicitly defined only in word order, but reflected in graphs of two of the other criteria.
- **17:03 to 25:07 ascending:** This trend can be observed in three of the criteria. The translation units only reflect this tendency in word order, and only from 21:14 to 25:07.

⁵⁵ The first criterion is consistency, the second representation of the constituents of Hebrew words by individual Greek equivalents, the third word order and the fourth quantitative representation.

Text references are used in the table to indicate translation units as identified in the respective sections. Trends reflected in the indicated translation units are identified by markers in capitals. However, trends visible on the graph, but not strong enough to be reflected in the translation units are indicated in lower-case letters.

For "asc." read "ascending", for "desc." "descending" and for "norm." "normal".

⁵⁶ Indicated in small capitals in figure 18.

- **28:57 to 34:12 ascending:** This trend is the most dominant in the table and is to be found in all the criteria, even though the start of the trend varies from the one criterion to the other by as much as a chapter. The trend is also noted in the translation units of the consistency and representation of constituents of Hebrew words by individual Greek equivalents criteria.

Regarding the comparison of the **positively identified translation units**, the following remarks can be made (the results of the second criterion are disregarded):⁵⁷

- There is very little similarity between the translation units of the different criteria.⁵⁸
- Large portions of the different criteria are composed of normal trends.
- The only trend that has universal support is that from 29:25 to 34:12 (taking the parts where the criteria overlap), and has a very strong ascending character. This is also the strongest deviation from the regression line for consistency and quantitative representation and comes in strong with word order.

3.2 Usability of Tov's Criteria Using the CATSS Data Base

One of the problems in adjudicating the usability of the Tov criteria lies in the validity of the processes used by the adjudicator. A lot of debate could result from examining the data excluded from the different data sets.

3.2.1 Definitions of the Criteria

The formulation of the Tov criteria clearly was not intended to serve as guideline for implementation in computer data bases. At no stage were specific instructions given that could serve as a guide for the computer programmer:

- With the **consistency** criterion, it had to be presumed by the author that the lexical choice takes place on element level in the Hebrew and on word level in the Greek. Although Tov (1981: 54) mentioned that the "stereotyping" can take the form of "a given Hebrew word, element (e.g. preposition), root or construction...", all except one of his examples are on the element level.

The alignment in the **CATSS** data base was done on the basis of "formal equivalence" (Tov and Wright, 1985: 155). More often than not, these lines of equivalences consisted of more than one

⁵⁷ These units are indicated in capital letters in figure 18.

⁵⁸ Similarity is being measured by the translation units having the same boundaries and the same trends.

Hebrew word or a Hebrew word(s) with more than one element.⁵⁹ It is obvious to the user of the data base, however, that the whole of the line of the parallel alignment cannot be used to find duplicates of that line. Especially if the line consists of more than one Hebrew element, the chances are slight that major duplications of the line could be found in the data base.

In the end it was decided to follow the majority of examples that Tov gave in his 1981 work, as well as the intention of Barr (1979: 306) when he used the term word in this regard. The searches for consistency were therefore based on equivalents on the element level in Hebrew and word level in Greek.

- The **word order** criterion was not well defined at all, and the author had to make some assumptions before the criterion could be implemented.⁶⁰
- When it was attempted to apply the **quantitative representation** criterion, two different meanings of the criterion had to be contended with.⁶¹ Again, the author had to decide on the meaning of the criterion.

Another aspect of the criterion gave rise to some concern regarding the validity of the criterion: pluses and minuses are combined in this criterion. When considering the MT and the LXX, the researcher always has to keep in mind that the Hebrew text from which the LXX was translated was not the MT. Pluses and minuses could have two separate sets of possible causes.⁶² This matter was well treated by Tov in his 1981 work from page 186 to 193. It is therefore peculiar that he ignored this when grouping the two phenomena together on page 58 of the same work.

- Tov himself admitted that the last criterion, **linguistic adequacy of lexical choices**, could not be implemented statistically.⁶³ In addition, the criteria that reflect the non-literal nature of translation cannot be implemented statistically either (Tov, 1981: 60-66).

⁵⁹ Of the 14 320 lines of equivalence in the CATSS data base of Deuteronomy, 6 408 had single Hebrew words, consisting of only a single element, in the parallel alignment. This amounts to only 44.7% of the data base.

⁶⁰ See section 2.3.

⁶¹ See section 2.4.

⁶² For different views on this subject see Barr, 1979; Barthélemy et al., 1979 and Tov, 1982d.

⁶³ Hope should not be abandoned in this regard. Advances have been made in mapping the semantic framework of semantic units in such a way that they can be compared (e.g. Botha, 1989).

3.2.2 Problems with Finding the Correct Equivalents

One of the major problems with all the criteria is the nature of the alignment of the CATSS data base.⁶⁴ Problems in this regard have already been exhaustively discussed (section 2.1.1; Nieuwoudt, 1988b: 403 and 1989b). Suffice it to say that the placing of different Hebrew elements on one line causes tremendous problems when elements in the MT and the LXX have to be matched up again. Finally, many records had to be disregarded due to the confusion caused by the presence of other words or word elements in the same line of formal equivalence.

The following criteria had problems with the alignment: consistency, representation of the constituents of Hebrew words and word order.

3.2.3 Problems with Parsing of the Hebrew Words and with the Hebrew Morphological Analysis

As was previously mentioned, several problems were experienced with the Hebrew morphological analysis:

- The order in which the grammatical analyses are to be found in the Maredsous data base, does not always match the word order in the CATSS data base.
- The words *LPNY* and *L) MWR* are incorrectly parsed.
- Two part of speech indicators in the Hebrew morphological data base, "Z" and "?" could not be used.
- The definite article proved to be a problem when used in conjunction with the prefixed prepositions.⁶⁵ The existence of these articles is not noted in either the CATSS data base or the Hebrew morphological analysis.⁶⁶

⁶⁴ While reading the criticism of this type of alignment, the reader should keep in mind that the present alignment methodology had been chosen by the CATSS team for specific reasons. For certain types of research problems this methodology has proven itself to be invaluable.

⁶⁵ It can be claimed, however, that these articles are "late" because their existence is only indicated in the vowel structure of the word.

⁶⁶ Unfortunately, not even the vocalization of the Hebrew morphological analysis indicates the presence of the article. Compare $B^* : (\&B ; R$ with $B^* : M . D : B^* = , R$ (the first word without the article and the second with the article) in Deut. 01:01.

- Although the presence of the pronominal suffix is indicated in the CATSS data base with the normal parsing marker, this pronoun is not indicated in the morphological analysis.⁶⁷ This information was needed when the representation of the constituents of Hebrew words by individual Greek equivalents was calculated.⁶⁸

3.3 Conclusions

The findings can be summarized as follows:

Some severe theoretical and practical problems were experienced when the Tov criteria were applied using the CATSS data base. These problems severely influenced the findings of at least two of the four criteria that could be applied. Even taking into account the forced marriage of two research projects in this case, and the level of the programming applied to the problem, it can still be said in all fairness that the Tov criteria were not formulated in such a way that their application on a computer data base could be facilitated in an easy way. In addition, the structure of the CATSS data base severely inhibits some types of searches.

However, the graphs of all the criteria show remarkable similarity, thereby indicating that the Tov criteria give the same general description of the data set. In addition, the graphs of the other criteria agree with the one dependable criterion, word order.

The only certain characteristic of the Tov criteria to come forward is the ascending trend from Deut. 29:25 to Deut. 34:12.

⁶⁷ In Deut. 01:03 the last word reads as follows in the CATSS data base:) *T/W*. In the Hebrew morphological analysis, however, no mention can be found of the pronoun) & , *T*.

⁶⁸ See section 2.2.1.

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CHAPTER 4: THE CATSS CRITERIA

1. Methodology

1.1 Aim

One of the most sensible pieces of advice was offered to me by H.T. Groeneveld. While discussing statistical analysis, he said that "the data should speak for themselves". This is indeed what this chapter is all about regarding the CATSS data base.

In the previous chapter, it was shown that the data in the CATSS data base are not ideally suited to be studied according to the Tov criteria. That does not invalidate the data as contained by the data base, or the structure of the CATSS data base.

In fact, the CATSS data base was set up as a research project with its own purposes, data and tools. The project has two aims: Tov (1985b: 221) made it quite clear that the CATSS project has a general goal: to provide data for all aspects of the study of the LXX and its relation to the MT. The parallel alignment took preference when the research began. However, it soon became necessary to add notations (Tov, 1985b: 223-225; 1986: 2-3) to the data base files, indicating different text-critical phenomena.

The notation markers were inserted in the data base by the researchers working on the project. According to Tov (1985b: 237) it was the original intention that the data base should be able to accommodate computer searches of the data.¹ Different text-critical phenomena can be searched for using the data base files. The question remains, however, in which manner these criteria are to be implemented. Tov rightly claimed that "... further studies are necessary to designate with sufficient precision the criteria and controls for determining the boundaries between different types of translation..." (1985b: 237).

¹ Tov (e.g. 1986: 4-5 and 141-144) supplied the researcher with many ideas for searches of the CATSS data base.

The aim of this chapter is to measure, again, the rigidity with which the Hebrew text is represented by the LXX as reflected in the application of several criteria in the data base:

- Possible criteria will be identified, selected from the phenomena represented by markers in the data base.
- Each criterion will be examined individually, and tested as to the practicality of its implementation. It seems obvious that it should be possible to implement the criteria represented by markers in the data base without any problems. However, it is also possible that certain subtle difficulties in the data processing sphere, similar to some of the problems in the previous chapter, may crop up.
- Should it be at all possible to use a specific criterion as an indication of the literalness of the translation, it will be utilized as such. Again, the methodology outlined in the second chapter, and implemented in the third will be followed: the base line of the data set will be calculated, deviations plotted, cut-off values calculated, and translation units determined.

At the end of the chapter, it will be attempted to evaluate the usability of the CATSS data base for research in the translation technique of the LXX as reflected by the attempted application of the criteria identified. In addition, it will also be attempted to gain an overview of the results of the application of these criteria.

1.2 Data Used

The CATSS data base will be used with searches spanning the MT and LXX columns, as well as Column B.2 If necessary, the searches will also include the grammatical analyses of the Hebrew and the Greek, but searches for these additions to the data base will not be the main purpose of this chapter.

As far as possible, it will be attempted to use all the data in the data base. In fact, if it is possible to implement a criterion in such a way that all the possible data in the data base can be used without exclusions of any sort, the value of the results of that criterion will be maximized.

Again, searches will be done using the simple search algorithms possible in the dBASE data base language. Only when straightforward searches do not seem to be successful, will programs be written to enhance the search algorithms.

² As this chapter is based on the markers, or symbols, inserted in the CATSS data base, it bears repeating that the version of the data base used in this study dates from 1987. It has been updated since, and other users of the data base will find that the information in the newer versions of Deuteronomy is more complete.

2. The Criteria Examined

The identities of the usable criteria are not so obvious as in the previous chapter. Neither is it possible to transform all the markers in the CATSS data base into criteria usable in the identification of translation technique. It will be attempted to make a selection of the different criteria, hoping that all the possible groups of criteria will be represented. The criteria chosen should be able to gauge the translation technique of the LXX.

Different groups of criteria could be distinguished, viz. markers indicating the nature of the parallel alignment, markers dealing with grammatical features of some kind, and markers inserted in Column B. Tov (1986) already explained the different types of phenomena and their associated markers. It will be attempted to convert each of the markers defined into a possible criterion.

A. MARKERS INDICATING THE NATURE OF THE PARALLEL ALIGNMENT

- **Split Representation** (Tov, 1986: 39-42): This phenomenon was included in the word order criterion in the previous chapter.
- **Differences in Sequence** (Tov, 1986: 42-50): This phenomenon was included in the word order criterion in the previous chapter.
- **Minuses and Pluses** (Tov, 1986: 51-56): As indicated in the previous chapter,³ these two phenomena should be treated separately, and they will, in turn, be used as criteria.
- **Doublets** (Tov, 1986: 56-59): As can be seen in the definition and examples of doublets, doublets can be regarded as special kinds of minuses, pluses and split representation. As such, they are treated under those headings. Other types of doublets may also occur as alone-standing phenomena (Tov, 1986: first table on page 57). However, only 17 doublets could be found in Deuteronomy, and it was judged that this data set is too small to provide an accurate reflection of translation technique.

For the sake of interest, the following table contains those occurrences. Although the 17 doublets are too few to use as a criterion, the reader should note the clustered nature of the occurrences of the doublets. The table contains, in order, the record number (out of 14 320), text reference, MT and LXX of the lines of the parallel alignment that contain the marker "{d}". With one exception (Deut. 02:31) these markers are to be found in the LXX column, indicating that the doublet refers to one Greek word representing more than one Hebrew word.

³ See chapter 3, section 2.4.

<u>Rec.No.</u>	<u>Ref.</u>	<u>MT</u>	<u>LXX</u>
1082	0231	L/R\$T	---
		{d}	
9436	2318	L)	OU)K {d} {...OU)K}
9437	2318	THYH	E)/STAI {d} {...E)/STAI}
9438	2318	QD\$H	PO/RNH {d} {...TELESFO/ROS}
9439	2318	M/BNWT	A)PO\ QUGATE/RWN {d} {...A)PO\ QUGATE/RWN}
9441	2318	Y&R)L	ISRAHL {d} {...ISRAHL}
9442	2318	W/L)	KAI\ OU)K {d} {...KAI\ OU)K}
9443	2318	YHYH	E)/STAI {d} {...E)/STAI}
9444	2318	QD\$	PORNEU/WN {d} {...TELISKO/MENOS}
9445	2318	M/BNY	A)PO\ UI(W=N {d} {...A)PO\ UI(W=N}
9446	2318	Y&R)L	ISRAHL {d} {...ISRAHL}
11307	2837	L/\$MH	E)KEI= {d} E)N AI)NI/GMATI
13357	3219	W/YN)C	KAI\ E)ZH/LWSEN {d} KAI\ PARWCU/NQH
13558	3237	B/W	E)P" AU)TOI=S {d} {...E)F" OI(=S}
13633	3243	(M/W	META\ {d} TOU= LAOU= AU)TOU=
13643	3243	W/NQM	KAI\ E)KDIKH/SEI {d} {...DI/KHN}
13933	3311	QM/YW	E)XQRW=N {d} E)PANESTHKO/TWN AU)TW=|

Figure 1: Doublets to Be Found in Deuteronomy

- **Distributive Renderings** (Tov, 1986: 59-61): No markers indicating distributive renderings could be found in Deuteronomy.
- **Repetitive Renderings** (Tov, 1986: 61-62): Only one marker indicating a repetitive rendering could be found in Deuteronomy. The data set is obviously too small to use as a criterion.

<u>Rec.No.</u>	<u>Ref.</u>	<u>MT</u>	<u>LXX</u>
8101	1917	{..r} W/L/PNY	KAI\ E)/NANTI

Figure 2: Repetitive Renderings to Be Found in Deuteronomy

B. MARKERS DEALING WITH GRAMMATICAL FEATURES

Almost all the grammatical criteria consist only of the normal markers discussed in the previous section, as applied to certain grammatical categories (Tov, 1986: 64-75). However, some special

grammatical markers are used to indicate some interesting phenomena. These markers are not all intended as indications of translation technique. In fact, some of them deal solely with grammatical phenomena. However, some of the phenomena could possibly be utilized to determine translation technique:

- **Hebrew Prepositions Represented by Greek Preverbs** (Tov, 1986: 69-70): The occurrence of this phenomenon can be seen as a departure from a purely literal translation of the MT, and could, as such, be measured. Thirty-three occurrences of the marker were found. This phenomenon can be used as a criterion.
- **Prepositions Added in the LXX** (Tov, 1986: 71-72): Although this phenomenon could be seen simply as an indication of pluses, the occurrences thereof are marked explicitly in the data base. However, no markers of this type could be found in Deuteronomy.
- **Infinitive Absolute** (Tov, 1986: 74): Although this marker occurs 70 times in Deuteronomy, the author could not see a way in which this phenomenon can be used as a criterion to measure translation technique.
- **Transliterated Hebrew Words** (Tov, 1986: 77-78): This phenomenon could be of some interest to future researchers. However, again the author could not apply this as a criterion: in order to judge whether the translator chose whether or not to transliterate a Hebrew element, all the elements where transliteration is possible have to be marked as such, or it must be possible to identify these elements in some other way. As this is not the case, the base line of this criterion could not be determined. It is therefore impossible to implement the criterion.

C. MARKERS INSERTED IN COLUMN B

Unfortunately, we again encounter the problem of a lack of features to compare with each other in this section (Tov, 1986: 96-121). Although plenty of phenomena can be found in Column B, these should be of such a nature that the translator would have a "Yes/No" choice of whether to translate in a certain way before they can be utilized as criteria for translation technique. In the case of many of the phenomena described, this choice is not evident, and the phenomenon is correspondingly more difficult to utilize as a criterion for translation technique.⁴

In the end none of the criteria in this group could be implemented.

⁴ See, for example, the indication of variants (Tov, 1986: 96-97).

2.1 Minuses

A minus is defined as an element of the MT for which the LXX does not have a correlating element (Tov, 1985b: 230; 1986: 51). This phenomenon is indicated in the CATSS data base with the marker "--" in the LXX column. This indication can also be enhanced with the marker "" (double quotes) to indicate that the minus is part of a long string of equivalents missing in the LXX.

2.1.1 Methodology

Minuses and pluses, it was found, can occur anywhere in the CATSS data base. Searches for phenomena that would exclude minuses and pluses were to no avail.⁵

However, while all phenomena can occur in conjunction with minuses and pluses, these two phenomena cannot occur together on the same line of the parallel alignment. It is not simple to evaluate this fact: the translation can consist of equal numbers of elements of the MT and the LXX, of alignments with elements missing in the MT and with elements missing in the LXX. Should the occurrences of pluses therefore be deducted from the baseline of the occurrences of minuses and vice versa? Or should the minuses and pluses be regarded as two sides of the same coin, in which case the base line should be the full data set?

After some deliberation, it was decided to adjust the base line of the criterion being applied: when quantitative representation is applied as a single criterion, the pluses and minuses should be seen as different aspects of the same event. However, in this chapter the two aspects are discussed separately. There is no reason to group these two aspects together again, especially if the reasons given for evaluating the two criteria separately are taken into account.⁶ In the light of this argument, it is clear that the base line of the minuses criterion should be adjusted to exclude all pluses, as no minus can occur where a plus is to be found.

The main data set was copied to a temporary data set. All the occurrences of pluses were deleted from the data set. The resulting data set was renumbered accumulatively in order to obtain the new base line, and these numbers copied to a new data base field containing the record numbers for the base line. Subsequently all records not containing minuses were deleted, and the data set was renumbered to reflect the occurrences of minuses in an accumulating fashion. The new base line and the present data base numbers were then used to calculate the statistics.

⁵ See chapter 3, section 2.4.1.

⁶ In the previous chapter, it was mentioned that minuses and pluses can have different reasons for occurring.

2.1.2 Results

Two hundred and sixty three minuses were found in a data set with an adjusted base line containing 13 753 records. The 1 000 random data sets returned a minimum standard error of estimation of 1.70168, a maximum of 9.81257 and a 90th percentile of 5.61627.

2.1.2.1 Interpreting the Graphs

The regression analysis of the data set indicates two major deviations from the regression line, viz. at record 541 (Deut. 01:40) and record 13 048 (Deut. 33:09).⁷ Both these deviations indicate a density of minuses higher than the average. The full data set contains an average of about 18.5 minuses for every 1 000 records.

2.1.2.2 Identifying the Translation Units

Both deviating trends mentioned above are ascending in nature. The first deviation begins its ascent at Deut. 01:01 and peaks at Deut. 01:40. The second trend begins its deviation at Deut. 28:51 and peaks at Deut. 33:09. Of the two trends, the second one has a higher peak as well as a longer duration: it begins far below the regression line, and peaks at the highest point of the graph of the residuals of the regression analysis.

The main data set has a standard error of estimation of 6.87656, which is higher than the maximum value allowed by the random data sets.⁸ The second deviating trend has to be detached from the main data set first.

As has occurred in the previous chapter, the last part of the graph exhibits a descending trend. Again, we cannot be sure whether this descending part is part of the normal deviation to be expected or whether it should be seen as a separate section of the graph. This last section may only be detached from the section containing the second deviation if the standard error of estimation of the second deviating trend (including the descending end of the graph) is more than the maximum allowed.

The data set was divided in two: Deut. 01:01 to Deut. 28:51 and Deut. 28:51 to Deut. 34:12. These two sections exhibited standard errors of estimation of 5.2526 and 2.62717, indicating that no further division of the data set is necessary.

⁷ See figure 3 for the regression analysis and figure 4 for the residuals of the regression.

⁸ The full figures: indications of differences = 263; correlation coefficient = 0.995921; R^2 = 99.19%; standard error of estimation = 6.87656; slope = 0.0185153; intersection = -4.74087.

Section 1⁹

The first section of the data base can be described as normal, and has, as could be expected of the largest section of the data set, an undulating nature. Its standard error of estimation is near the maximum allowed (5.61627). This is reflected on the graph in the major deviations at Deut. 01:40 and Deut. 19:02. The average slope of this section is about 17 minuses in every 1 000 records, which is quite near the slope for the main data set.

Section 2¹⁰

This deviating section of the data base ranges from Deut. 28:51 to Deut. 34:12, with the data point at Deut. 33:09 deviating the most from the regression line. The slope is about 27 minuses in every 1 000 records, which is much more than the slope of the main data set and that of the first section. The deviations from the ascending nature of this section of the data set should be seen as random variations within the data, and not as significant deviations.

2.1.2.3 Reliability of the Results

Of the 14 320 alignment elements in Deuteronomy, 13 753 could be used in examining the minuses. Although it would have been nice to be able to use the whole data base in applying the minus criterion, being able to use 96% of the data base is not to be sneered at. As a large part of the data base could be utilized, this criterion is judged as quite dependable.

In addition, the translation units of the present criterion do reflect the units as indicated by the larger criterion of quantitative representation.¹¹ Both these criteria indicate that the book should be divided in two, as regards translation technique. Quantitative representation indicates that the division should take place at Deut. 29:25, while the minuses indicate Deut. 28:51.

⁹ The full figures: indications of differences = 190; correlation coefficient = 0.995452; R^2 = 99.89%; standard error of estimation = 5.2526; slope = 0.0174142; intersection = 0.00534121.

¹⁰ The full figures: indications of differences = 73; correlation coefficient = 0.992412; R^2 = 98.49%; standard error of estimation = 2.62717; slope = 0.0272073; intersection = -108.59.

¹¹ See the previous chapter, section 2.4.

Minus Signs in the CATSS Data Base: Regression Analysis

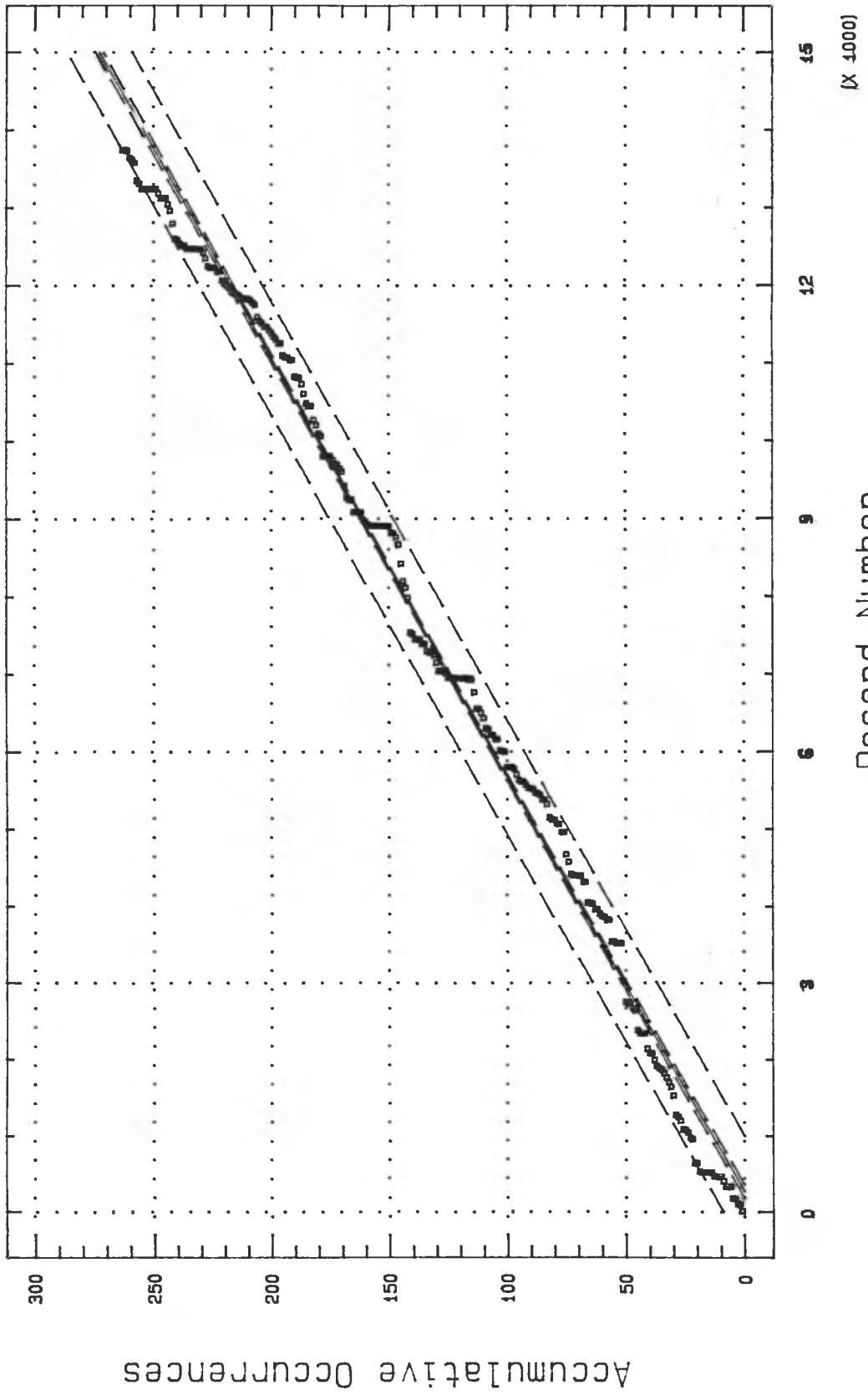


Figure 3

Minus Signs in the CATSS Data Base: Residuals

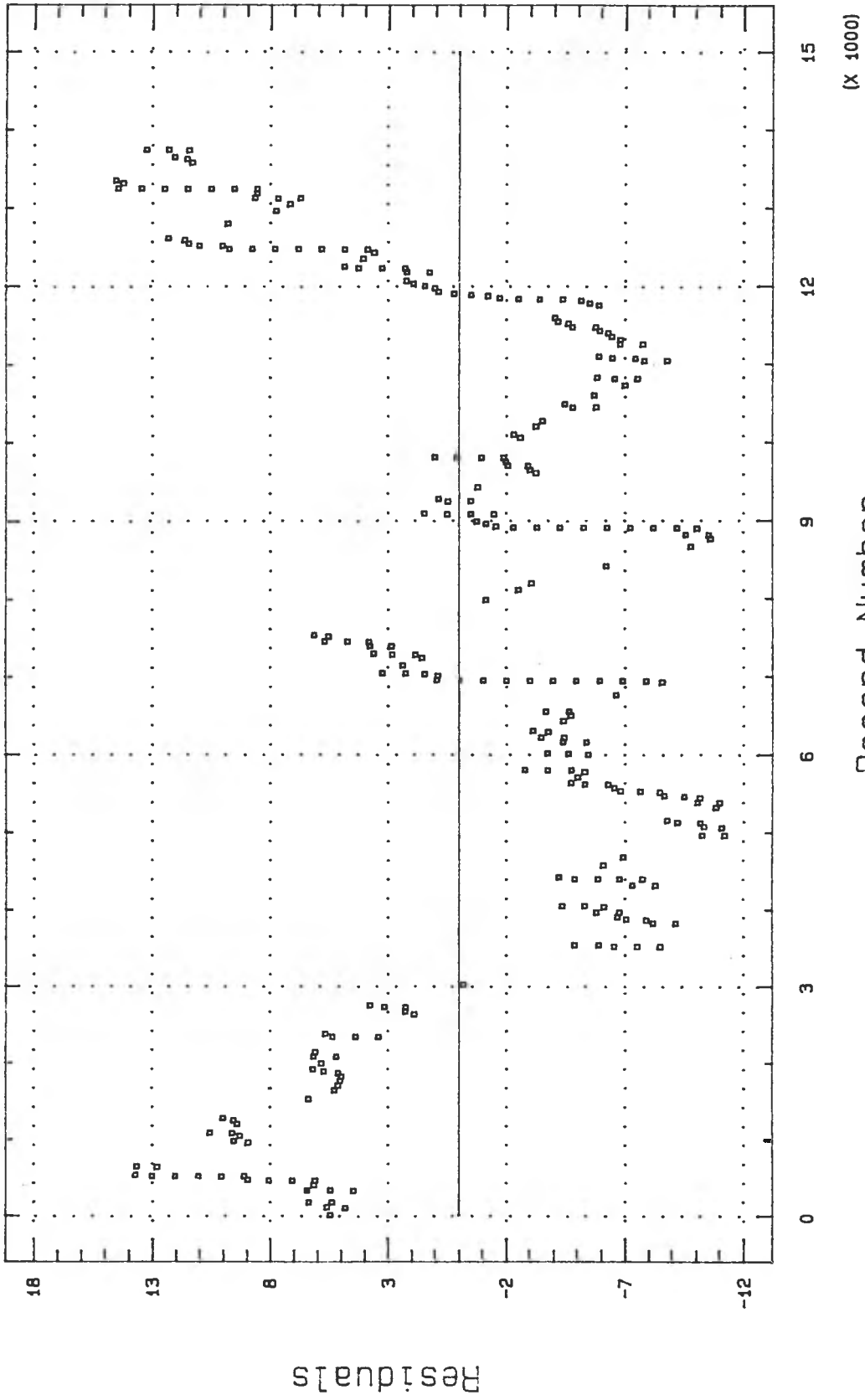


Figure 4

2.2 Pluses

Markers indicating pluses occur in the CATSS data base where the LXX contains elements not reflected in the MT. The markers used are the "---+" for shorter pluses and '----+ ""' for longer strings of pluses (Tov, 1986: 52).

2.2.1 Methodology

Exactly the same methodology is followed in applying this criterion, as was followed in evaluating the minuses.

The base line of the graph was obtained by copying all records not containing minuses to a new temporary data base. The numbers of the records on this new base line were obtained by numbering the records in the new data base accumulatively. All occurrences of pluses were numbered accumulatively, thereby determining the Y-axis of the graph.

2.2.2 Results

The base line of the data set consists of 14 057 records, while 567 pluses are indicated. The random data sets returned a 90th percentile of all the standard errors of estimation of 7.94590.¹²

2.2.2.1 Interpreting the Graphs

The regression analysis of the data set indicates two major deviating trends.¹³ The first one occurs at record number 9 645 (Deut. 24:17) and the second at record 13 419 (Deut. 32:44). The first deviation has a descending nature and its residual value bottoms out at -24.7. The second deviation has an ascending nature and its residual value peaks at about 31.

The general slope of the complete data set is 0.04, which translates to 40 pluses in every 1 000 records.¹⁴

¹² The other figures for the 1 000 random data sets are minimum 2.71791 and maximum 13.51098.

¹³ See figure 5 for a graph of the regression analysis and figure 6 for a graph of the residuals of the regression analysis.

¹⁴ The full figures: indications of differences = 567; correlation coefficient = 0.997869; R^2 = 99.57%; standard error of estimation = 10.698; slope = 0.0400462; intersection = -14.6499.

2.2.2.2 Identifying the Translation Units

The standard error of estimation of the complete data set is 10.698, which is more than the maximum allowed.

The second deviation is the most extreme of the two and will have to be dealt with first. This ascending trend starts at record number 12 091 (Deut. 30:04). After the deviating section (from record 12 091 to the end of the data set) was detached, the following standard errors of estimation were obtained: the first (normal) part was 8.22427 and the second (deviating) part was 6.44491.

Another subdivision of the data set had to be made, as the standard error of estimation of the normal section exceeds the maximum allowed. The second section identified as a possible deviating section has its most extreme data point at a low of -24.5. It seems as if this trend stretches from record 7 461 (Deut. 18:06) to 12 091 (Deut. 30:04).¹⁵ After it was detached from the first section of the graph, the standard errors of estimation of the divided section are as follows: the first (normal) section (Deut. 01:01 to 18:06) is 5.15406, and the second (deviating) section (Deut. 18:06 to 30:04) is 8.81246.

It would seem as if the section from Deut. 18:06 to Deut. 30:04 will have to be subdivided again. It seems obvious that the strongest deviating trend in that section is the descending line on the graph between Deut. 18:06 and Deut. 24:17.¹⁶ After splitting this part of the data set, the standard errors of estimation of the two resulting sections are 1.29534 and 7.49923.

It is obvious that the graph of this criterion exhibits two strong deviating trends. As all standard errors of estimation are at last below the maximum allowed, we can now proceed to describing the sections:

- Record 1 to 7 461 (normal)

¹⁵ In this instance the subjective nature of the methodology followed in this research is made manifest. The section could stretch from record 7 461 to 9 645, from 1 to 9 645, from 7 461 to 9 645, from 7 461 to 12 091 etc. The author took his clues for the identification of a section from a visual interpretation of the graph. In this case, it seems obvious that the descending trend starts at 7 461. More of a problem is the question as to where the deviating section should end. It seems as if the whole section from 7 461 to 12 091 exhibits a descending trend, interrupted by one ascending section. This will be the approach followed. If the standard error of estimation of the deviating section to be detached should exceed the maximum allowed, the section will again be subdivided.

¹⁶ Again, this is a subjective interpretation of the data. This section of the data consists of one very strong downwards trend relative to the regression line, followed immediately by an upwards turn on the graph, in turn followed by a downwards trend, just as steep as the first descending turn. The present division of the data set was chosen because it was thought that the first descending section is the strongest, and the longest trend. It was therefore detached first to attempt to get all standard errors of estimation below the maximum allowed.

- Record 7 461 to 9 645 (deviating - steeply descending relative to the regression line)
- Record 9 645 to 12 091 (normal relative to the regression line)
- Record 12 091 to 14 057 (deviating - ascending relative to the regression line)

Section 1¹⁷

This section of the graph (Deut. 01:01 to 18:06) can be described as normal relative to the regression line. The figures bear out this impression, as the slope of this data set indicates about 41 indications of differences in every 1 000 records compared to about 40 indications of differences in every 1 000 records in the data set as a whole. This section is not uniform in character, as can be seen in the standard error of estimation of more than five.

Section 2¹⁸

The section of the graph from Deut. 18:06 to 24:17 begins above the regression line and descends sharply. From the second highest point of the graph of the residuals, the line descends to the lowest point of the graph. The line is very uniform, as indicated by the standard error of estimation. The descending slope of the graph is reflected in the low slope figure of about 21 indications of non-literal translations in every 1 000 records.

Section 3¹⁹

One could argue that the section from Deut. 24:17 to Deut. 30:04 should have been processed as two separate sections, as the section consists of a steeply ascending section (relative to the regression line) and an equally large steeply descending section. However, should we examine the standard error of estimation, we would find that it is below the maximum allowed. In addition, the starting and ending points of the section are on about the same level. The section should therefore be seen as a normal section with a lot of variation, but still within the limits that indicate whether the section forms a homogeneous unit or not. The varying nature of the division is indicated in the rather high standard error of estimation of 7.49923. About 43 non-literal translations can be expected in every 1 000 translations.

¹⁷ The full figures: indications of differences = 301; correlation coefficient = 0.998251; R^2 = 99.65%; standard error of estimation = 5.15406; slope = 0.0412643; intersection = -17.7017.

¹⁸ The full figures: indications of differences = 46; correlation coefficient = 0.995437; R^2 = 99.09%; standard error of estimation = 1.29534; slope = 0.0217172; intersection = 140.163.

¹⁹ The full figures: indications of differences = 98; correlation coefficient = 0.964965; R^2 = 93.12%; standard error of estimation = 7.49923; slope = 0.0430674; intersection = -58.2298.

Section 4²⁰

The last division must be counted as a deviation, beginning at Deut. 30:04 and ending at Deut. 34:12. It exhibits a steeply ascending trend on the graph, with about 64 indications of differences in every 1 000 records. Its range also includes the descending section right at the end of the graph. This inclusion is reflected in the high standard error of estimation of 6.44491.

2.2.2.3 Reliability of the Results

If we are to compare the results of this application of the pluses criterion with the research done previously (Nieuwoudt, 1992), it seems as if the results are quite similar. The author would like to use this fact as an argument in favour of the present methodology of using random data sets to determine the cut-off value.

From 14 320 records in the data base, 14 057 could be used in this instance. That is more than 98%, indicating a high reliability of the data.

If both the issues mentioned are taken into account, it would seem as if the results of applying this criterion should be regarded as quite reliable.

²⁰ The full figures: indications of differences = 122; correlation coefficient = 0.983319; R^2 = 96.71%; standard error of estimation = 6.44491; slope = 0.0642305; intersection = -321.497.

Indications of Pluses: Regression Analysis

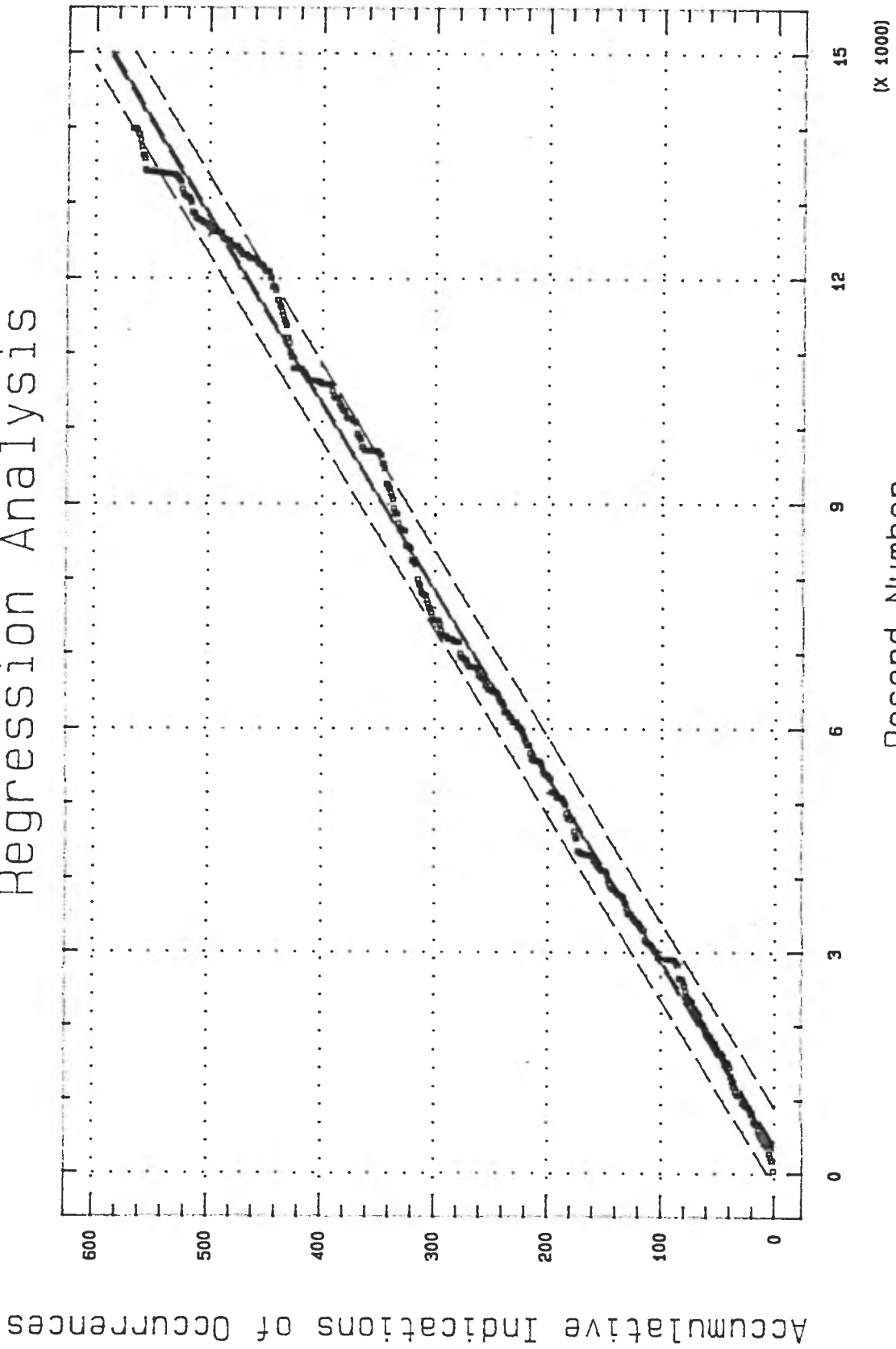


Figure 5

Indications of Pluses: Residuals of the Regression

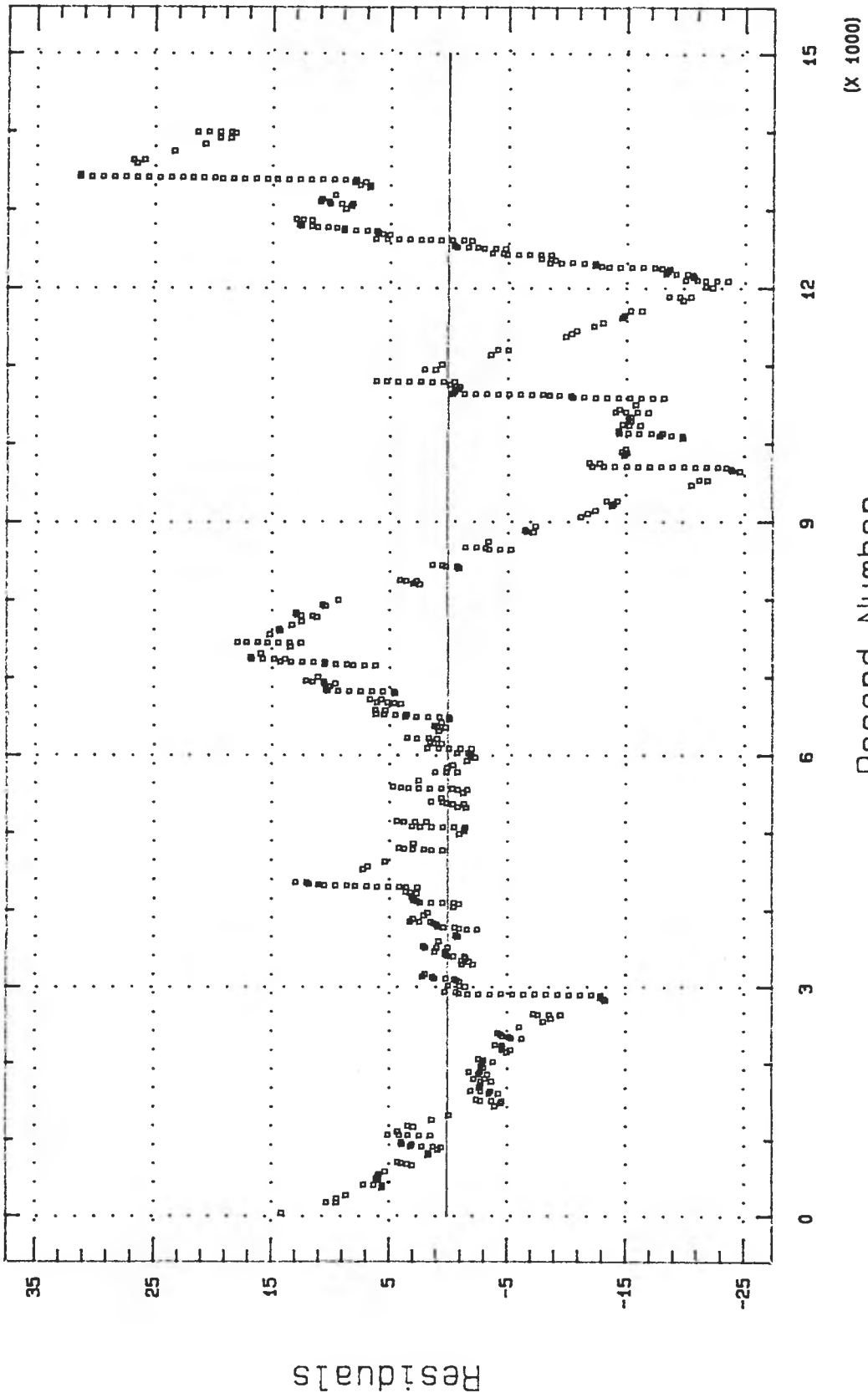


Figure 6

2.3 Hebrew Prepositions Represented by Greek Preverbs

The only grammatical marker that could be used as a criterion was the "{p}". These markers indicate occurrences of "Hebrew prepositions represented by Greek preverbs" (Tov, 1986: 69-70). As the translator could have translated the preposition by a separate Greek preposition, this phenomenon may be used to indicate deviations from a strictly literal translation technique.

2.3.1 Methodology

As is clear from the definition of this phenomenon, the markers can only be found in records where the Hebrew column contains a preposition. The parallel alignment of the CATSS data base does not, however, contain indications of all the prepositions, and the author had to access the Hebrew grammatical analysis of Poswick to obtain this information. Great was our surprise when it seemed that the grammatical analysis did not contain a separate marker indicating the prepositions, but only a general one for "particle".

All records in which the part of speech indicator "W" ("particle") was found were copied to a temporary data base with the part of speech indicator, the lemma and the root. This data base was subsequently sorted according to the lemma,²¹ allowing the author to examine all the occurrences of a certain lemma at the same time. Each lemma was examined to determine the part of speech, and it was attempted to delete all non-prepositions from the data base. These included *BLTY*, *KY*, *LWL*), *LW*, *LM(N* and)*\$R*.²²

Problems were experienced with some of the particles, however, as they could fulfil the function of both a particle and a preposition. Most notable amongst them are *L*, *ZWLH* and)*T*. No hint could be found in the data base to distinguish between these two functions programmatically. In the end it was decided to include all the occurrences of particles that could fulfil both functions.

It was found that all the occurrences of the marker under investigation still occurred in the resulting depleted data base. The records were numbered accumulatively in order to create the new base line. All the occurrences of the marker "{p}" were also numbered accumulatively, and the random data sets were created using these parameters.

²¹ The lemma field in the data base file containing the grammatical analysis is much more comprehensively annotated than the root field.

²² Although the ultimate aim is to use the data base programmatically, this culling was done by hand. If this was not done, the implementation of this criterion would have had to be abandoned.

2.3.2 Results

The resulting data base contains 3 794 records, of which 34 contain the marker. The random data sets have a cut-off value of 2.0063.²³

2.3.2.1 Interpreting the Graphs

Although the graph of the regression analysis is quite clear for a change,²⁴ the graph of the residuals of the regression analysis is also included.²⁵ The graphs depict the undulations of the frequency of occurrences of the marker quite clearly due to the low density of occurrences. The two most noteworthy features of the graphs are the long descent relative to the regression line from record 232 (Deut. 02:08) to 2 367 (Deut. 21:20), and the ascending trend from 2 367 (Deut. 21:20) to the end of the graph.

The general slope of the data set is about nine occurrences of markers in every 1 000 records.²⁶

2.3.2.2 Identifying the Translation Units

Even though the standard error of estimation of the complete data set is extremely low, it is still more than the maximum allowed.

The ascending trend at the end of the data set is the most obvious deviation in the data set and will therefore be detached first. As was done in the applications of previous criteria, the detached part will include the descending portion at the end of the graph.

This division resulted in a standard error of estimation of 0.804 for the first part of the data set and 1.03 for the second part. Additional subdivision is therefore unnecessary.

Section 1

The first section of the graph can be described as normal and has Deut. 01:01 and Deut. 21:20 as its margins. It has a slope of about five markers in every 1 000 records.²⁷ The inclusion of the long

²³ The maximum value is 3.11479 and the minimum 0.61582.

²⁴ See figure 7.

²⁵ See figure 8.

²⁶ The full figures: indications of differences = 34; correlation coefficient = 0.962834; R^2 = 92.7%; standard error of estimation = 2.73136; slope = 0.0087753; intersection = -2.53744.

²⁷ The full figures: indications of differences = 13; correlation coefficient = 0.980253; R^2 = 96.09%; standard error of estimation = 0.804355; slope = 0.00513; intersection = 1.33623.

descending part described above, which is part of this section, leads to a very low standard error of estimation.

Section 2

The deviating section detached from the main data set stretches from record 2 367 to 3 794 or Deut. 21:20 to Deut. 34:12. The slope of occurrences of markers is almost twice as steep as that of the complete data set (about 14 markers encountered in every 1 000 records),²⁸ although the section also includes two portions of the graph that display a descending pattern. The inclusion of these sections leads to a higher than expected standard error of estimation.

2.3.2.3 Reliability of the Results

In order for the results of a criterion to be reliable, the base line should be set up as perfectly as possible. In this case, one should have been able to identify the whole collection of prepositions in Hebrew, and to compare them with the Greek equivalents.

In applying this criterion to the data, we could not be certain that the base line of the data set was set up correctly. In the first place, the prepositions are not uniquely marked by the part of speech indicator. In the second place, the ambiguity of parts of speech of some of the particles, like *L*, is not resolved. One is therefore left with the situation of not only being uncertain of whether the base line is set up correctly, but, instead, of being certain that some elements in the present base line should have been left out.

On the other hand, statistically speaking, all occurrences of non-prepositional uses of the ambiguous particles should be distributed evenly throughout the whole data set, thereby nullifying some of the potential problems. (One could not be certain of this, however.) In addition, the profile of the criterion reflects that of the other criteria, which should count in favour of the dependability of the result.

²⁸ The full figures: indications of differences = 21; correlation coefficient = 0.98682; R^2 = 97.38%; standard error of estimation = 1.03018; slope = 0.01474; intersection = -20.4552.

Hebrew Prepositions and Greek Preverbs: Regression Analysis

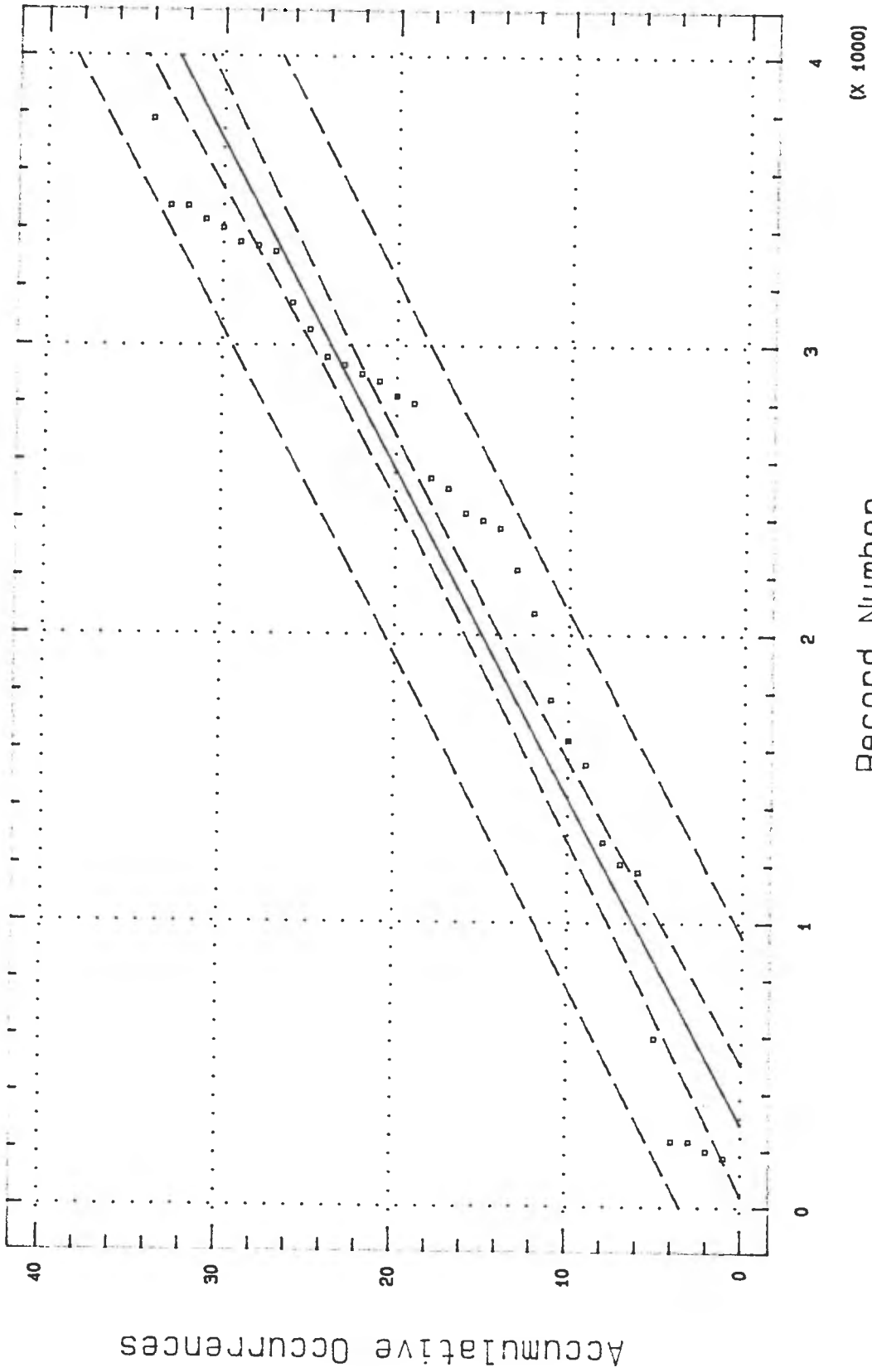


Figure 7

Hebrew Prepositions and Greek Preverbs: Residuals of Regression

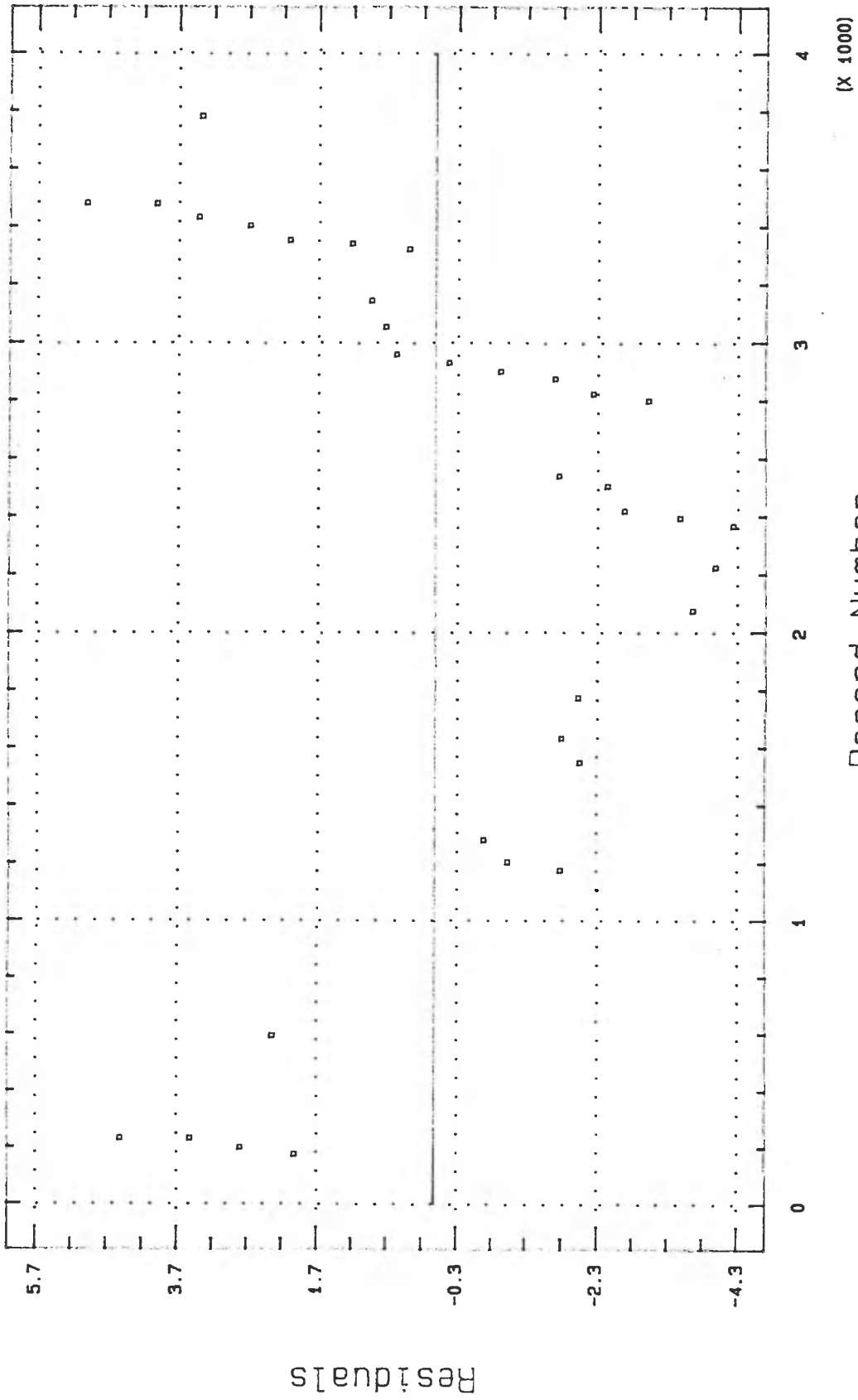


Figure 8

3. Conclusion

Two aspects deserve our attention:

- How usable are the markers encoded in the CATSS data base?
- Was the differentiation between the pluses and the minuses of any importance, or not?

3.1 Appraising the Value of the Markers Inserted in the CATSS Data Base

The markers for the different text-critical phenomena were inserted into the data base by hand by the CATSS research team, representing some of the most comprehensive work ever done in this regard. These markers are intended to be used for computer searches of the data base. In this study, the markers were not only used for searches for certain phenomena, as was one of the original intentions of the placing of the markers, but also for the identification of different translation units and description of translation techniques.

Are the markers being used in this study for a purpose they were not intended for? The facts remain:

- Few of the markers could be utilized for the detection of translation units.
- Of those that remained, only one of the criteria could be implemented without an adjusted base line: the combined pluses and minuses, labelled by Tov as quantitative representation.²⁹ Of the criteria represented by markers in the CATSS data base, no other could be implemented in a straightforward manner. It is obvious that some refinement of the data base, or of the methods of doing searches using the data base, should be forthcoming.

One also comes to the conclusion that the markers in the data base should not be used in an ad hoc manner to determine translation technique and translation units. Tov's warning (1985b: 237) regarding the use of the data base for determining translation units is not to be taken lightly. In fact, it is the opinion of the author that no attempt should be made to determine translation units using the markers in the CATSS data base if the research is not based on a solid statistical methodology. This is necessary not only regarding the boundaries of translation units, as Tov suggests, but also regarding the literalness.

²⁹ Please note that the criteria split representation and differences in sequences were successfully implemented in chapter 3. It was impossible to evaluate the implementation of distributive renderings, repetitive renderings, doublets and prepositions added in the LXX due to a lack of data, not due to the nature of the criteria.

However, the reader should never lose sight of the fact that the CATSS data base, and the markers contained therein, are not intended for research primarily regarding translation technique. The data base was intended for research on the LXX and its relationship to the Hebrew text in general (Tov, 1985b: 221-222). It disturbs the author, however, that, while it is endeavoured to accommodate all the possible aspects of the research into the LXX and its relation to the Hebrew text, the data that are necessary for the determination of translation technique and demarcation of translation units, which is surely one of the most important issues at hand, are not as usable as they should be.

3.2 Comparing the Minuses and Pluses

E. Tov grouped together the pluses and the minuses under one heading: "Quantitative Representation" (1986: 51-56), and "Minuses and Pluses" (1986: 51-56). As could be seen in sections 2.1 and 2.2 above and in the figure below, the two criteria display different results.

<u>Minuses</u>	<u>Pluses</u>
01:01	01:01
NORM.desc	NORM.norm.
18:06	18:06
NORM.asc.	DESC. desc.
24:17	24:17
NORM.vari.	NORM.vari.
30:04	30:04
ASC.asc.	ASC.asc.
34:12	34:12

Figure 9: The Comparative Table of Translation Units Identified by the Different Criteria³⁰

The two criteria present different results in the first half of Deuteronomy, but the results agree in the second half. The fact that major differences in the results are to be found should be enough reason, in the author's opinion, to view these two criteria separately in the future.

³⁰ Text references are used in the table to indicate translation units as identified in the respective sections. Trends reflected in the indicated translation units are identified by markers in capitals. However, trends visible on the graph, but not strong enough to be reflected in the translation units are indicated in lower-case letters.

For "asc." read "ascending", for "desc." "descending", for "vari." "varying" and for "norm." "normal".

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CHAPTER 5: THE PERSON OF THE VERB

While the previous two chapters concentrated on the broader types of criteria favoured by the Jerusalem school, this chapter will be devoted to the study of the type of criterion favoured by the Helsinki school - the grammatical. In particular, the person of the verb will be discussed.

One of the problems this author encountered when consulting the works of the Helsinki school is the limited scope within which the research was done. Owing to the considerable depth of the research conducted by this school, the researchers were forced to limit themselves to particular parts of speech (e.g. Soisalon-Soininen, 1965; Sollamo, 1979), or even to certain lexical stems (Soisalon-Soininen, 1978b). While these studies may well be "*Bausteine*" (Tov, 1987b: 348), one does look forward to works that would have a broader scope and that would, perhaps, solve the tension created by contrary findings within the school using different criteria (Aejmelaeus, 1982: 178-179, 180). Could it be possible to investigate grammatical phenomena on the same scale as the criteria of the Jerusalem school? In this chapter, the author will attempt to accomplish exactly this, although on an admittedly smaller scale than the normal investigations of the Helsinki school. The person of the verb will be investigated relating to two specific aspects:

It will be attempted to describe the translation of the person of the verb in Deuteronomy in such a fashion that these results can be used to complement the data of the first two chapters. It will be attempted to use the same approach to the data as has been used in those chapters.

An additional aspect, not originally planned, will also be examined. When the author wanted to investigate the person of the verb, it suddenly became apparent that there is not only one way to describe the person of the verb.¹ If a regularity in the translation of the person of the verb is to be sought, it is obvious that the goal of the research should be the combination of the different aspects of the inflection of the verb that will reflect the highest level of consistency. In this regard, three different

¹ It is apparent that the term person of the verb has two distinctly different meanings. The first of these meanings relates to the total person of the verb, incorporating the gender, number and person (first, second or third). The second meaning relates only to the last aspect mentioned in the broader meaning.

In order to distinguish between the two meanings, the first will be called the inflection of the verb (Cowley, 1910: 117), and the second the person of the verb.

aspects have to be considered, viz. the person (first, second or third), the gender and the number. It could be that these aspects will reflect a high consistency of translation when taken into consideration individually. It could also be that the individual aspects do not reflect as high a level of consistency in translation as will the different aspects when they are combined into the formats used in practice, viz. the person, gender and number combined into a single grammatical unit. Both these approaches will be investigated, and it will be attempted to indicate which of the approaches reflects the highest level of consistency in translation in Deuteronomy.

The chapter consists of three parts: the data used, the aspects of the verb used in isolation in criteria, and the aspects of the verb combined to form criteria.

1. The Data

The data used for this study were obtained from the combined CATSS data bases, as described in the second chapter. The data had to be expanded regarding the different aspects of the Hebrew verb.²

It is to be expected that the Hebrew verb will not map to the translated Greek verb in a one-to-one relationship. In fact, 3 521 Hebrew verbs were found in the data base against 3 654 Greek verbs. It is already clear that a culling of the data sets will have to be done before the data could be utilized in an optimal manner.

The following data was excluded from the data sets used below:

- The records containing the Greek participle where the person is at issue. The inflection of the Greek participle contains no information as to the person involved. Therefore, the moment the person of the verb is the issue, the Greek participle cannot render a binomial result to the query of the criterion.
- The records containing the Greek infinitive. The Greek infinitive is excluded for the same reason as the Greek participle. In addition, this form of the verb does not contain any information about the number of the verb. Eventually, the Greek infinitive could not make any contribution to the results.
- The record containing any mention of possible text-critical problems in the alignment. This includes all minuses and pluses, all records where Column B contains some data, all records in which the marker "{" was used (Tov, 1986: 7-9), and all records in which it was indicated by the marker "~" that a change in word order is to be suspected.³
- The records containing a non-verb in the Greek translation. A number of instances were found in which the Greek verb does translate the Hebrew verb with a verb. In that case, of course, no binomial results can be obtained. These records will be indicated in the section discussing the methodology used for implementing each criterion.

Eventually 3 452 usable records were filtered from the data base. About 10% of the original records were lost in the filtering action described above.

² See chapter 2.

³ For reasons as to why records with text-critical problems should be excluded, please see chapters 2, 3 and 4.

2. The Different Aspects in Isolation

In this section each option of the different aspects of the inflection of the verb will be applied to the sample data set in turn.

Unfortunately, one of the aspects had to be excluded from the investigation from the beginning, viz. the gender. The inflection of the Greek verbs contains no mention of gender, except in the case of the participle. Unfortunately, so few participles were considered usable data that the gender had to be discarded from the onset.

The aspects that will be investigated are the number (single and plural), and the person (first, second and third).

2.1 The Number of the Verb

2.1.1 Single

Of the 3 452 usable verbs in Deuteronomy, 2 138 Hebrew verbs are used in the singular. Of those, 66 records could not be utilized, as the corresponding Greek words are not verbs.

Record Number,⁴ Part of Speech,⁵ Greek Word, Greek Column

252	A1A	FOBERO/S	KAI\ TH\N FOBERA\N
920	A1	DUNATO/S	KAI\ DUNATW/TERON
1722	A3N	E)PISTH/MWN	KAI\ E)PISTH/MWN
2201	A1	U(YHLO/S	U(YHLW=|
2314	N1	FONEUTH/S	TO\N FONEUTH/N
2618	A1	U(YHLO/S	U(YHLW=|
3356	A1	PISTO/S	PISTO/S
3428	A1	EU)LOGHTO/S	EU)LOGHTO\S
3512	A1	U(YHLO/S	TO\N U(YHLO/N
3547	A1A	KRATAIO/S	KAI\ KRATAIO/S
3829	A1A	FOBERO/S	KAI\ TH=S FOBERA=S
3943	A3	EU)MH/KHS	KAI\ EU)MH/KH
4431	A1	U(YHLO/S	TW=| U(YHLW=|
4689	A1A	FOBERO/S	KAI\ O(FOBERO/S
4777	A1	U(YHLO/S	TO\N U(YHLO\N
4998	N2	KU/RIOS	O(KU/RIOS
5605	A1A	I)SXURO/S	I)SXURW=S
6004	A3H	SAFH/S	SAFW=S
6096	N2	NEKRO/S	E)PI\ NEKRW=|
6307	N3M	GE/NHMA	TO\ GE/NHMA
6348	D	MAKRA/N	MAKRA\N
6879	N	PA/SXA	TO\ PASXA
7301	N1M	KRITH/S	TO\N KRITH/N
7364	N1M	KRITH/S	TOU= KRITOU=
7652	N2	FARMAKO/S	FARMAKO/S
7655	A1B	E)GGASTRI/MUQOS	E)GGASTRI/MUQOS
7859	N1	FONEUTH/S	FONEUTH=|
7863	N2	FONEUTOS	TOU= FONEUTOU=
7894	N1	TU/XH	TU/XH|
8709	A3	A)PEIQH/S	A)PEIQH\S
8710	A3	E)REQISTH\S	KAI\ E)REQISTH\S
9233	N1T	QLADI/AS	QLADI/AS
9459	N1	PO/RNH	PO/RNHS

⁴ For the correlating verse, please see the tables in the appendixes.

⁵ For an explanation of the codes, please see Adler, 1984: 4-5.

9922	N1M	<i>KRITH/S</i>	<i>TW=N KRITW=N</i>
10281	A1	<i>U(YHLO/S</i>	<i>TW=| U(YHLW=|</i>
10669	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10688	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10696	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10704	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10712	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10722	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10735	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10744	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10757	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10774	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10782	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
10793	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
11043	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
11046	A1B	<i>E)PIKATA/RATOS</i>	<i>KAI\ E)PIKATA/RATOS</i>
11049	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOI</i>
11052	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATA</i>
11061	A1B	<i>E)PIKATA/RATOS</i>	<i>E)PIKATA/RATOS</i>
11064	A1B	<i>E)PIKATA/RATOS</i>	<i>KAI\ E)PIKATA/RATOS</i>
11264	A1B	<i>PARA/PLHKTOS</i>	<i>PARA/PLHKTOS</i>
11452	N3M	<i>O(/RMHMA</i>	<i>O(/RMHMA</i>
11623	A1B	<i>E)/NTIMOS</i>	<i>TO\ E)/NTIMON</i>
11624	A1	<i>QAUMASTO/S</i>	<i>KAI\ TO\ QAUMASTO\N</i>
11943	A1B	<i>CULOKO/POS</i>	<i>A)PO\ CULOKO/POU U(MW=N</i>
11945	N2	<i>U(DROFO/ROS</i>	<i>U(DROFO/ROU U(MW=N</i>
12300	N1A	<i>DIASPORA/</i>	<i>H(DIASPORA/ SOU</i>
12422	A1B	<i>U(PE/ROGKOS</i>	<i>U(PE/ROGKO/S</i>
13455	A1	<i>U(YHLO/S</i>	<i>H(U(YHLH\</i>
13548	N1	<i>E)PAGWGH/</i>	<i>E)N E)PAGWGH=|</i>
14046	N3	<i>A)/RXWN</i>	<i>A)RXO/NTWN</i>
14078	A1	<i>EU)LOGHTO/S</i>	<i>EU)LOGHTO\S</i>
14082	A1	<i>DEKTO/S</i>	<i>DEKTO\S</i>

Figure 1: List of Greek Words Excluded as the Greek Translation Is Not a Verb

All the records containing singular Hebrew verbs were merged into a data set. After all the non-verb Greek equivalents, as specified in the table above, were culled from the data set, 2 072 records remained. Of those, 140 records translated the singular Hebrew verb with a Greek verb in the plural.

The data points that represent these 140 records were plotted accumulatively against the range of the 2 072 original records. As was the case in the previous two chapters, a graph of the regression analysis and a graph of the residuals of the regression analysis were plotted.⁶

2.1.1.1 Interpreting the Graphs

In order to identify the different translation units, the maximum cut-off value allowable for a homogeneous data set was computed by generating 1 000 random data sets and calculating their standard errors of estimation. The 90th percentile of those standard errors of estimation is 3.94103. The standard error of estimation of the whole data set is 5.95728, indicating that the data set will have to be subdivided.⁷

The graph of the residuals of the regression analysis displays a steep ascent at the beginning of the graph, followed by a meandering descent to the lowest point on the graph at Deut. 26:16. The strongest trend of the graph is, however, the very steep ascent found in the last part of the graph. The ascent starts at the lowest point on the graph, and ends at the highest point of the graph at Deut. 34:12.

2.1.1.2 Identifying the Translation Units

The biggest deviation in the data set, the ascending trend at the end of the graph, was detached first. This resulted in standard errors of estimation of 3.1238 for the first part of the data set and 2.75794 for the detached part. As both are below the maximum allowable (3.94103), the data set was not subjected to any more subdivisions.

Section 1⁸

The first section is composed of two distinctive sections: an ascending trend at the beginning of the graph and a descending trend ending at the lowest point of the graph at Deut. 26:16. The diversity, which should be interpreted as the normal randomness of a data set, results in a slightly exaggerated standard error of estimation. The slope indicates that about 52 non-singular Greek translations could be expected for every 1 000 records.

⁶ See figures 2 and 3 respectively.

⁷ The full figures: non-literal translations = 140; correlation coefficient = 0.989233; R^2 = 97.86%; standard error of estimation = 5.95728; slope = 0.0602827; intersection = 2.84041.

⁸ The full figures: non-literal translations = 82; correlation coefficient = 0.991467; R^2 = 98.3%; standard error of estimation = 3.1238; slope = 0.0522612; intersection = 7.33326.

Section 2⁹

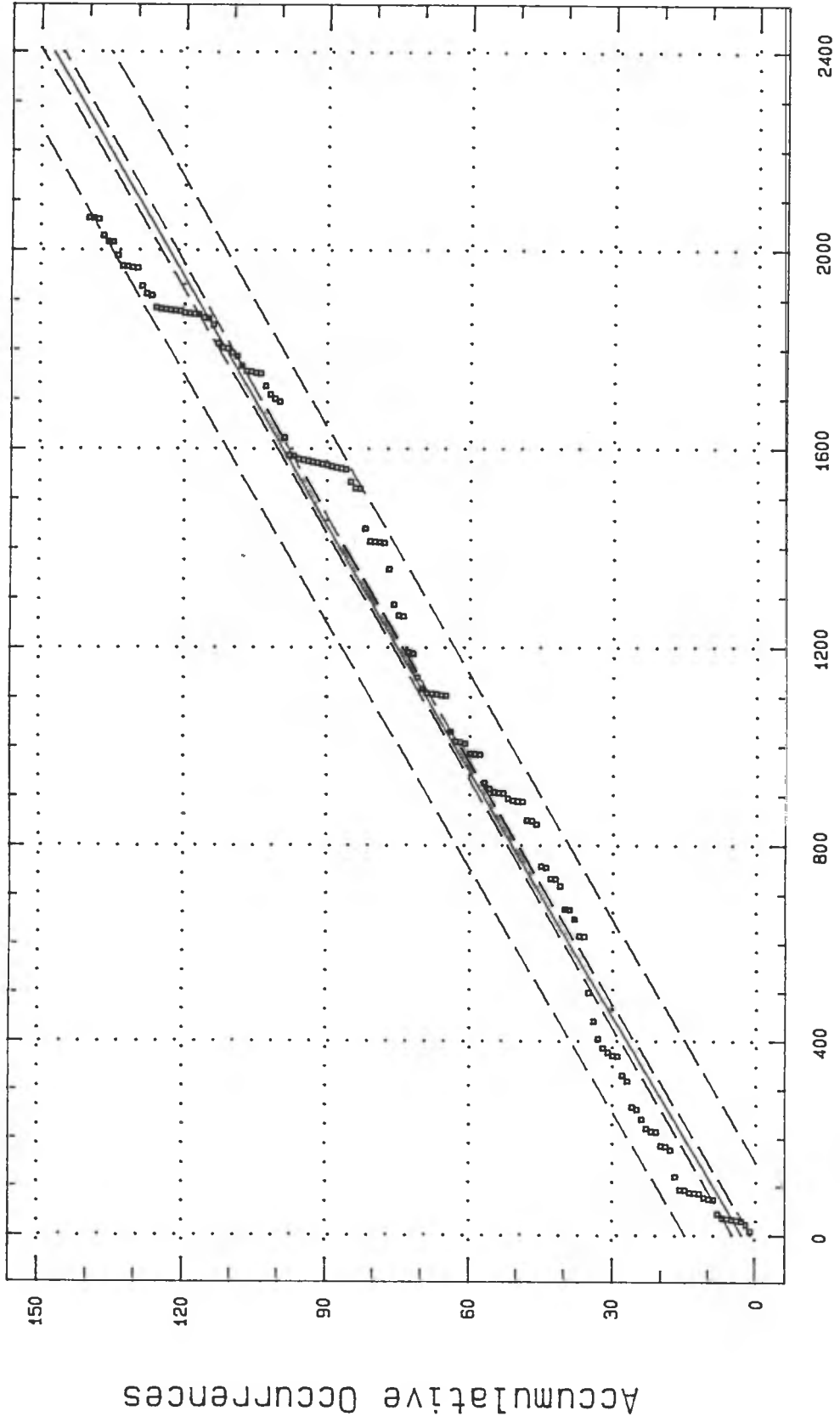
This section starts at the lowest point of the graph at Deut. 26:16. It keeps climbing until it reaches the highest point of the graph at Deut. 34:12. The graph of this section does tend to meander a bit, resulting in a higher than expected standard error of estimation. The slope indicates that 100 non-singular Greek translations of the Hebrew verb can be expected in every 1 000 records.

2.1.1.3 Interpreting the Results

The author regards these results with some confidence: the statistics isolated the one obvious trend in the data set. In addition, the standard errors of estimation, though indicating some variance within the two sections, are well below the maximum allowed.

⁹ The full figures: non-literal translations = 58; correlation coefficient = 0.986811; R^2 = 97.38%; standard error of estimation = 2.75794; slope = 0.100243; intersection = -67.4209.

Singular of the Inflection of the Verb: Regression Analysis



Record Number

Figure 2

Singular of the Inflection of the Verb: Residuals of the Regression

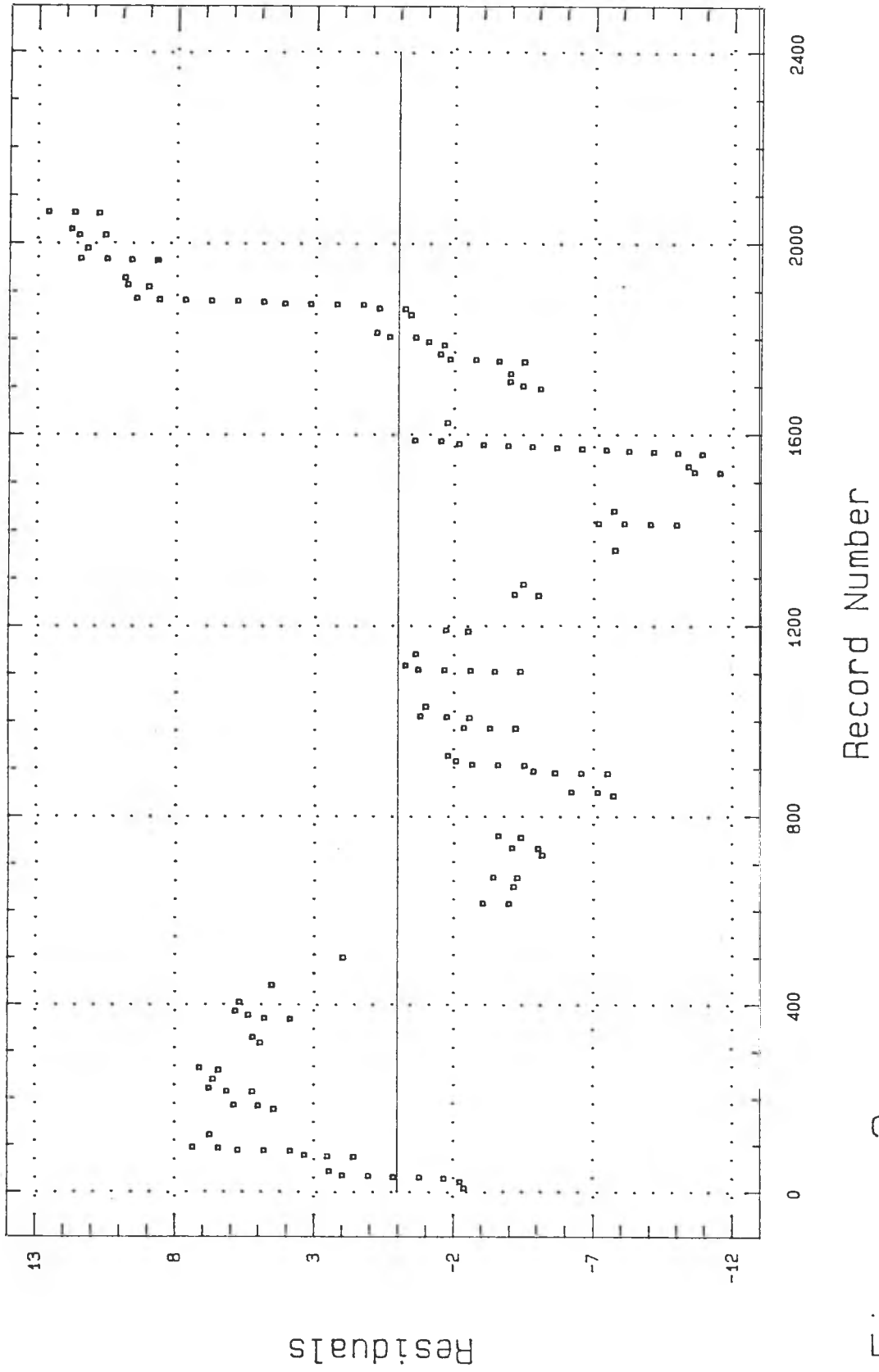


Figure 3

2.1.2 Plural

In total, 649 occurrences of the Hebrew verb were found in the plural. Of these, 24 (see the table below) had to be discarded, as the Hebrew verb had not been translated with a Greek verb, and the inflections of the Greek and Hebrew verbs could not be correlated.

<u>Record Number,¹⁰</u>	<u>Part of Speech,¹¹</u>	<u>Greek Word,</u>	<u>Greek Column</u>
168	A3N	E) PISTH/MWN	KAI | E) PISTH/MONAS
169	A1	SUNETO/S	KAI | SUNETOU | S
188	A1	SUNETO/S	KAI | SUNETOU | S
197	N3	GRAMMATOEISAGWGEU/S	KAI | GRAMMATOEISAGWGEI=S
200	N1M	KRITH/S	TOI=S KRITAI=S U(MW=N
1244	A1A	O) XURO/S	O) XURAI/
2802	A1	O) RQO/S	O) RQW=S
3938	A3	TEIXH/RHS	KAI | TEIXH/REIS
4733	A1B	E) /NDOCOS	KAI | TA | E) /NDOCA
5271	A1	U(YHLO/S	TW=N U(YHLW=N
7080	N1M	KRITH/S	KRITA | S
7688	N3N	KLHDW/N	KLHDO/NWN
7689	N2N	MANTEI=ON	KAI | MANTEIW=N
7735	D	)ORQW=S	O)RQW=S
8103	N3T	OU)=S	W)=SIN
8107	N1M	KRITH/S	OI(KRITAI |
8125	A1B	E) PI/LOIPOS	KAI | OI(E) PI/LOIPOI
8479	N1M	KRITH/S	KAI | OI(KRITAI/ SOU
11499	A1A	O) XURO/S	KAI | TA | O) XURA/
11635	A1	QAUMASTO/S	KAI | QAUMASTA/S
11638	A1	PISTO/S	KAI | PISTA | S
12232	A1	KRUPTO/S	TA | KRUPTA |
14026	N2N	E) MPO/RION	KAI | E) MPO/RIA
14128	A3	SUNNEFH/S	SUNNEFH | S

Figure 4: List of Greek Words Excluded as the Greek Translation Is Not a Verb

¹⁰ For the correlating verse, please see the tables in the appendixes.

¹¹ For an explanation of the codes, please see Adler, 1984: 4-5.

After the records containing non-suitable Greek equivalents were culled from the data set, 625 records remained. Of these, 55 occurrences were found where the plural Hebrew verb is not equated with a plural Greek verb.

As should be familiar to the reader by now, the deviating data points were plotted accumulatively against the number of records processed. The graph of the regression analysis and the graph of the residuals of the regression analysis were computed and printed.¹² The 1 000 random data sets returned a maximum allowable standard error of estimation of 2.47985.

2.1.2.1 Interpreting the Graphs

The two biggest deviations in the graphs both occur in the first half of the graph. The graph starts off with a very steep climb and peaks at about verse 17 of the first chapter of Deuteronomy. The second deviation begins immediately afterwards. The graph steeply descends to the lowest point reached, at Deut. 05:22. The only other significant trend in the graph is the gradual but definite upwards trend of the rest of the graph.

The standard error of estimation of the main data set is 2.89384, slightly more than the allowed maximum, thereby forcing the subdivision of the data set.¹³

2.1.2.2 Identifying the Translation Units

This researcher was tempted to detach the descending trend from the rest of the data set. In this way, the data set would be divided into three parts, each of which accurately reflects the trend of that specific section of the data set. It was decided, however, to stick to the methodology decided upon, and to detach the section that contains the most deviating section first.

The section from Deut. 01:01 to Deut. 01:17 was first detached. The first section contains only three data points, owing to which it was impossible to calculate the statistics for this section.¹⁴ The standard error of estimation for the rest of the data set is 2.02859, which is below the maximum allowable. The data set was therefore not subdivided again.

Section 1

This section has a very steeply ascending character, and contains only three data points. These three data points are records 10, 11 and 12 of the data set, which means that they occurred in an unbroken

¹² See figures 5 and 6.

¹³ The full figures: non-literal translations = 55; correlation coefficient = 0.983858; R^2 = 96.80%; standard error of estimation = 2.89384; slope = 0.0954765; intersection = -6.45659.

¹⁴ The data points are too few to allow dependable statistics, as could be seen from the results of the regression analysis performed on this section. See the following footnote.

series. This leads to the very steep ascending line at the beginning of the graph. The three data points in the section are, however, too few to render usable statistics.¹⁵

Section 2

The second section stretches from Deut. 01:17 to the end of the book. It contains two distinctly different sections, as explained above, first exhibiting a very steep downwards trend, ending at Deut. 05:33, and then ascending gradually above the regression line till it reaches the second highest point on the graph at Deut. 31:06.

The average slope is about 0.1, indicating about 103 differences in translation for every 1 000 records.¹⁶ The standard error of estimation is near the maximum allowable owing to the fact that two very strong opposing tendencies in the graph are accommodated within one section. The methodology decided upon clearly indicates, however, that the deviations should be seen as random and not as significant.

2.1.2.3 Interpreting the Results

The present results, kept in this format to stay within the methodology, have two weak points, viz. the very small first section, and the contrasting tendencies within the second section, leading to a high standard error of estimation for this section.

Although the methodology decided upon clearly indicates that the author should first detach the most deviating section from the rest of the data set, in this case it led to unsatisfying results. It would have been much more satisfactory to detach the very strong and long second deviation, as explained above.¹⁷

¹⁵ The full figures: non-literal translations = 3; correlation coefficient = 1; R^2 = 100%; standard error of estimation = 0; slope = 1; intersection = -9.

¹⁶ The full figures: non-literal translations = 52; correlation coefficient = 0.991178; R^2 = 98.24%; standard error of estimation = 2.02859; slope = 0.103065; intersection = -9.77851.

¹⁷ In order to predetermine the value and accuracy of the present methodology, it has to be implemented strictly. In future research, however, the author will attempt to refine the methodology used. In that research, all the unsatisfactory results obtained in this study will have to be addressed.

Plural of the Inflection of the Verb: Regression Analysis

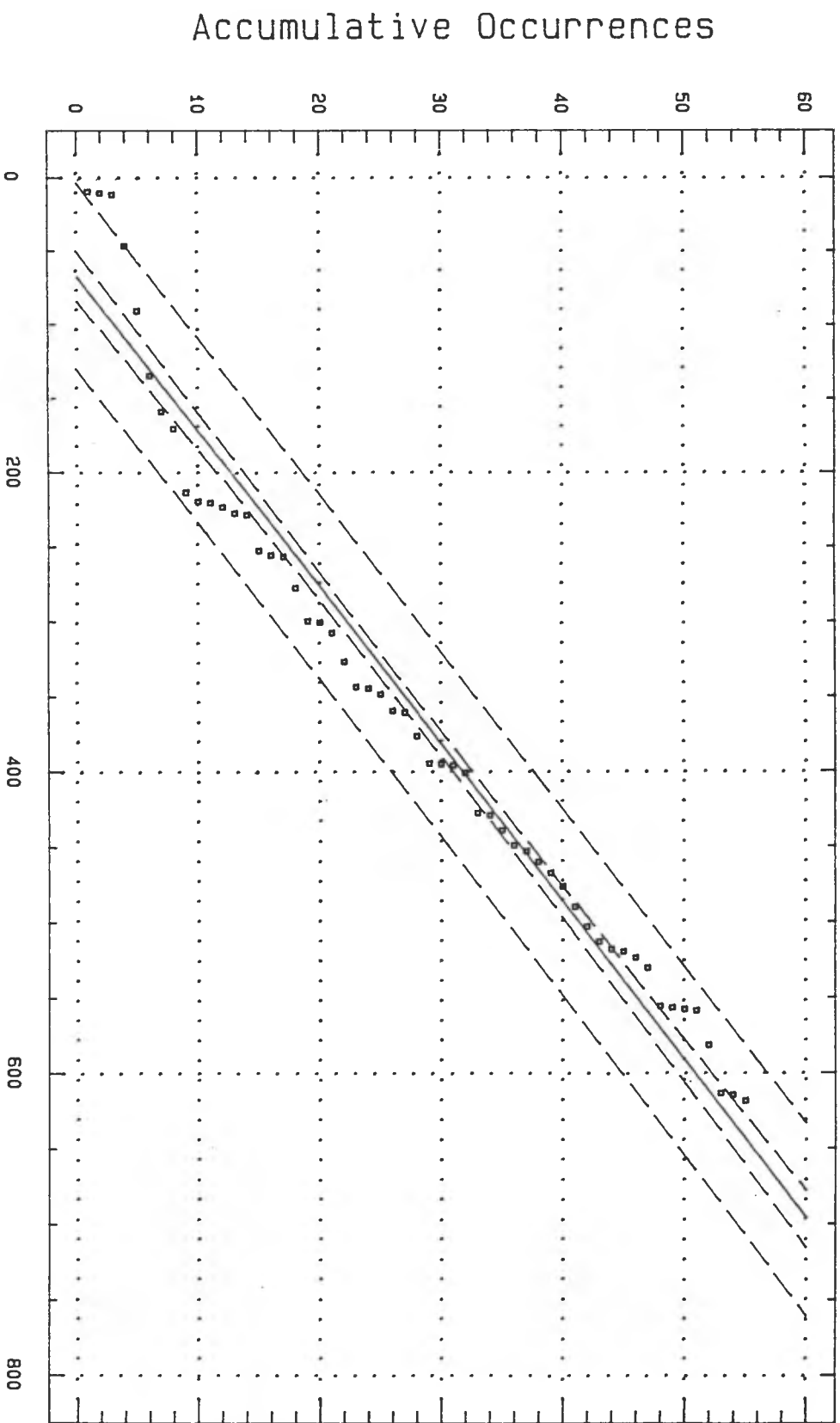
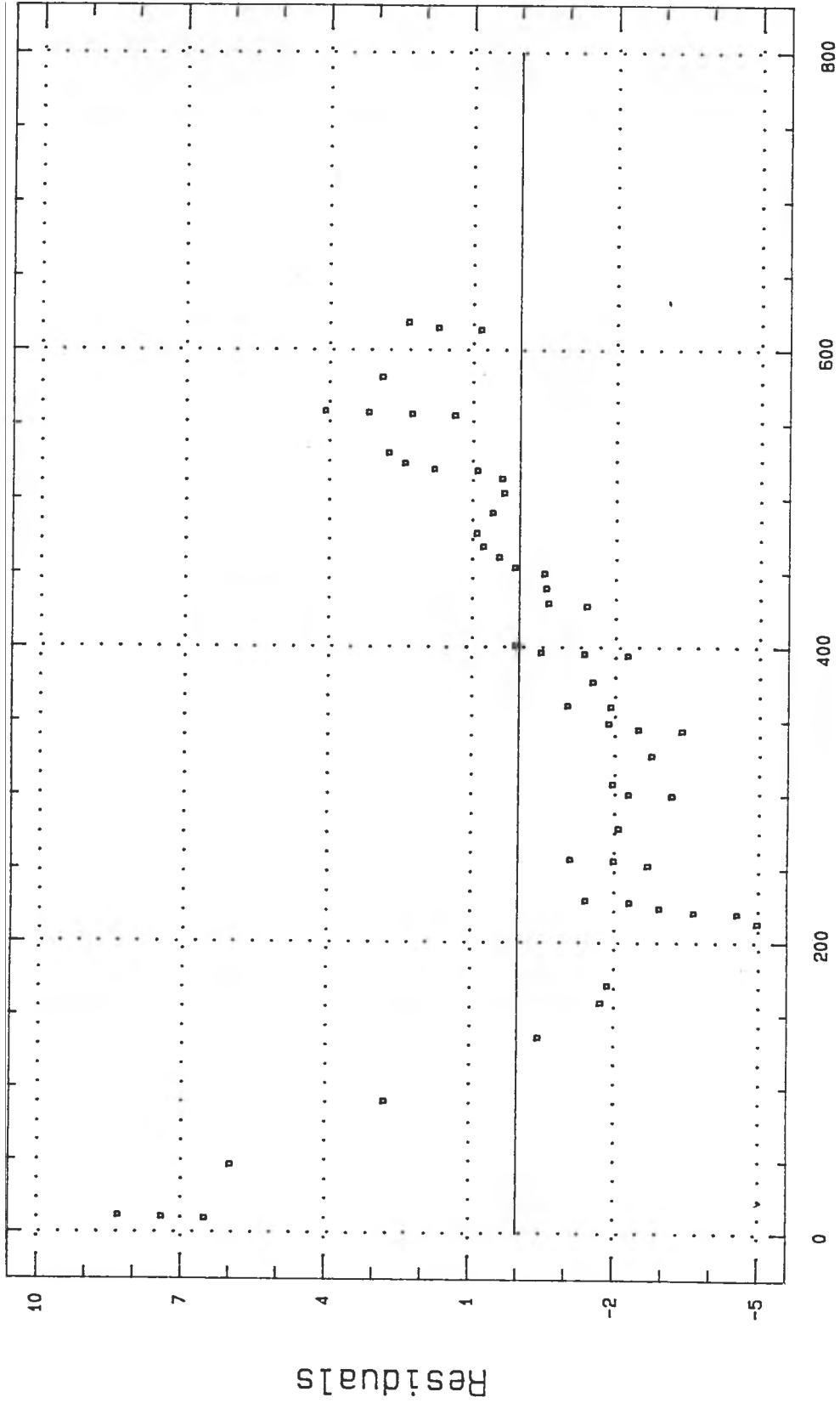


Figure 5

Plural of the Inflection of the Verb: Residuals of the Regression



Record Number

Figure 6

2.1.3 Conclusions

Both the singular and plural of the verb performed well as criteria for indicating the translation technique. The trends indicated are strong, facilitating the subdivision of the data set. Markedly different translation techniques could be identified and it was possible for the author to subdivide the data sets. However, some of the trends exhibit the potential to be subdivided themselves.

<u>Singular</u>	<u>Plural</u>
01:01	01:01
NORM.asc.	ASC.asc
NORM.asc.	01:17
NORM.asc	NORM.desc.
02:22	NORM.desc.
NORM.norm.	NORM.desc.
NORM.norm.	05:33
NORM.desc.	NORM.norm./asc.
15:23	NORM.norm./asc.
NORM.asc.	NORM.norm./asc.
20:16	NORM.norm./asc.
NORM.desc.	NORM.norm./asc.
26:16	NORM.norm./asc.
ASC.asc.	NORM.norm./asc.
28:05	NORM.norm./asc.
ASC.desc.	NORM.norm./asc.
28:55	NORM.norm./asc.
ASC.asc.	NORM.norm./asc.
ASC.asc.	31:06
ASC.asc.	NORM.desc.
34:12	34:12

Figure 7: The Comparative Table of Translation Units Identified by the Different Criteria¹⁸

As can be seen in the figure above, the translation units indicated by the singular and the plural differ almost totally. Not only do the formal translation units differ, but also the informal.

Agreements between the formal translation units of these two criteria could be found only regarding the "normal" sections. The deviating section of the singular is from Deut. 26:16 to 34:12, and that of the plural from Deut. 01:01 to 01:17. The section from Deut. 01:17 to 26:16 is formally "normal" for both criteria. It is obvious that not too much should be read into this apparent agreement: the normal

¹⁸ Text references are used in the table to indicate translation units as identified in the respective sections. Trends reflected in the indicated translation units are identified by markers in capitals. However, trends visible on the graph, but not strong enough to be reflected in the translation units are indicated in lower-case letters.

For "asc." read "ascending", for "desc." "descending" and for "norm." "normal".

sections of both criteria have a high degree of variance, indicating that they could be subdivided in other circumstances. In addition, the trends within these sections differ, as will be illustrated in the section below.

In the whole of Deuteronomy, only four sections could be found in which the criteria of the singular and plural of the verb informally agree on the trend in translation technique relative to their respective regression lines. In addition, these four sections are all rather restricted in scope:

- Deut. 01:01 to 01:17 (ascending)
- Deut. 15:23 to 20:16 (ascending)
- Deut. 26:16 to 28:05 (ascending)
- Deut. 28:55 to 31:06 (ascending)

2.2 The Person of the Verb

2.2.1 First Person

The 211 occurrences of first persons of the verb found in Deuteronomy could all be used for statistical calculations. However, only nine non-first person Greek translations could be found. The 90th percentile of the standard errors of estimation of the 1 000 random data sets is 0.92660.

As the data set has a very scant population, there was no need for a graph of the residuals of the regression analysis. All details are quite visible on the graph of the regression analysis.¹⁹ The standard error of estimation for the whole data set is 0.813882, indicating that the data set should not be subdivided.²⁰

2.2.1.1 Interpreting the Graphs

From the graph of the regression analysis, it is immediately obvious that all the data points are within the prediction limits.²¹ The data set is obviously very thinly distributed and has a slope of about 48 non-first person Greek translations for every 1 000 occurrences of the verb in the first person.

2.2.1.2 Interpreting the Results

Very few elements were found where the Greek person of the verb is not in congruence with the Hebrew. The results obtained showed no pattern beyond the normal randomness to be expected in a data set, and the whole of Deuteronomy is consequently to be regarded as a single translation unit.

The validity of this result is compromised by the fact that so few data points are to be found on the graph. In fact, so few data points are available that the statistical results, to the mind of this author, became seriously suspect.

¹⁹ See figure 8.

²⁰ The full figures: non-literal translations = 9; correlation coefficient = 0.960583; R^2 = 92.27%; standard error of estimation = 0.813882; slope = 0.0476858; intersection = -0.764679.

²¹ This observation, when viewed in conjunction with the results of the second person and the third person below, vindicates the decision to use the 90th percentile of the standard errors of estimation of the 1 000 random data sets as a cut-off point. As was previously pointed out, this decision was a subjective one, although based on previous research.

In a previous study the prediction lines have been used as cut-off points (Nieuwoudt, 1992). In this instance, as in the two cases mentioned below, the prediction lines and the 90th percentile value both agree that the data set should be regarded as homogeneous.

First Person of the Verb Regression Analysis

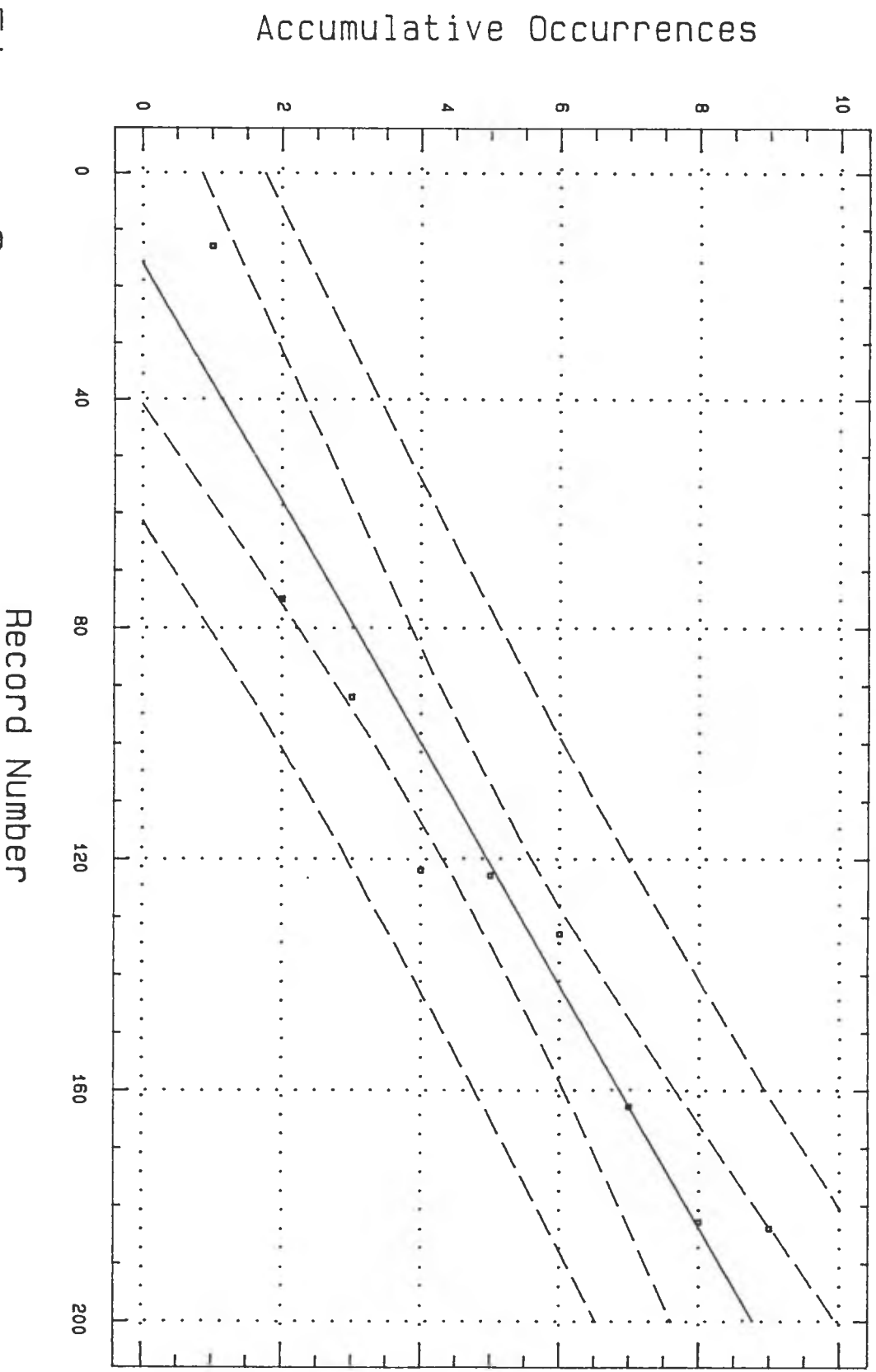


Figure 8

2.2.2 Second Person

The data set consists of 849 occurrences of the verb in the second person, of which only 27 are not rendered by the second person in Greek. The 1 000 random data sets generated using these parameters returned a 90th percentile of the standard errors of estimation of 1.72911.

Again, the data set has few deviations, which can clearly be seen on the graph of the regression analysis,²² negating the need for the graph of the residuals of the regression analysis. As can be seen on this graph, only one data point borders on the prediction lines of the regression analysis, indicating to the author that the data set may be of a homogeneous nature.

This observation was borne out by the figures: the standard error of estimation of the whole data set was 1.43946, indicating that the data set should not be subdivided.²³

2.2.2.1 Interpreting the Graphs

The data set is sparsely populated, although not to the same degree as was the case with the first person. As was mentioned above, the whole data set should be regarded as a unity, reflecting a homogeneous translation technique. The variance within the data set should, in accordance with the statistical method followed, be regarded as the natural randomness of the data set, and no particular significance should be attached to it. The average slope indicates that about 30 non-second person Greek translations could be expected for every 1 000 Hebrew verbs in the second person.

2.2.2.2 Interpreting the Results

Although the data set is not as sparsely populated as was the case with the first person of the verb, the author still does not feel comfortable with the population. It should be said, however, that there are sufficient data points in the data set to indicate a pattern similar to that of previous criteria: The data set begins with a slight ascending trend, followed by a bit of randomness till about the middle of the data set, and then a sharp but short ascending trend from about Deut. 16, ending with a sharp ascending trend from Deut. 32:14 onwards.

In this data set, however, none of these trends are definite enough to merit the subdivision of the data set.

²² See figure 9.

²³ The full figures: non-literal translations = 27; correlation coefficient = 0.984061; R^2 = 96.84%; standard error of estimation = 1.43946; slope = 0.0298916; intersection = -1.58682.

Second Person of the Verb Regression Analysis

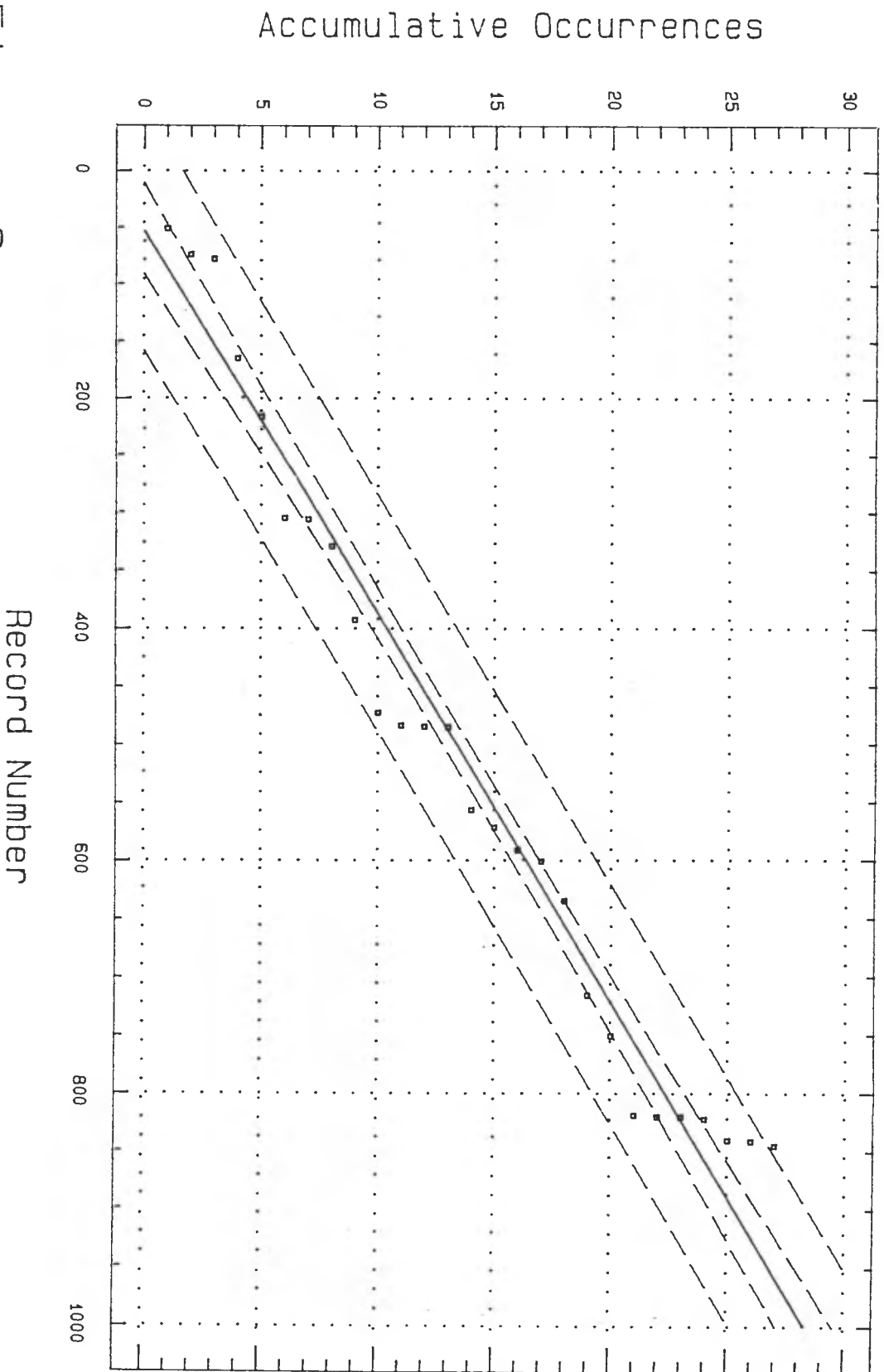


Figure 9

2.2.3 Third Person

It is to be expected that the third person of the verb would constitute the majority of the occurrences of the persons of the verb. Indeed, 1 195 occurrences of the Hebrew verb in the third person are to be found against 1 060 of the first and second persons combined. However, very few deviations from the third person are to be found in the Greek translation - only 26!

The cut-off value is 1.73050, while the standard error of estimation of the data set as a whole is 1.36946.²⁴ It is clear therefore that the data set should not be subdivided.

2.2.3.1 Interpreting the Graphs

The nature of the sparsely populated data set can clearly be seen on the graph of the regression analysis, making the graph of the residuals of the regression analysis superfluous.²⁵

While the translation technique in this data set should be seen as homogeneous, the author still wants to point out the only clear trend in the data set: from Deut. 21:12 to 28:15 a sharp ascending trend relative to the regression line can be discerned. This trend, although touching the upper prediction line, does not cross it. This lends more credibility to the statistical method that indicated the homogeneity of the translation technique of the data set.

2.2.3.2 Interpreting the Results

While the criterion of the second person has about the same number of deviations from the Hebrew second person as this criterion has from the third, it should be kept in mind that the second person has only about 70% of the potential for deviations that the third person has, the base lines of the two criteria consisting of 849 and 1 195 records respectively. Taking this fact into consideration, it seems that there are very few deviations indeed from the person of the third person of the Hebrew verb. So few, in fact, that the author is of the opinion that the integrity of the results of this criterion is compromised.²⁶

²⁴ The full figures: non-literal translations = 26; correlation coefficient = 0.984492; $R^2 = 96.92\%$; standard error of estimation = 1.36946; slope = 0.0223144; intersection = 0.15385.

²⁵ See figure 10.

²⁶ See section 2.2.5.1 for an explanation about the effect this type of distribution of a data set can have on its results.

Third Person of the Verb Regression Analysis

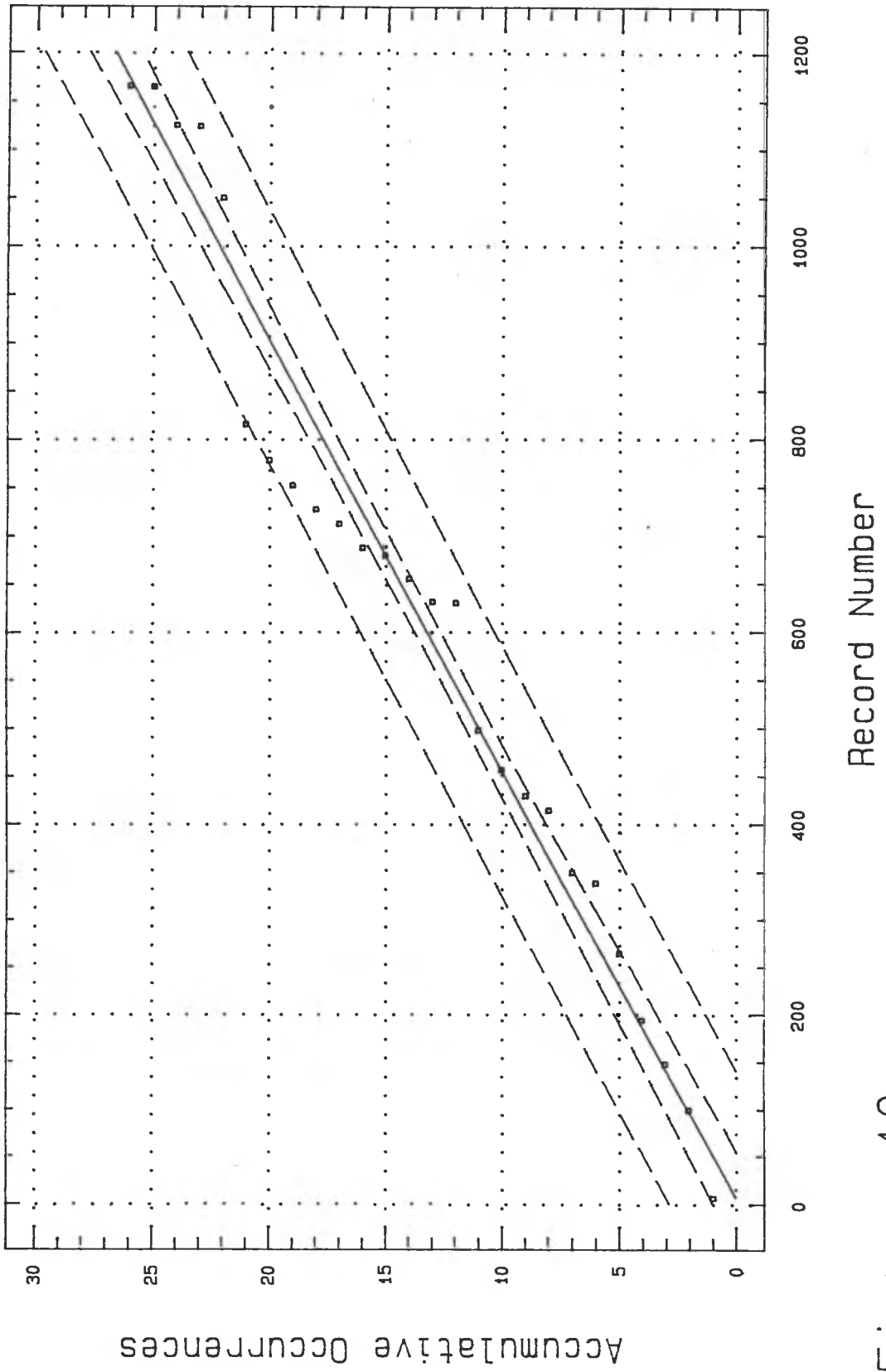


Figure 10

2.2.4 Combined Persons of the Verb

It came as a big surprise to the author to find, after successfully establishing translation units using the number of the verb, that using the person of the verb as a criterion does not render the same kind of results. The cause for this phenomenon could be attributed to two different factors. In the first place, it could be that the criteria dealing with the person of the verb reflect a homogeneous translation technique. It could also be that, for each of the data sets, there are too few values on the Y-axis to render reliable statistical results.²⁷

The author therefore thought to combine all the data of all the persons of the verb into a single data set. Although this will result in an accumulation of the records on the base line to 2 255, it will also increase the number of accumulated occurrences of deviations from the person of the Hebrew to 62.

These parameters were used to generate the 90th percentile of the standard errors of estimation of the 1 000 random data sets: 2.63230. When, however, the standard error of estimation was computed for the data set, it amounted to only 2.07903.²⁸ Although only marginally smaller than the maximum value allowable, it still indicates that the data set should not be subdivided.

As this experiment clearly did not render better results than the investigation into the different persons of the verb on individual level, this course of investigation was not pursued any further.

²⁷ In statistical terms it is said that the results of the data set lack significance.

²⁸ The full figures: non-literal translations = 62; correlation coefficient = 0.993448; R^2 = 98.69%; standard error of estimation = 2.07903; slope = 0.027218; intersection = -2.38084.

Combined Persons of the Verb: Regression Analysis

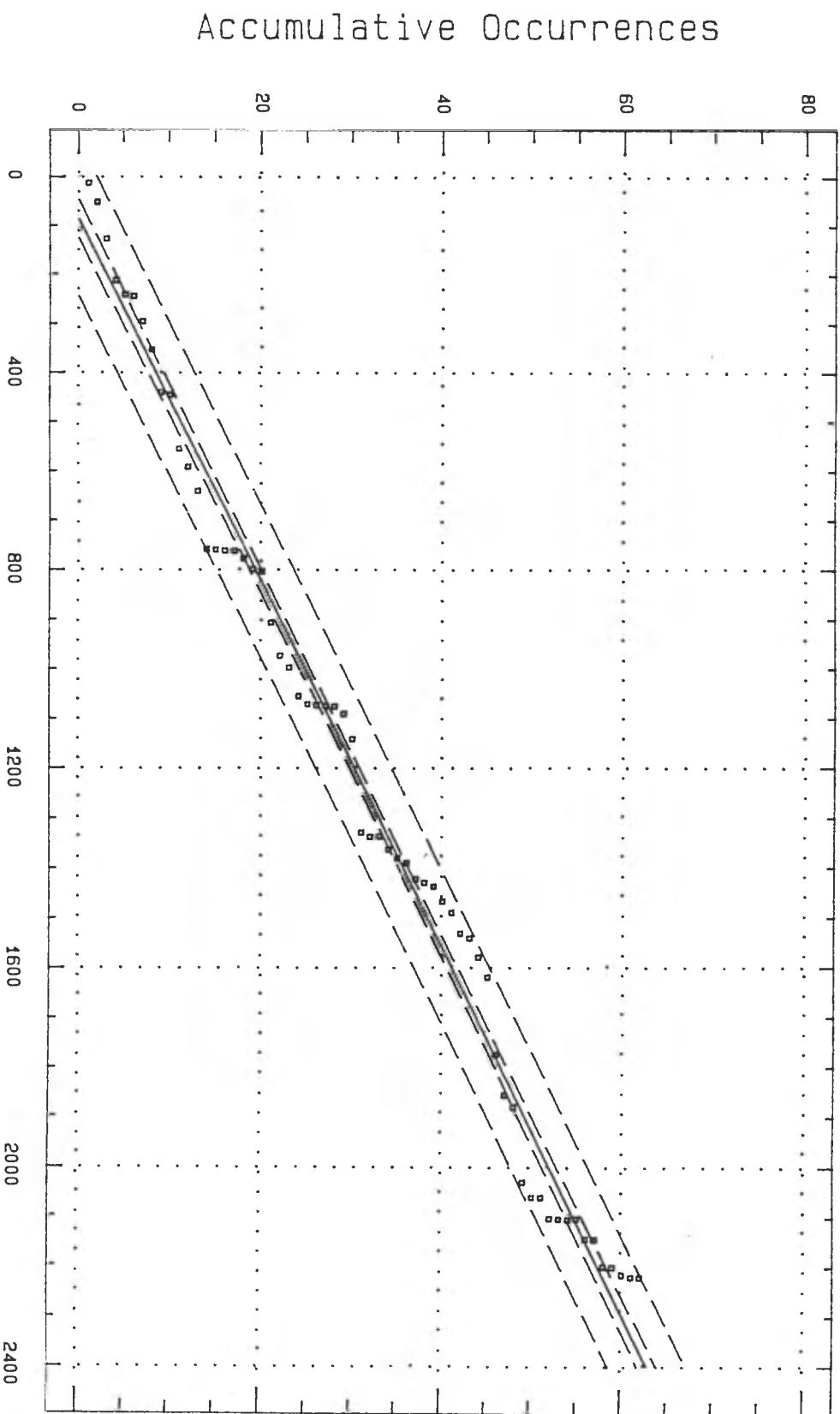


Figure 11

Record Numbers

2.2.5 Conclusion

The phenomenon encountered while examining the criteria relating to the person of the verb caused a lot of problems for the research. It was particularly difficult to decide which of the two factors mentioned in the previous section should be proffered as the reason for the indication of homogeneity of translation technique by the person of the verb.

2.2.5.1 Too Little Data?²⁹

The author is not satisfied with the population of any of the three data sets in question, regarding them all as having too little data to **guarantee** reliable statistical results.

While the question of too little data to allow reliable statistical results occurred in the previous two chapters as well, it is only in this chapter that it became a critical issue. This problem is to be laid at the door of the methodology. The present approach measures only the differences between the two texts. The fewer the differences, the fewer data points are generated on the Y-axis, and the more unreliable the results become. In short, as the translation gets closer and closer to the original in congruence, it becomes correspondingly more and more difficult to detect patterns in the translation technique.

²⁹ This section is, as the reader will see, both an argument regarding one of the possible reasons for the statistical results in this section, and an excursion on the effects of a literal translation technique on the methodology followed in this work.

EXCURSION: Problems Using Literalism to Measure Translation Technique

Can a Translation Be Too Literal to Measure?

The cause for the problems encountered in this chapter of the present study is not only to be laid at the door of the statistical methodology. It also implicates the theoretical approach on which the statistical methodology was founded. As was explained in chapter 2, the present statistical methodology has its theoretical foundation in the work of J. Barr and E. Tov. The present methodology is based on the presupposition that the difference between the two texts is being measured, as is to be expected from the research technique called typology of literalism. James Barr (1979: 294 f.) approached the problem from both angles: free and literal translation is to be measured. He made it very clear that different criteria measuring the degree of freedom or literalness can render different answers when applied in the same section of text (Barr, 1979: 234). He also mentioned that the "... different modes of literality might be formally designated and marked. If this were done one could then go through any particular book in the Greek or other version and give for each verse a percentage notation or something similar, quantifying the degree of literality on each of several levels" (Barr, 1979: 234). Emanuel Tov (1981: 50-66) used this suggestion and formally worked out a methodology suited to measure the literalness of a translation. He proposed five criteria for literalness (Tov, 1981: 54-60), which he found easier to formulate. Not only could the results of these criteria be quantified, but bad performance of a section of the translation, as measured by one of these criteria, would point towards that section being non-literal in translation technique (Tov, 1981: 53). In addition to this identification of the non-literal sections by negative indications, these non-literal sections could also, according to Tov (1981: 53), be identified by positive criteria. Tov (1981: 53) could not see the way clear, however, towards expressing these positive criteria used to identify non-literal sections in statistical format.

Neither of the scholars mentioned in the previous paragraph explained exactly how the statistical analysis should be done, a factor that led to the writing of this dissertation. The author did seek expert statistical advice, which made this study a possibility. It was eventually decided to quantify the translation technique as trends deviating from a completely literal translation. The statistical methodology followed in this study therefore measures the non-literalness of a translation unit, as suggested by Tov.

In the end, it all boils down to statistical significance. When the extent of a data set, or one of the factors used in a regression analysis, falls below a certain critical limit, the statistical results become unreliable.³⁰ While the slope of the data set is not compromised, the calculations regarding R^2 , correlation coefficient, and, most important, standard error of estimation are indeed compromised.

³⁰ For an extreme example, see the statistical results of the first section of the plural (section 2.1.2.2) of this chapter.

The implications are profound on a section that displays a very literal translation technique. While it is still possible to calculate the number of non-literal translations in the hypothesized translation unit, the subdivision of the book into translation units, using the standard error of estimation, becomes impossible, as the integrity of the statistical measuring device is compromised. Therefore the more literal the translation technique, the more unreliable the results regarding the identification of translation units. The question may be asked therefore whether criteria based on the literalness of translation make for good statistical criteria.³¹

Translation Technique Predetermined by the Translator?

The theory measuring the literalness and freeness of a translation unit, as it was proposed by Barr and Tov, utilizes criteria that measure an abstract concept - the literalness with which the translator rendered the source text. It should be kept in mind, however, that the translator probably did not make a conscious decision regarding the translation technique.³² This notion is supported by the varying character of translation technique detected both by this author and by Aejmelaeus (1982: 165). If the translator had had a formal table of equivalents to work from, or had followed an explicitly defined translation technique, this variance probably would not have occurred.

The Helsinki school should consider an implication of this argument: if the translator did not follow a rigorous table of equivalents, there is no reason why the translator should render the different elements of the grammar with the same level of literalness. This notion is supported by the evidence in

³¹ It may be possible for someone better versed in statistics than the present author to propose a statistical approach which will bypass the problem. For example, it may be possible to use different approaches for the identification of respectively the translation units and the translation technique, avoiding the problem of small data sets.

This author is, however, in doubt as to whether this is possible. All statistical results depend to a large degree upon the data set being statistically significant. As long as the literalness and freeness of the LXX are going to be measured based on binomial data sets, small data sets are going to pose a problem.

³² Compare the following:

"... many ancient translators of the Bible seem not to have had any clear or definite policy for a literal or a free rendering of the text..." (Barr, 1979: 280),

"... the tendency of many early translators was not to be consistently literal or consistently free, but to combine the two approaches in a quite inconsequential way. It is, on the whole, late in the development of ancient biblical translation that trends favouring a more rigorous and consequent approach emerge..." (Barr, 1979: 281) and

"But, in fact, these translators never paused to consider their aims any more than the methods by which best to attain them. Their work is characterized by intuition and spontaneity more than conscious deliberation and technique." (Aejmelaeus, 1991: 24-25).

this section: the number of the verb is not translated with the same level of literalness as the person. Before the results concerning literalness of detail analyses like grammatical criteria could be accepted as accurate therefore, the mapping regarding those criteria should be determined first.³³ The possibility that the translator had only been aware of certain aspects of the grammar should also be taken into consideration. Only these aspects could have been consciously rendered in a meticulous fashion by the translator.

³³ See the discussion concerning mapping in chapter 2.

2.2.5.2 Homogeneity!

On the other hand, when it is taken into consideration that data sets that have even fewer occurrences of deviation from the Hebrew do render reliable results indicating different translation units,³⁴ the author tends to favour the explanation that the results above are caused by homogeneity of translation technique as reflected by the criteria indicated.

In the end, however, one cannot be certain which factor is causing the statistical results above, and both reasons should be kept in mind.

³⁴ See, for example, minuses in chapter 3.

3. The Aspects Combined into Grammatical Units

3.1 Introduction

The Helsinki school is famous for its detailed work concerning analysis of translation technique using grammatical criteria and for its detailed studies of the grammar of the LXX. It is not the only one using that approach, however, as an examination of the doctoral dissertations of both Sailhamer and Wittstruck will bear out.

All the researchers mentioned above tried to combine different aspects of the grammar into a single criterion.³⁵ In the previous section this author dealt with the different persons of the verb in isolation, and then tried to combine the persons of the verb into a single criterion. The person of the verb can also be examined taking into account the morphology of the inflection of the verb in total (i.e. including the gender and number), and the syntax.

As could be seen from the screen prints of sections of the data files,³⁶ the author accumulated data on both these issues, and originally intended to include the data in discussions in this dissertation. However, the time allotted for this study, and the necessarily narrowly defined scope of a doctoral dissertation did not allow for both these issues to be included. After some exploratory analyses, it was found that the syntax of the verb, when applied to translation technique, is a verifiable minefield, and will need a study with the scope of the work of Anderson and Forbes (1986). The second part of this chapter will therefore be restricted to the study of the inflection only.

³⁵ I. Soisalon-Soininen (1965) combined the morphology of the infinitive (he made a distinction between the infinitive construct and the absolute infinitive) with syntax (the combination with different prepositions). R. Sollamo (1979) and A. Aejmelaeus (1982) continued this methodology.

T.K. Wittstruck (1972), when examining the Greek translators of Deuteronomy, took into account the different morphological forms of the verb, in addition to simple syntactical structures.

J.H. Sailhamer (1981) discussed the translational technique of the Greek Septuagint for the Hebrew verbs and participles in Psalms 3 to 41 also using the different morphological forms of the verb as categories. His differentiation between the *WE*- and normal forms of the verb also indicates his awareness of the importance of syntax.

³⁶ See chapter 2, figure 4.

As the person of the verb is again used in this section, some of the problems experienced in section 2.2 will also be reflected by the data in this section.

A data point is counted as non-literal when one or more than one of the aspects of the inflection of the translation differs from that of the Hebrew text. For example, even if only the number of the data point is translated non-literally, although the person may be translated literally, the data point will be regarded as non-literal.

3.2 Third Person Singular

It was possible to obtain a data set containing 955 usable occurrences of the verb in the third person singular. Only four occurrences were excluded because the Hebrew verb had not been rendered by a Greek verb.

<u>Record Number</u>	<u>Part of Speech</u>	<u>Greek Word</u>
6348	D	MAKRA/N
7894	N1	TU/XH
11452	N3M	O(/RMHMA
13455	A1	U(YHLO/S

Figure 12: List of Greek Words Excluded as the Greek Translations are not Verbs

The data remaining was sufficient to do a regression analysis, after which the customary graphs of respectively the regression analysis and the residuals of the analysis could be plotted.³⁷

3.2.1 Interpreting the Graphs

The maximum standard error of estimation allowable was calculated to be 2.62027, this being the cut-off value. The data set will have to be subdivided as the standard error of estimation of the whole data set was calculated to be 4.98775.³⁸

The two strongest trends in the data set are the very strong decline in the first section, and a steady, if undulating, ascend in the second section of the graph. The first section definitely is the stronger trend of the two, beginning very high above the regression line on the graph of the residuals of the regression analysis, and plunging to the most negatively deviating of all the points on that graph. This point is at Deut. 20:11 and can be taken as the point of division between the two trends.

The standard error of estimation of the two sections are both below the maximum allowable, and, accordingly, the data set was not subjected to further subdivision.

³⁷ See figures 13 and 14.

³⁸ The full figures: non-literal translations = 63; correlation coefficient = 0.962888; R^2 = 92.72%; standard error of estimation = 4.98775; slope = 0.0733626; intersection = -11.2678.

Section 1³⁹

This section has a homogeneous character, reflected in the low standard error of estimation. It begins at Deut. 01:01 and ends at Deut. 20:11. The slope indicates that about 30 non-literal translations could be expected in every 1 000 occurrences of the third person singular.

Section 2⁴⁰

The second section begins at Deut. 20:11 and accommodates the rest of the book. Its character is much less homogeneous than that of the first section, as can be seen both on the graph and in the high standard error of estimation (near the maximum allowable). Yet it still maintains a uniform general ascending trend. The researcher can expect about 100 non-literal deviations in every 1 000 occurrences of this form of the inflection.

3.2.2 Interpreting the Results

These results can be used with confidence: the division between the two sections is definite and is supported not only by the change in direction on the graph of the residuals of the regression analysis, but also by the change in character from uniform to less uniform.

³⁹ The full figures: non-literal translations = 16; correlation coefficient = 0.97985; R^2 = 96.01%; standard error of estimation = 0.984302; slope = 0.0299455; intersection = 0.75534.

⁴⁰ The full figures: non-literal translations = 47; correlation coefficient = 0.986969; R^2 = 97.41%; standard error of estimation = 2.23067; slope = 0.0993594; intersection = -29.9828.

Third Person Singular of the Hebrew Verb: Regression Analysis

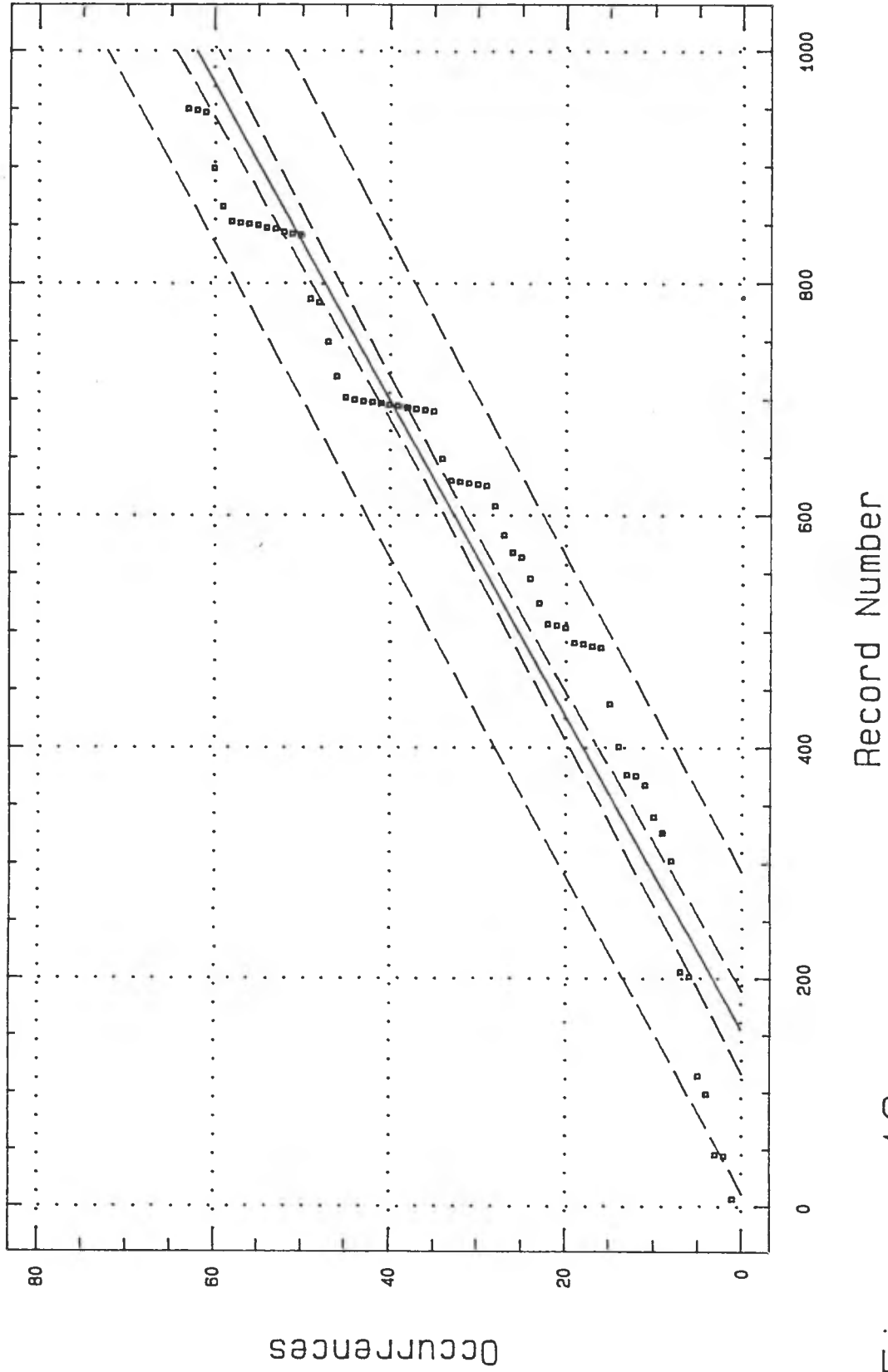
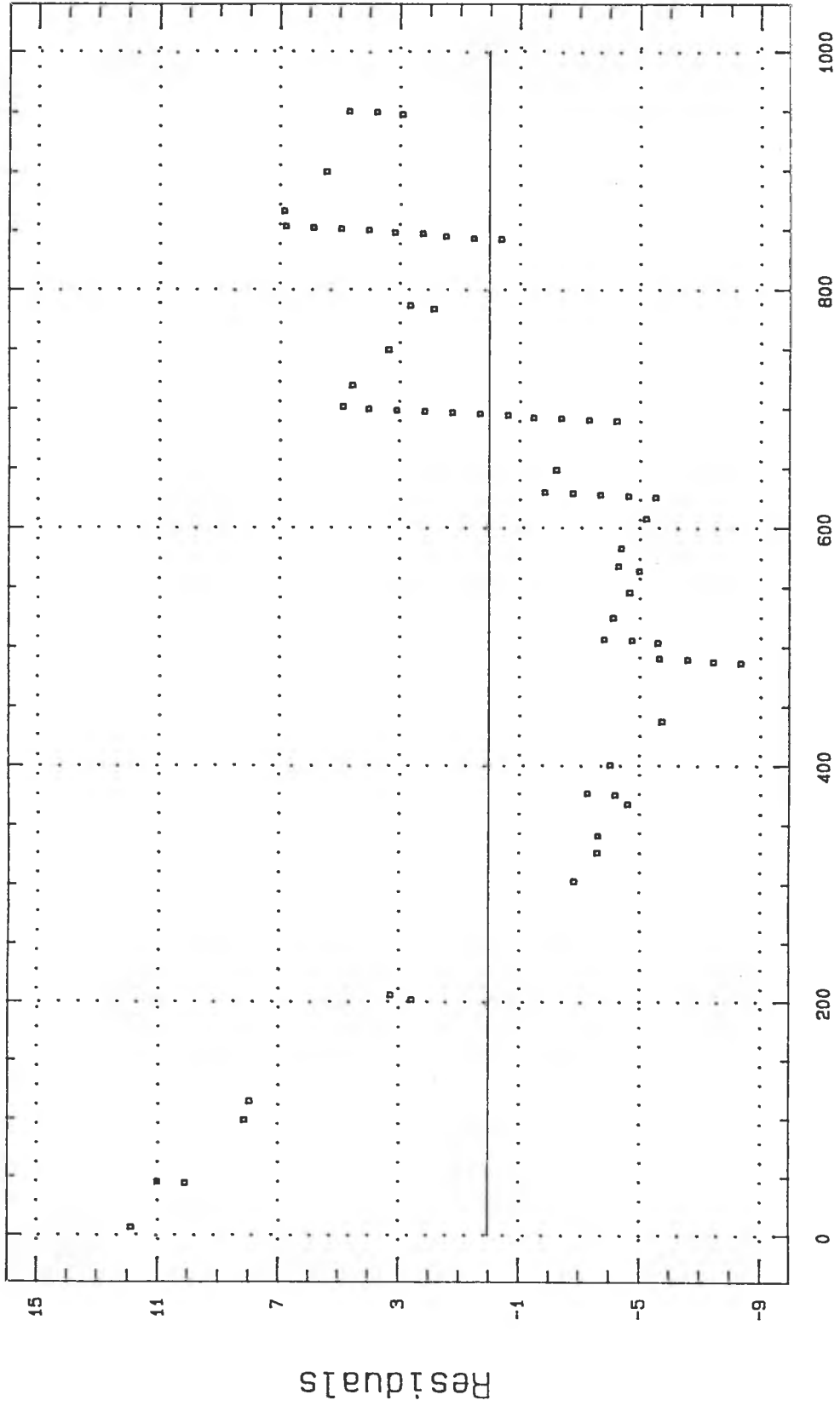


Figure 13

Third Person Singular of the Hebrew Verb: Residuals of Regression Analysis



Record Number

Figure 14

3.3 Second Person Singular

As could be expected in a book dealing with law, the second person singular and plural of the Hebrew finite verb occur in abundance. Six hundred and thirteen instances of the second person singular can be found. Only one Hebrew verb is equated with a Greek non-verb in the CATSS data base.

<u>Record Number,</u>	<u>Part of Speech,</u>	<u>Greek Word.</u>
5605	A1A	I) SXURO/S

Figure 15: List of Greek Words Excluded as the Greek Translations are not Verbs

Only 76 instances could be found of the Greek verb not being in the second person singular. Using these parameters, the regression analysis and the residuals of the regression have been computed.⁴¹

The 1 000 random data sets were generated and the 90th percentile of the standard errors of estimation was calculated to be 2.93226. The graph of the residuals of the regression analysis climbs steeply from below the lower prediction line to about Deut. 4:40, then slowly meanders downward to the second lowest point on the graph at Deut. 28:58. From here the plot climbs very steeply to the highest point on the plot, which is still below the upper prediction line. In fact, of the whole plot of the regression analysis, only the beginning of the plot does not fall within the prediction lines.

3.3.1 Interpreting the Graphs

When the standard error of estimation for the whole data set was calculated, it returned a value of 2.93179,⁴² indicating that the data set should not be subdivided. This author would have liked to have detached that first ascending section of the data set as indicated by the plot of the residuals of the regression analysis. It was decided, however, to stick to the method decided upon.

The data set has a non-uniform nature, as described above. This is reflected in the very high standard error of estimation. The average slope indicates that 102 non-literal translations could be expected from every 1 000 possible literal translations.

⁴¹ See figures 16 and 17.

⁴² The full figures: non-literal translations = 76; correlation coefficient = 0.991267; R^2 = 98.26%; standard error of estimation = 2.93179; slope = 0.102198; intersection = 8.76161.

3.3.2 Interpreting the Results

The data set is dense enough to render reliable statistics. The prediction lines and confidence lines are near the regression line. The author is not completely satisfied that the data set is not to be subdivided. Some caution therefore has to be exercised when the translation units of this criterion are interpreted. The slope of the data set could, in the opinion of this author, be trusted.

Second Person Singular of the Verb: Regression Analysis

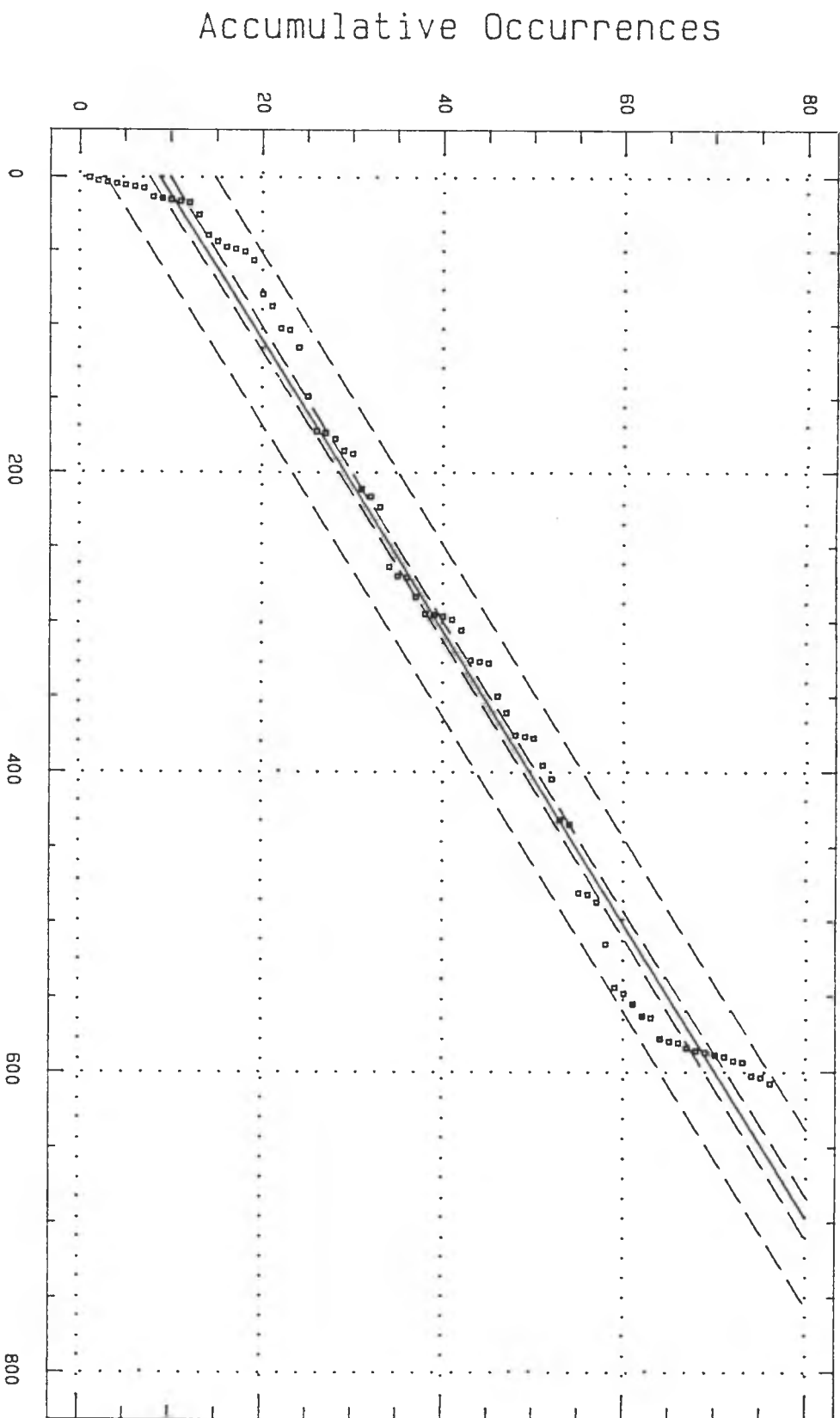


Figure 16

Second Person Singular of the Verb: Residuals of Regression Analysis

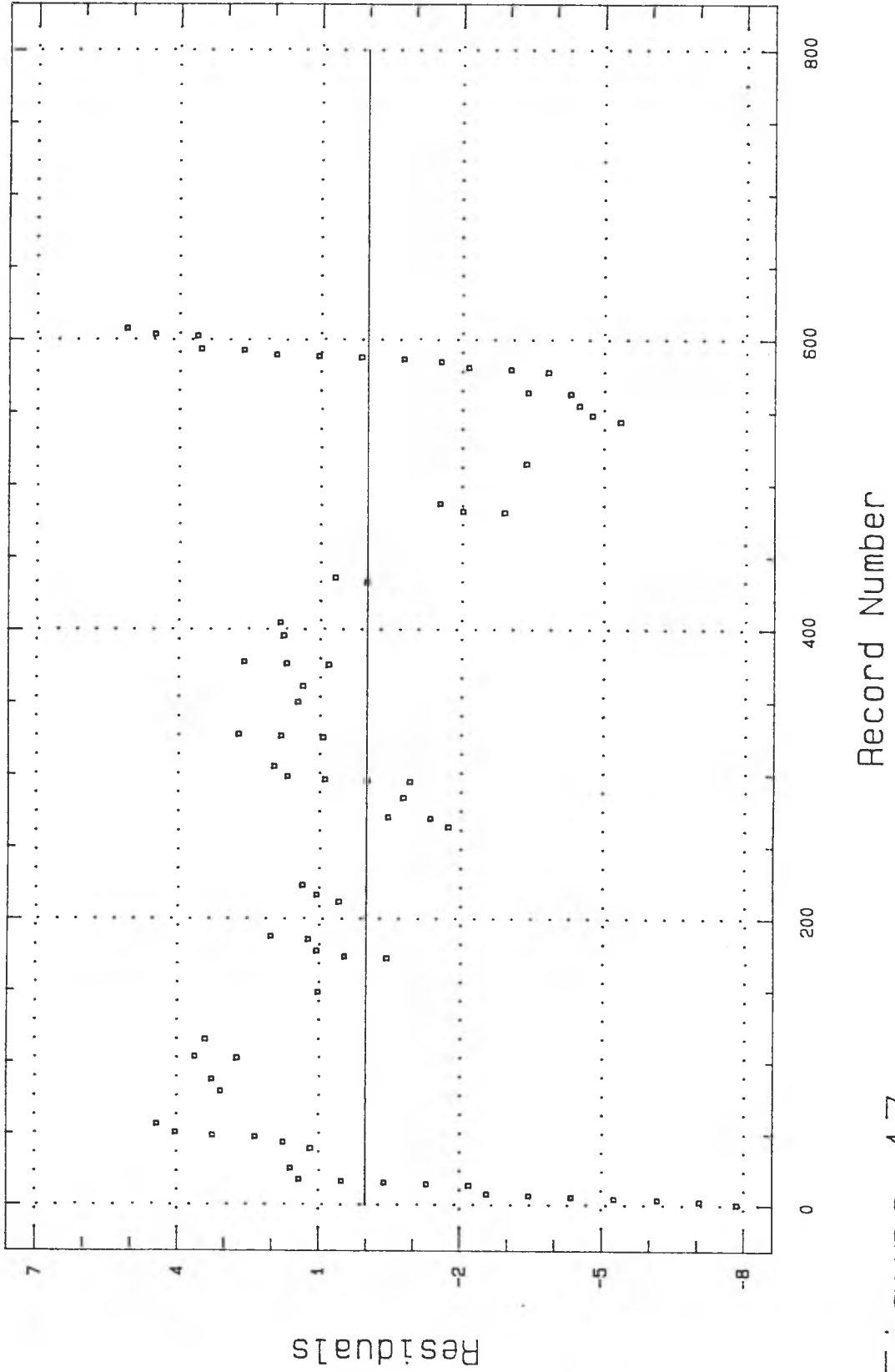


Figure 17

3.4 First Person Singular

Very few instances of the first person singular were recorded - 160. Of those, only 11 examples of Greek translations do not occur in the first person singular. As can be seen from the resulting graph of the regression analysis,⁴³ the data set is very sparse - to such an extent that trends can be seen so clearly that the graph of the residuals of the regression analysis is not necessary.

Although it was obvious that this data set may contain too little information for reliable statistical analysis, the cut-off value was calculated: 1.00518.

3.4.1 Interpreting the Graphs

The only noticeable trend occurs in the centre of the graph from about record 80 to about record 104, and is ascending in nature. The data sets indicate that this ascent starts at Deut. 11:14 and ends at Deut. 18:16.

The standard error of estimation for the data set is 1.10138,⁴⁴ indicating that the data set should be subdivided. When the sparseness of the data is taken into account, also indicated by the very widely positioned lines indicating the estimation and prediction lines on the graph of the regression analysis, this author is of the opinion that this data set is too scantily populated to render accurate statistical results or to be subdivided. Should the data set be subdivided by detaching the possibly deviating trend described above, the three data sets would result: the first with one data element, the second with six and the third with three. It is obvious that no concrete findings could be based on information of this sort.

3.4.2 Interpreting the Results

Taking the findings of the previous section into account, this author seriously suggests disregarding the results of this criterion.

⁴³ See figures 18 and 19.

⁴⁴ The full figures: non-literal translations = 11; correlation coefficient = 0.949079; $R^2 = 90.08\%$; standard error of estimation = 1.10138; slope = 0.112084; intersection = -4.30158.

First Person Singular of the Verb: Regression Analysis

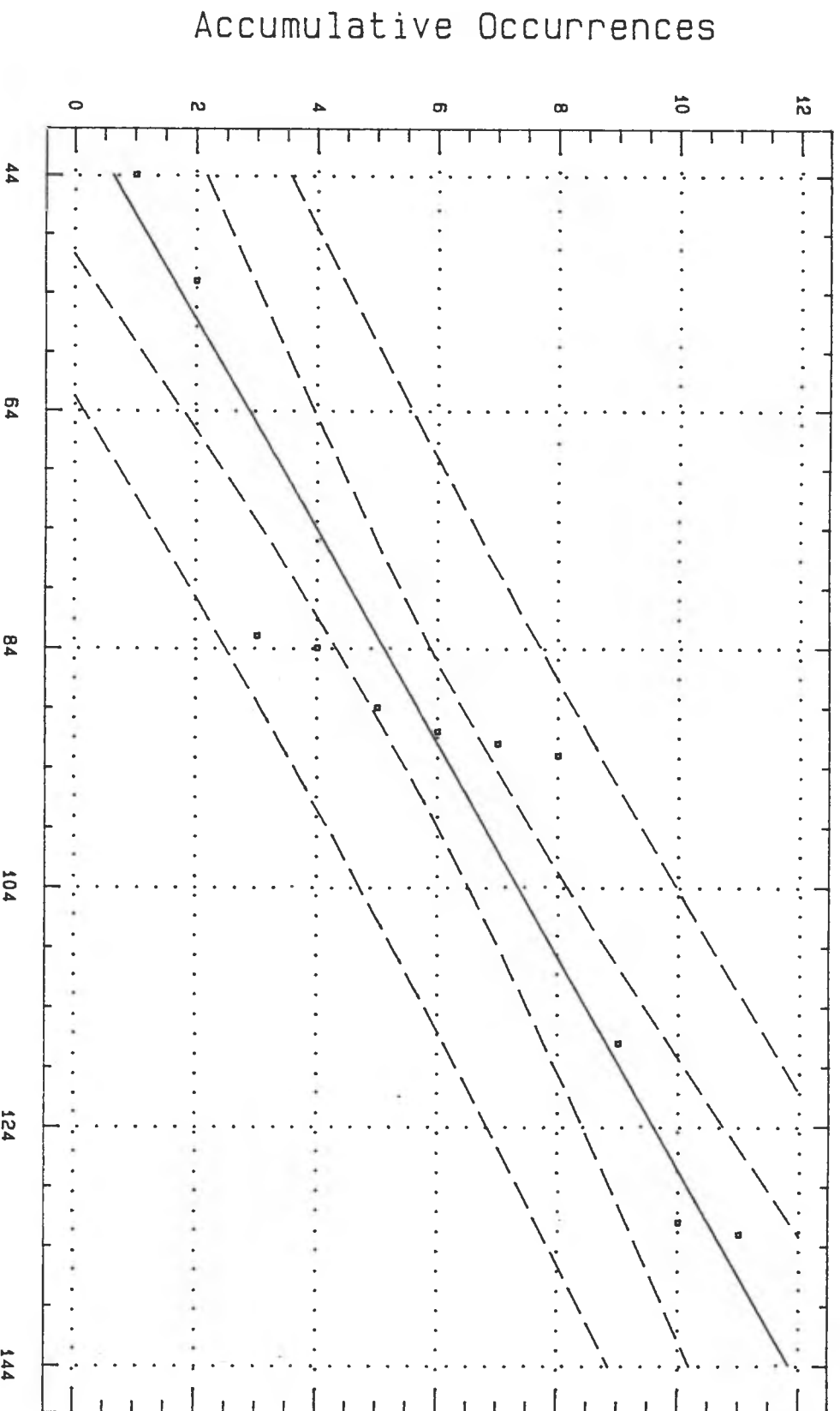
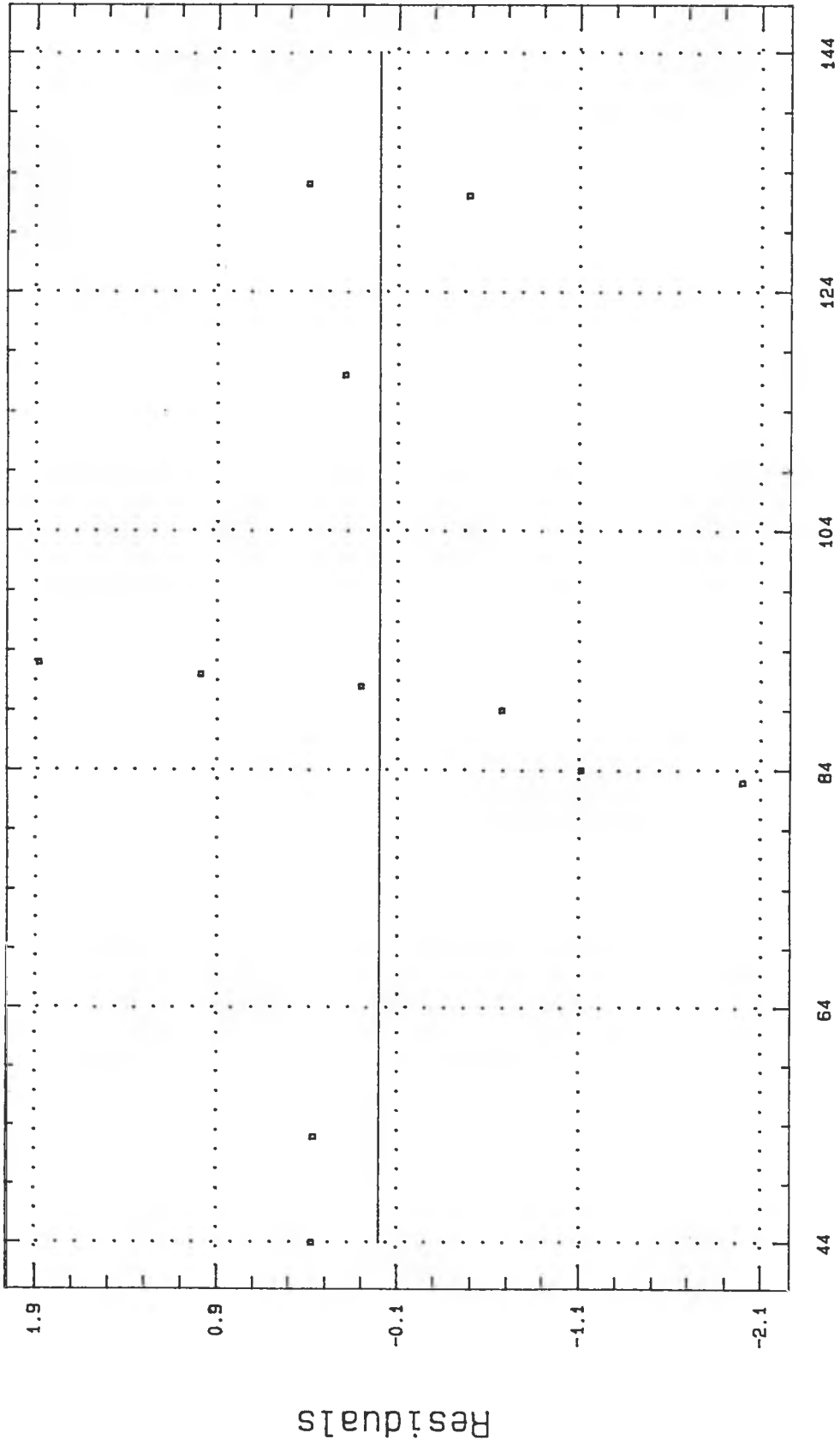


Figure 18

Record Number

First Person Singular of the Verb: Residuals of Regression Analysis



Record Number

Figure 19

3.5 Third Person Plural

Plurals of the Hebrew verb occur much less frequently than does the singular.⁴⁵ It is therefore to be expected that the data sets in this section would be less densely populated than in the case of the singular of the verb.

Two hundred and forty four occurrences of the Hebrew verb in the third person plural were found, of which four instances are aligned with Greek non-verbs in the CATSS data base.

<u>Record Number</u>	<u>Part of Speech</u>	<u>Greek Word</u>
2802	A1	<i>O) RQO/S</i>
7735	D	<i>) ORQW=S</i>
8103	N3T	<i>OU) =S</i>
14128	A3	<i>SUNNEFH/S</i>

Figure 20: List of Greek Words Excluded as the Greek Translations are not Verbs

Graphs of the regression analysis and the residuals of the regression analysis were plotted using the 240 remaining records for the X-axis, and the 35 non-literal translations found for the Y-axis.⁴⁶ The cut-off value is 1.90251.

3.5.1 Interpreting the Graphs

Looking at the graph of the residuals of the regression analysis, the data set could be divided into three. The first part falls below the regression line, the second part above, and the third part below again. The two strongest deviating trends are approximately from record 53 to record 70, and from record 145 to record 228.

The 90th percentile of the standard errors of estimation of the 1 000 random data sets is 1.90251. The standard error of estimation for the real data set is 1.5662,⁴⁷ indicating that the data set should not be subdivided.

⁴⁵ See sections 2.1.1 and 2.1.2 of this chapter. The number of the Hebrew verb is distributed as follows: 2 130 in the singular and 649 in the plural.

⁴⁶ See figures 21 and 22.

⁴⁷ The full figures: non-literal translations = 35; correlation coefficient = 0.988598; $R^2 = 97.73\%$; standard error of estimation = 1.5662; slope = 0.147311; intersection = -0.0434423.

The data set seems to be homogeneous in translation technique, as the standard error of estimation is well below the cut-off point. This homogeneity is also reflected in the fact that no data point is outside the 95% prediction lines.⁴⁸ One could expect to find about 147 non-literal Greek translations in every 1 000 possible literal translations, which is rather high.

3.5.2 Interpreting the Results

The author can see no reason why the results rendered by this criterion should not be regarded as reliable. It seems as if the data set contains enough data in order for the sample to be representative, and enough non-literal translations can be found to render a reliable regression analysis.

⁴⁸ See the graph of the regression analysis.

Third Person Plural of the Hebrew Verb: Regression Analysis

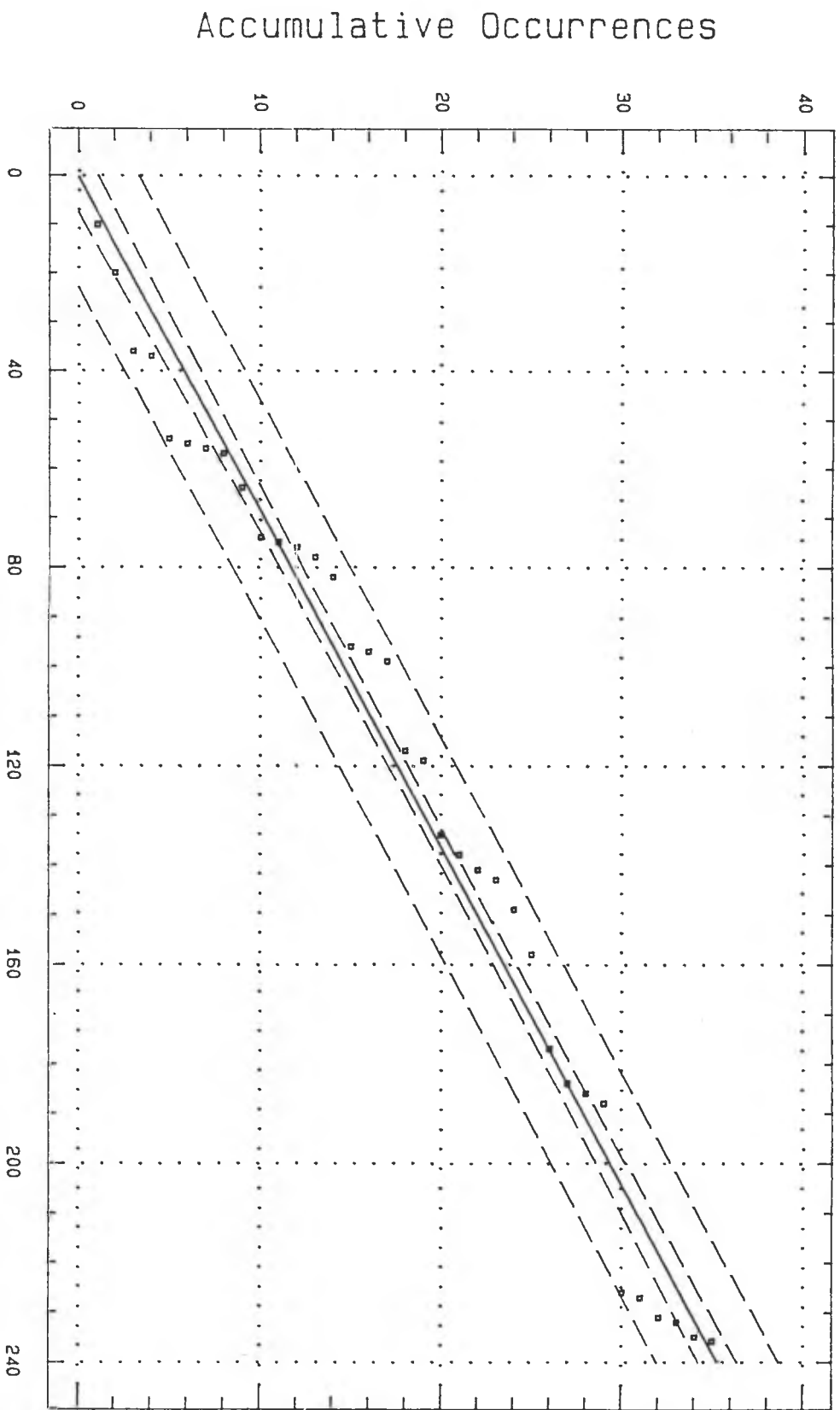
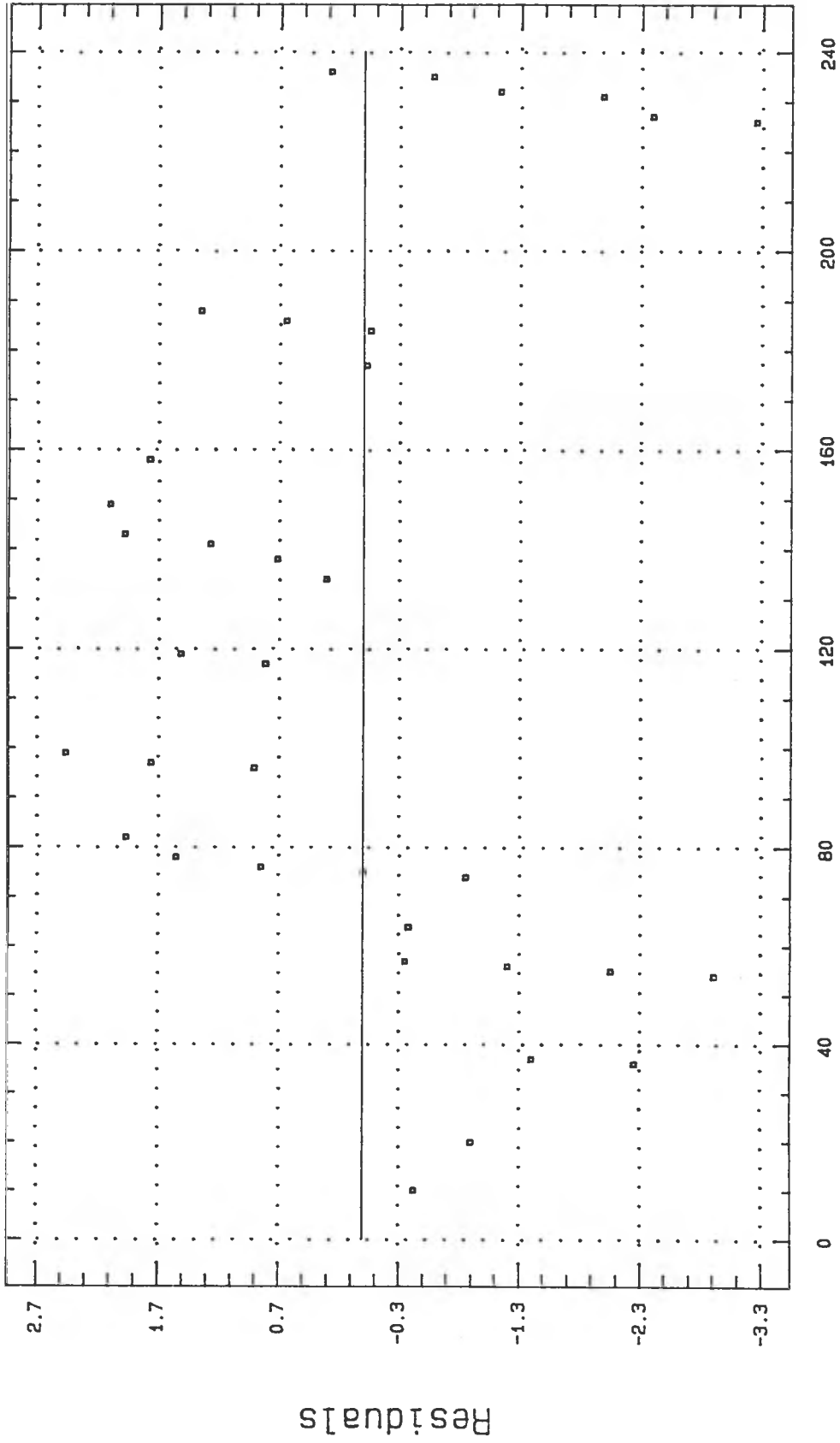


Figure 21

Third Person Plural of the Hebrew Verb: Residuals of Regression Analysis



Record Number

Figure 22

3.6 Second Person Plural

Although there are almost as many occurrences of the second person plural of the Hebrew verb as there are occurrences of the third person plural, the 237 occurrences are still only about a third of the occurrences of the second person singular.

All the verbs found are aligned with Greek verbs in the parallel alignment of the CATSS data base. Twenty one non-literal translations were found. The regression analysis was done, and the graphs of the regression analysis and the residuals of the regression analysis were plotted.⁴⁹ The standard error of estimation of the 1 000 random data sets is 1.48956.

3.6.1 Interpreting the Graphs

As can be seen on the graph of the residuals of the regression analysis, the data set is sparsely populated, and definite trends are difficult to observe. The plot of the residuals gives the impression of randomness rather than of definite trends.

This observation is supported by the standard error of estimation of the data set, viz. 0.85577.⁵⁰ This is well below the maximum allowable. All of the data points on the graph of the regression analysis are also well within the prediction lines.

The slope of the data set is very mild, indicating that only about 79 non-literal translations could be expected in every 1 000 possible literal translations.

3.6.2 Interpreting the Results

While neither the population of the data set nor the statistical analyses indicated problems regarding the population of the data set, this author tended to regard the results with some caution. If the data set had to be subdivided, the resulting subsets would have been dangerously small.

⁴⁹ See figures 23 and 24.

⁵⁰ The full figures: non-literal translations = 21; correlation coefficient = 0.990923; R^2 = 98.19%; standard error of estimation = 0.85577; slope = 0.0789398; intersection = 1.41821.

Second Person Plural of the Hebrew Verb: Regression Analysis

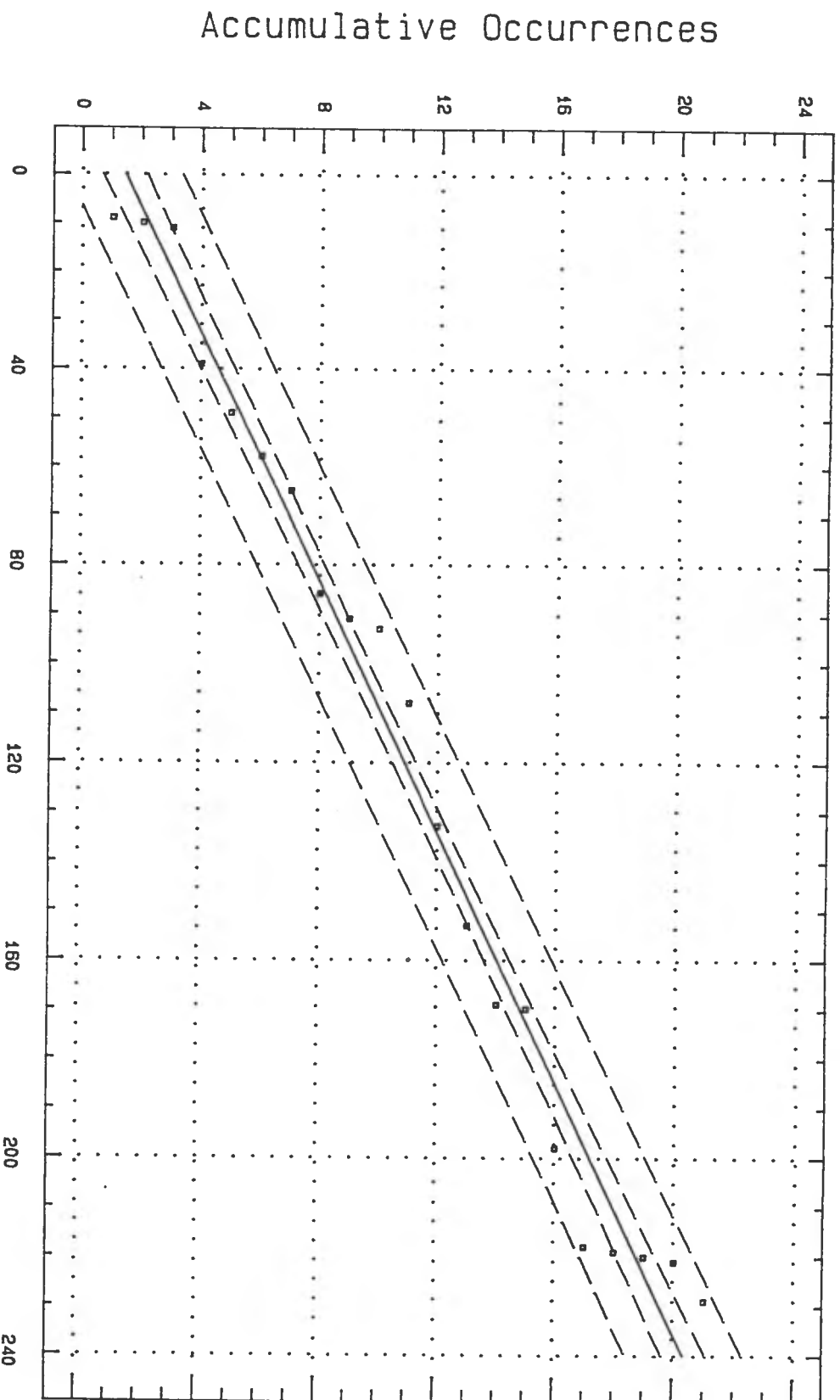


Figure 23

Record Number

Second Person Plural of the Hebrew Verb: Residuals of Regression Analysis

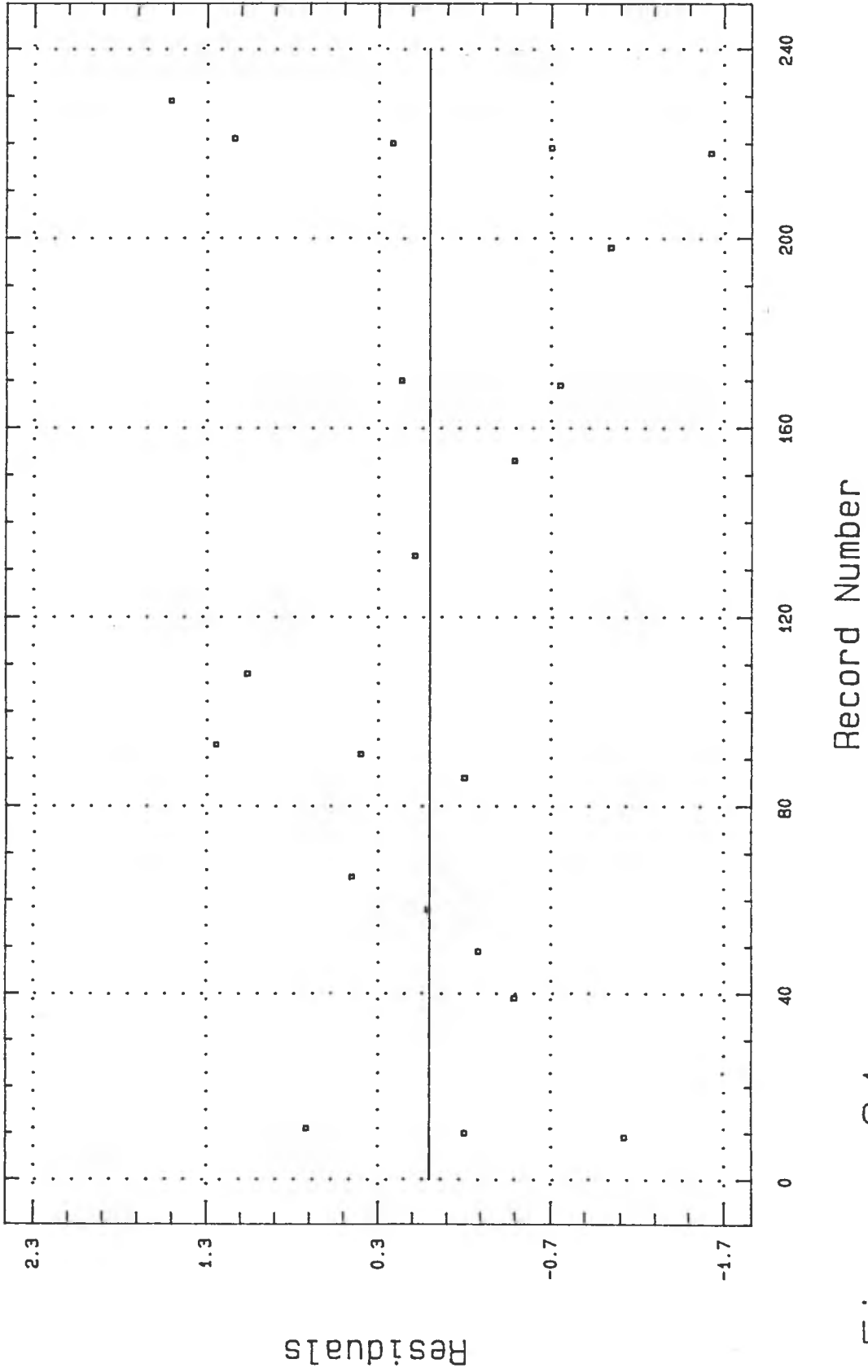


Figure 24

3.7 First Person Plural

Fifty one occurrences of the Hebrew verb are in the first person plural. Only two Greek verbs do not reflect this person. The resulting data set could not be used for any statistical analysis. This criterion can therefore not be used on the book of Deuteronomy.

3.8 Conclusion

From this research, conclusions could be drawn regarding the reliability of the results proffered by the criteria used above, and regarding the translation technique and translation units reflected by these criteria.

3.8.1 Reliability of the Results

As was expected, the problems encountered when the criterion of the plural of the verb was applied to the data set are also to be found when the inflection of the verb is investigated.

The results of two of the criteria, first person singular and first person plural, are either very suspect or unobtainable. Some doubt has been expressed about the validity of the criteria of the second person singular and second person plural. The author thought at first that the size of the data sets is to be blamed, as there are fewer second and first person verbs in the Hebrew text than there are third person verbs. However, the second person singular occurs more times than the third person plural, which is not affected.

One of the findings presented by this set of criteria could be that the person of inflection of the verb seems to play a larger role than the number. The grouping seem to be as follows: third person - reliable results, second person - results with some doubt, first person - unreliable results. The author is of the opinion, however, that a lot more work would have to be done before this hypothesis could be proven.

3.8.2 Translation Units and Translation Technique

Regarding the translation units, the criteria do not reflect much. Only the third person singular indicates different translation units within the book. This, unfortunately, also implicates the translation technique described, as the translation technique is described only within a translation unit. For what it is worth, the translation units and relative translation techniques are listed below.

3S	2S	1S	3P	2P	1P
01:01	01:01	01:01	01:01	01:01	01:01
DESC.desc.	NORM.norm.	NORM.norm.	NORM.asc.	NORM.norm.	--
20:11	NORM.norm.	NORM.norm.	NORM.asc.	NORM.norm.	--
NORM.asc.	NORM.norm.	NORM.norm.	NORM.desc.	NORM.asc.	--
34:12	34:12	34:12	34:12	34:12	34:12

Figure 25: The Comparative Table of Translation Units Identified by the Different Criteria⁵¹

No support can be found for the one definite trend in an "official" translation unit, viz. the descending trend of the third person singular. The only other regularity worth mentioning is the support for the observed (but not proven) ascending trend in the second translation unit of the third person singular by the second person plural. The third person plural, however, contradicts this. The rest of the table makes for relatively uninteresting reading.

⁵¹ Text references are used in the table to indicate translation units as identified in the respective sections. Trends reflected in the indicated translation units are identified by markers in capitals. However, trends visible on the graph, but not strong enough to be reflected in the translation units are indicated in lower-case letters.

For "asc." read "ascending", for "desc." "descending" and for "norm." "normal". The "--" indicates that no valid data could be obtained.

4. Conclusion

The following points became clear in this chapter:

- The different aspects of the inflection of the verb performed differently when used as criteria to assess the literalness of a translation unit. While the criteria using the number of the verb rendered clear, decisive results, the same cannot be said for the criteria based on the person of the verb. In this study, some regularities in translation technique were discovered in the criteria used in isolation, but these regularities were lost when those criteria were used in combination with other criteria. The regularities in translation technique concerning the number of the verb⁵² were not reflected when the different aspects of the inflection of the verb were combined in a single criterion.⁵³ In fact, the results of the person of the verb obliterated the results of the number.

This led the author to the following conclusions: even if combined criteria were to be used in future research, it may be important to use the criteria individually as well. In addition, it is clear that the results of the different criteria are dissimilar. Not only can the researcher not assume the results of criteria on the basis of the results of other criteria, but it must also be clear that the translation technique can only be described comprehensively by using as many criteria as possible.

Future researchers following the approach of the Helsinki school, where different aspects of the grammar are combined into a single criterion, should heed the problems experienced in this study.

- Throughout this study, the present author repeatedly mentioned that using statistical analysis encompassing all possible criteria could render results not otherwise possible. In this chapter, however, the opposite seems to be the case. The results of the individual, detailed criteria are more reliable than those of the combined criteria.

Three possible reasons may be given for this phenomenon: it could be that the mapping of translation equivalents by the translation technique is embodied in the different aspects of the inflection of the verb in isolation to one another. In that case the translation technique could only be described accurately by simple individual criteria. Secondly, it could also be that not enough criteria were used in combination in order to obtain a balanced picture of the translation

⁵² See section 2.1.3.

⁵³ See section 3.8.

technique as a whole. Thirdly, it could be that this researcher implemented the different aspects incorrectly in some way or another.⁵⁴

- If mapping of translation equivalents is a problem, it would seem logical that broader criteria, like those proposed by Barr and Tov, would have a better chance of correctly representing the literalness of translation technique at this stage of research. The accuracy of the results of these criteria does not depend upon identifying the unknown elements of the mapping for the relevance of the criteria. This argument is supported by the data in this dissertation - the CATSS criteria and Tov criteria rendered many more consistent results than the grammatical criteria.

The results obtained by implementing grammatical criteria are of critical importance for the retroversion of the LXX. It does seem, however, as if some more research still has to be done concerning the way in which literalness should be measured using these criteria.

⁵⁴ This seems improbable. Incorrect implementations of the criteria would have rendered invalid results for all, not only for the person of the inflection of the verb.

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CHAPTER 6: DISCUSSING TEXT-CRITICAL PROBLEMS

1. Introduction

This chapter will be devoted to a discussion of some text-critical problems in Deuteronomy using the results of the different criteria analysed in this study. The discussion will be on micro-level, i.e. it will only be attempted to discuss single lines of the parallel alignment. It is not the object of this chapter to attempt an in-depth discussion about text-critical problems, but rather to attempt to implement the results of the criteria. In this fashion, it may be possible to gauge the value of the results obtained in this study.

2. The Problems

Some lines containing problems will be selected from the parallel alignment. As it will be attempted to discuss real text-critical problems, it was decided to use lines in which the parallel alignment contains an annotation in Column B. In addition, the author would like to utilize the results obtained in chapter 5. The problems should therefore be problematic regarding the person of the verb. A short list of records containing problems of this sort was compiled.¹

¹ See figure 1.

725	0207	YD(	=v		DIA/GNWQI	3MS	2S
981	0225	)XL	=v		E)NA/RXOU	1S	2S
2637	0516	~ YY+B	=Y)RYKN	YMYK	MAKROXRO/NIOS	3MS	2S
		L/K			GE/NH|		
5614	1223	T)KL	=%vap		BRWQH/SETAI	2MS	3S
5667	1227	Y\$PK	=%vpa		PROSXEEI=S	3MS	2S
6286	1421	TTNN/H	=%vap		DOQH/SETAI	2MS	3S
6813	1601	HWCY)/K	=;YC)T	<ex34.18>	E)CH=LQES	3MS	2S
7331	1710	YWRW/K	=%vap		NOMOQETHQH=|	SOI	3MP 2S
13448	3227	)GWR	=@?)GR		MAKROXRONI/SWSIN	1S	3P
13876	3307	TBY)/NW	=%vap		EI)SE/LQOISAN	2MS	3P
14075	3323	YR\$/H	=YR\$	<sp>	KLHRONOMH/SEI	2MS	3S
		? <fp>					

Figure 1: List of Some of the Text-Critical Problems Indicated by the CATSS Data Base²

Records 6 813 and 14 075 both contain problems also indicated in the readings of other witnesses. These problems will therefore be discussed in some detail in the following sections.

The results of some of the criteria proved to be more reliable than the results of others. The table below will list these impressions. This information should be taken into account when the contributions of the different criteria to each text-critical problem are considered.

Criterion	Reliability
Consistency of Lexical Equivalents (Chap. 3, Section 2.1)	Not good, but the results agree with those of the other criteria in that group.
Representation of Constituents (Chap. 3, Section 2.2)	Not good.
Word order (Chap. 3, Section 2.3)	This criterion is one of the most reliable criteria.

² The fields are (in order) the record number of the original line in the CATSS parallel alignment, the text reference (the first pair of figures indicates the chapter and the second pair the verse), the MT, Column B, the LXX, the person of the Hebrew verb, and the person of the Greek verb.

Quantitative Representation (Chap. 3, Section 2.4)	The reliability of the criterion is compromised by the fact that the minuses and pluses are grouped together. The whole data base could be used in the analysis, however, leading to the criterion being regarded as reliable.
Minuses (Chap. 4, Section 2.1)	This criterion is very reliable.
Pluses (Chap. 4, Section 2.2)	Very reliable.
Hebrew Prepositions Presented by Greek Preverbs (Chap. 4, Section 2.3)	The results of this criterion should be regarded with some suspicion.
Number of the Verb - Single (Chap. 5, Section 2.1.1)	Good.
Number of the Verb - Plural (Chap. 5, Section 2.1.2)	Good, but the results could be better with subdivision of the data set.
Person of the Verb - First (Chap. 5, Section 2.2.1)	Bad. The data set is very sparsely populated.
Person of the Verb - Second (Chap. 5, Section 2.2.2)	Bad. No translation units could be identified.
Person of the Verb - Third (Chap. 5, Section 2.2.3)	Bad. The data set could not be subdivided due to very few non-literal translations.
Person of the Verb - Combined (Chap. 5, Section 2.2.4)	Bad. The data set could not be subdivided due to very few non-literal translations.
Person of the Verb - Third Singular (Chap. 5, Section 3.2)	These results can be used with some confidence.
Person of the Verb - Second Singular (Chap. 5, Section 3.3)	Sufficient data are available, but the fact that the data set cannot be subdivided reflects negatively on the quality of the results.
Person of the Verb - First Singular (Chap. 5, Section 3.4)	Bad. The data set is too sparsely populated to be used.
Person of the Verb - Third Plural (Chap. 5, Section 3.5)	These results should be regarded as reliable.

Person of the Verb - Second Plural (Chap. 5, Section 3.6)

Average. No translation units could be identified.

Person of the Verb - First Plural (Chap. 5, Section 3.7)

Too little data are available to utilize this criterion.

Figure 2: Reliability of the Contributions of the Different Criteria

The contribution of each criterion to the problem at hand will be listed. The following columns will be utilized in the figures below:

- The relevant criterion will be indicated using the designation of the criterion, the chapter it was discussed in, as well as the relevant section. The reader should refer to the relevant section, as well as to the translation unit (called segment in the figures below) for more particulars regarding the translation unit and the translation technique observed in the unit.
- The number of non-literal translations per 1 000 records (the column with the heading NL), that may be found in the translation unit in which the relevant verse occurs will be indicated. This will give an indication of the translation technique followed as reflected by the criterion.
- Finally, the homogeneity of the translation technique in the translation unit will be indicated by comparing the standard error of estimation of the translation unit with the cut-off value. The lower the standard error of estimation, the better the homogeneity of the translation is judged to be. If, however, the standard error of estimation approaches the cut-off value, the homogeneity of the translation units will be indicated as bad. The standard error of estimation and the cut-off value will be indicated in brackets in that order.

2.1 Deut. 16:01

2.1.1 Contributions from the Different Criteria

The translation technique in the relevant translation unit is indicated as follows by the different criteria:

Criterion	NL	Homogeneity
Consistency of Lexical Equivalents (Chap. 3, Section 2.1, Segment 2)	188	Excellent (3.84831/13.2157).
Representation of Constituents (Chap. 3, Section 2.2, Segment 0)	368	Average, but no translation units could be determined for this criterion (12.0193/16.62231).
Word order (Chap. 3, Section 2.3, Segment 3)	54	Average (5.59725/8.51198).
Quantitative Representation (Chap. 3, Section 2.4, Segment 1)	55	Not good (8.87992/9.96221).
Minuses (Chap. 4, Section 2.1, Segment 1)	17	Bad (5.2526/5.61627).
Pluses (Chap. 4, Section 2.2, Segment 1)	41	Not good (5.15406/7.94590).
Hebrew Prepositions Presented by Greek Preverbs (Chap. 4, Section 2.3, Segment 1)	5	Good (0.804355/2.0063).
Number of the Verb - Single (Chap. 5, Section 2.1.1, Segment 1)	52	Bad (3.1238/3.94103).
Number of the Verb - Plural (Chap. 5, Section 2.1.2, Segment 2)	103	Not good. This translation unit should, ideally, be subdivided (2.02859/2.47985).
Person of the Verb - First (Chap. 5, Section 2.2.1, Segment 0)	48	Bad. The data set could not be divided into different translation units (0.813882/0.92660).

Person of the Verb - Second (Chap. 5, Section 2.2.2, Segment 0)	30	Bad. The data set could not be subdivided, and the standard error of estimation is near the cut-off value (1.43946/1.72911).
Person of the Verb - Third (Chap. 5, Section 2.2.3, Segment 0)	22	Bad. The standard error of estimation is near the cut-off value (1.36946/1.73050).
Person of the Verb - Combined (Chap. 5, Section 2.2.4, Segment 0)	27	Bad. The standard error of estimation is near the cut-off value (2.07903/2.63230).
Person of the Verb - Third Singular (Chap. 5, Section 3.2, Segment 1)	30	Very good (0.984302/2.62027).
Person of the Verb - Second Singular (Chap. 5, Section 3.3, Segment 0)	102	Bad. The standard error of estimation is only marginally smaller than the cut-off value (2.93179/2.93226).
Person of the Verb - First Singular (Chap. 5, Section 3.4, Segment 0)	112	This data set is unusable (1.10138/1.00518).
Person of the Verb - Third Plural (Chap. 5, Section 3.5, Segment 0)	147	Bad. The standard error of estimation is near the cut-off value (1.5662/1.90251).
Person of the Verb - Second Plural (Chap. 5, Section 3.6, Segment 0)	79	Not good (0.85577/1.48956).
Person of the Verb - First Plural (Chap. 5, Section 3.7, Segment 0)	-	This data set is too small to be utilized.

Figure 3: Contributions from the Results of the Different Criteria

2.1.2 Evaluating the Problem

\$MWR		FU/LACAI
)T XD\$		TO\N MH=NA
H/)BYB		TW=N NE/WN
W/(&YT		KAI\ POIH/SEIS
PSX		TO\ PASXA
L/YHWH		KURI/W|
)LH/YK		TW=| QEW=| SOU
KY		O(/TI
B/XD\$		E)N TW=| MHNI\
H/)BYB		TW=N NE/WN
HWCY)/K	=;YC)T <ex34.18>	E)CH=LQES
YHWH		---
)LH/YK		---
M/MCRYM		E)C AI)GU/PTOU
LYLH		NUKTO/S

Figure 4: Deut. 16:01 in the Parallel Alignment of the CATSS Data Base

HWCY) K had been translated by *E) CH=LQES* in the LXX. The third person of the verb had clearly been translated by a second person singular in the LXX. This verse occurs in the middle of a narrative segment of Deuteronomy, and mentions the Lord leading Israel out of Egypt. The CATSS data base indicates the difference between the MT and the LXX, including the reference to Ex. 34:18, and then recommends using the retroverted Hebrew reading. The retroverted reading will then read *YC) T* instead of the phrase *HWCY) K YHWH) LHYK*.

The text-critical apparatus of the *Biblia Hebraica Stuttgartensia* (1984: 315) indicates that all the Greek witnesses except the Origen text read *E) CH=LQES*. It also indicates that the Greek reading is supported by a parallel reading in Ex. 34:18 - *YC) T*. *YC) T* then replaces the phrase *HWCY) K YHWH) LHYK*.

The Samaritan Pentateuch (Von Gall, 1918: 398) agrees with the reading of the MT.

Targum Neophyti (Diez Macho, 1978: 145) and Targum Pseudo-Jonathan (Ginsburger, 1903: 329) read *)PYQ YTKWN*, while Targum Onkelos (Sperber, 1959: 318) reads *)PQK*. The verb is in the third person masculine singular for all the Targumim. In all the Targumim, the "Lord our God" is indicated explicitly as the subject of the verb.

The Peshitta (Codex Ambrosianus) reads) *PQK*, with *MRY*) *LHK* indicated as the subject of the verb. Again the verb is in the third person masculine singular.

The Göttingen edition of the LXX (Wevers, 1977: 207) indicates that the text groups *d* and *t* of the LXX and the Arabic translations agree with the MT and translate *ECHGAGE(N) SE*. The *d* and *t* text groups, are, however, very closely related (Wevers, 1977: 38). The third person singular in some manuscripts of the LXX should therefore be seen as reflecting recensional activity.³

It is evident that the whole phrase *HWCY)K YHWH)LHYK* is at issue here. Not only does the person of the verb differ, but the whole Hebrew phrase is rendered differently in the LXX.

The criteria that could be of assistance are quantitative representation, minuses, the person of the Hebrew verb (third person), and the person of the Hebrew verb (third person singular):

- **Quantitative Representation:** Fifty five non-literal translations can be expected for every 1 000 translation elements in this translation unit. The homogeneity of the unit is not, however, good. In addition, the validity of the criterion itself is compromised. It would be better to use a subdivision of this data set, the minuses, as a criterion.
- **Minuses:** The translation unit in which Deut. 16:01 occurs does not have a good homogeneity, and about 17 non-literal translations can be expected in every 1 000 translation elements. The criterion is very reliable. Even taking into account the most deviating parts of the translation unit, fewer than 40 non-literal translations in every 1 000 translation elements can be expected. It therefore seems probable that the translator would render the phrase literally.
- **Person of the Hebrew Verb (Third Person):** The reliability of this criterion is compromised, as the main data set could not be subdivided into separate translation units. This also resulted in a bad homogeneity figure. The results of the criterion are therefore not regarded as reliable. These problems originate, however, in a very literal translation technique of this aspect of the verb. Only 22 non-literal translations can be expected for every 1 000 verbs in the third person.
- **Person of the Hebrew Verb (Third Person Singular):** When the third person of the verb is combined with the singular number, however, the data set can be subdivided. Not only are the results of the criterion regarded as reliable, but the homogeneity of the translation unit in which this verse occurs is very good. The translation technique indicates 30 (more than the previous criterion used) non-literal translations possible in every 1 000 translations.

³ The text groups that support the third person singular of the verb are composed of minuscules. In addition, it is in fact only one composite text group that supports this reading. Finally, none of the uncials support the reading.

2.1.3 Conclusion

It would seem as if the two most reliable criteria, the minuses and the person of the verb (third person singular) both agree that a very literal translation technique was followed. The average chances are less than 4% that a non-literal translation has been used. It is therefore proposed that the suggestion of the CATSS data base should be accepted. The Hebrew *Vorlage* of the LXX probably read *YC) T* instead of *HWCY)K YHWH)LHYK*. This is, however, against the readings of the Samaritan Pentateuch, the Targumim and the Peshitta.

It is also interesting to notice that the Tov criteria, the CATSS criteria and the grammatical criteria all agree regarding this problem.

2.2 Deut. 33:23

2.2.1 Contributions from the Different Criteria

The translation technique in the relevant translation unit is indicated as follows by the different criteria:

Criterion	NL	Homogeneity
Consistency of Lexical Equivalents (Chap. 3, Section 2.1, Segment 4)	191	Good (5.78864/13.2157).
Representation of Constituents (Chap. 3, Section 2.2, Segment 0)	368	Average, but no translation units could be determined for this criterion (12.0193/16.62231).
Word order (Chap. 3, Section 2.3, Segment 6)	63	Good (4.29374/8.51198).
Quantitative Representation (Chap. 3, Section 2.4, Segment 2)	88	Not good (8.07797/9.96221).
Minuses (Chap. 4, Section 2.1, Segment 2)	27	Average to good (2.62717/5.61627).
Pluses (Chap. 4, Section 2.2, Segment 4)	64	Not good (6.44491/7.94590).
Hebrew Prepositions Presented by Greek Preverbs (Chap. 4, Section 2.3, Segment 2)	14	Average (1.03018/2.0063).
Number of the Verb - Single (Chap. 5, Section 2.1.1, Segment 2)	100	Below average (2.75794/3.94103).
Number of the Verb - Plural (Chap. 5, Section 2.1.2, Segment 2)	103	Bad. This segment of the graph should, ideally, be subdivided (2.02859/2.47985).
Person of the Verb - First (Chap. 5, Section 2.2.1, Segment 0)	48	Bad. The data set could not be divided into different translation units (0.813882/0.92660).

Person of the Verb - Second (Chap. 5, Section 2.2.2, Segment 0)	30	Bad. The data set could not be subdivided, and the standard error of estimation is near the cut-off value (1.43946/1.72911).
Person of the Verb - Third (Chap. 5, Section 2.2.3, Segment 0)	22	Bad. The standard error of estimation is near the cut-off value (1.36946/1.73050).
Person of the Verb - Combined (Chap. 5, Section 2.2.4, Segment 0)	27	Bad. The standard error of estimation is near the cut-off value (2.07903/2.63230).
Person of the Verb - Third Singular (Chap. 5, Section 3.2, Segment 2)	100	Not good (2.23067/2.62027).
Person of the Verb - Second Singular (Chap. 5, Section 3.3, Segment 0)	102	Bad. The standard error of estimation is only marginally smaller than the cut-off value (2.93179/2.93226).
Person of the Verb - First Singular (Chap. 5, Section 3.4, Segment 0)	112	This data set is unusable (1.10138/1.00518).
Person of the Verb - Third Plural (Chap. 5, Section 3.5, Segment 0)	147	Bad. The standard error of estimation is near the cut-off value (1.5662/1.90251).
Person of the Verb - Second Plural (Chap. 5, Section 3.6, Segment 0)	79	Not good. Again the standard error of estimation is near the cut-off value (0.85577/1.48956).
Person of the Verb - First Plural (Chap. 5, Section 3.7, Segment 0)	-	The data set is too small to be utilized.

Figure 5: Contributions from the Results of the Different Criteria

2.2.2 Evaluating the Problem

Verse 23 of Deuteronomy 33 is in the middle of a poetic segment, and recounts the blessings by Moses of the 12 tribes just before his death.

According to the *Biblia Hebraica Stuttgartensia*, the problematic word reads *YR\$H* in the MT - second person of the verb, with pronominal suffix third feminine singular.⁴ The text-critical notes indicate that *YYR\$* (the third person of the verb) is used in the Samaritan Pentateuch, in lots of versions and in Targum Pseudo-Jonathan.

The Samaritan Pentateuch does indeed read *YMH WDRWM YYR\$*.

Targum Neophyti reads *YRT*, while Targum Onkelos and Targum Pseudo-Jonathan have *YYRT*. All the verbs are in the third person masculine singular.

The Peshitta reads *WLTYMN) N) RT*, indicating the person of the verb as third person masculine singular.

The CATSS data base and the text edition of the LXX by Wevers (1977: 371) both indicate that the LXX reads *KLHRONOMH/SEI*. The Göttingen edition does, however, indicate that some of the witnesses have a problem with this verb. The most important one is V, and the *Complutensis* even uses *-SEIS*. It is clear that the LXX witnesses are not united in this regard.

<i>W/L/NPTLY</i>	<i>KAI \ TW= | NEFQALI</i>
<i>)MR</i>	<i>EI) =PEN</i>
<i>NPTLY</i>	<i>NEFQALI</i>
<i>&B (</i>	<i>PLHSMONH \</i>
<i>RCWN</i>	<i>DEKTW=N</i>
<i>W/ML)</i>	<i>KAI \ E) MPLHSQH/TW</i>
<i>BRKT</i>	<i>EU) LOGI/AN</i>
<i>{...}</i>	<i>PARA \</i>
<i>YHWH</i>	<i>{ . . pPARA \ } KURI/OU</i>
<i>YM</i>	<i>QA/LASSAN</i>
<i>W/DRWM</i>	<i>KAI \ LI/BA</i>
<i>YR\$/H ? <fp> =YYR\$ <sp></i>	<i>KLHRONOMH/SEI</i>

Figure 6: Deut. 33:23 in the Parallel Alignment of the CATSS Data Base

⁴ This morphological analysis is problematic. The morphological analysis of Poswick indicates an imperative, and Koehler-Baumgartner (1958: 406) parsed the word as an imperative, but put a question mark behind the analysis.

Most of the criteria indicate that the last segment of Deuteronomy should constitute a separate translation unit ascending relative to the regression line.⁵ That is, more non-literal translations occur in this last segment of Deuteronomy than in the previous segments. However, such comparisons are of limited value. According to previous studies (e.g. Aejmelaeus, 1982: 176-181), Deuteronomy is very literally translated. The figures quoted in the NL column in figure 5 above tend to support this opinion. The only criteria with high figures, indicating a more free translation style, are consistency of lexical equivalents and representation of constituents. The other criteria all indicate fewer than 150 non-literal translations in every 1 000 translations.

The only criteria that can contribute directly to the solution are representation of constituents, the person of the verb (second person), and the person of the verb (second person singular):

- **Representation of Constituents:** It can be seen that the pronominal suffix *H* is missing from the Greek, allowing this criterion to be used. The criterion is not very reliable, and the data set could not be subdivided. The translation unit being used therefore comprises the whole Deuteronomy. In this translation unit, 368 non-literal translations regarding this criterion could be expected for every 1 000 possible translations.
- **Person of the Verb (Second Person):** This criterion indicates that only 30 non-literal translations can be found for every 1 000 translations in this translation unit. As, however, Deuteronomy could not be divided in different translation units, this figure reflects the translation technique in the whole Deuteronomy. The standard error of estimation for the translation unit is high. As can be seen on the relevant graph, the graph indicating non-literal translations climbs steeply at the end of Deuteronomy.
- **Person of the Verb (Second Person Singular):** Unfortunately, the problems experienced with the previous criterion were also encountered here. The non-literal translations in this case are 102 for every 1 000 records.

It seems as if all the criteria that can be utilized exhibit some problem in this translation unit. At first it seemed very encouraging that all the criteria indicated only one translation unit for Deuteronomy. Unfortunately, however, the results of the criteria regarding translation technique vary to a great extent.

Some text traditions support the variant reading of *YYR\$*. It seems as if the translation techniques indicated by the criteria using the person of the verb support the variant reading as being the reading in the *Vorlage*. In contrast, the results of the criterion indicating the representation of constituents, are much more ambivalent about the problem.

⁵ To be specific: consistency, word order, quantitative representation, minuses, pluses, singular of the verb, plural of the verb, and third person singular of the verb.

2.2.3 Conclusion

If the reader examined the *YR\$H* in its context, it will immediately be evident that more information is needed in order to make a balanced suggestion. This author would have liked more information regarding the person of the verbs used in connection with the other tribes, more information regarding the use of the verb *YR\$* in this segment etc. It is evident that the information above comprises only some of the information needed to address this problem.

3. Conclusion

It is the opinion of the author that it has been demonstrated that the results of the application of text-critical criteria to a data set can contribute towards a possible solution. In fact, these results may be deemed as essential contributions to a possible solution.

Regarding the agreement or non-agreement of the results of the different groups of criteria with each other, encouraging results were obtained. In the case of Deut. 16:01, the criteria are in some congruence regarding the results. This could indicate that the solution proposed for that problem should be regarded with confidence. The results of the criteria that could be utilized in the discussion of the second problem were all problematic, and not reliable. It would therefore be a fallacy to argue that the contradicting evidence in this regard points towards the different groups of criteria rendering different results.

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CHAPTER 7: CONCLUSIONS

As the reader would have noticed, conclusions have been reached at the end of each section of this dissertation. The author will not attempt to reiterate those conclusions in this chapter. Instead, some final impressions regarding the method followed, the different criteria used, and the use of translation technique in evaluating text-critical variants of the Bible will be discussed.

1. Methodology

Statistical methods have not been used in this study simply because it is the vogue to use statistical analysis. It was conclusively demonstrated that, by using statistics, the author was able to obtain certain results that were not attained by previous research. Specifically, sample data texts probably reflecting the original texts could be compiled, the translation technique of a whole book as measured by a certain criterion was described in graphical format, the translation units were determined and described using a scientific methodology, the translation technique observed was described in unambiguous terms, and different criteria could be utilized simultaneously to provide data according to which solutions for problematic variants could be suggested:

- It was attempted to solve the chicken-and-egg problem of the original texts and the translation technique using a statistical method called **representative sampling**. While some criticism can still be levelled at this research regarding the phenomena excluded from the sample data sets, the principle of the method proved to be sound. The data obtained rendered significant results in some instances, although some of the criteria could not be used due to the small size of the sample data set. It should be noted, however, that small data sets are also caused by the fact that certain phenomena do not occur often in Deuteronomy, e.g. distributive renderings and repetitive renderings.¹
- As far as possible, two **graphs** have been plotted for each criterion - the graph depicting the regression analysis, and the graph depicting the residuals of the regression. Readers have been able to observe the translation technique as measured by a specific criterion in graphic format without the translation technique being snipped into chapters, sections of books, books or even sections of the Bible.

¹ See chapter 4.

The information on these graphs has not yet been exploited to any great extent, and future research may yet learn a lot from these figures.

- In previous research, the boundaries of the **translation units** had been taken for granted. It was proven that these translation units can and should be determined using statistics. The translation units were determined before the translation technique was described, as had been suggested by E. Tov (1981: 50-53).

The author is in complete agreement with the results obtained by A. Aejmelaeus (1982: 164-167). Some variance in the translation technique was experienced throughout Deuteronomy. Although some of the shifts in translation technique coincide with the change of the "type of text" (sic Aejmelaeus), not all variance can be attributed to this factor.

It is also clear that each criterion indicates different translation units as well as different translation techniques within those units. To the author, this is one of the greatest benefits to be gained from "letting the data speak for itself".

- The **translation technique** was described using two indicators: the slope of the non-literal translation elements and the homogeneity of the slope in the specific translation unit. The results obtained in this fashion, although more sophisticated than those previously published in this field, can be refined even further. The work of Andersen and Forbes stands as an example of what can be accomplished.

The point was made above that in practice these results should be of more value than a description of the translation technique in subjective and relative terms (e.g. Tov and Wright, 1985: 150).²

- In chapter 6 it was demonstrated how the results of **different criteria**, even from different methodologies, can be utilized simultaneously while examining text-critical variants. This feature of the present methodology may be one of its most important advantages.

Regarding the use of statistics in general, it should be noted that the statistical approach in this study should be developed even further:

- The value of the contribution of a qualified and experienced statistician as a member of a multi-disciplinary team in planning the research, structuring the data and controlling the manipulation of data would have been incalculable. This was not possible at the stage the study, which is a doctoral dissertation and therefore has limits regarding the scope of the research and the maximum time allowable, commenced. Future researchers in this direction would do well, however, to take note of this.

² See chapter 2, section 2.4.2, as well as the quotations from Wittstruck in that section.

- This author was not always satisfied with the data discarded in the sample data set. It was already stated that it is difficult to blame only the structure of the CATSS data base. More, possibly statistical, experimentation will be required in order to cut down on the number of lines of the parallel alignment that had to be discarded.
- The approach used in this study is based on the premise that a completely literal translation is possible. However, the analysis measures only the non-literal translation elements, and the results of the analysis prove to become increasingly less significant as the translation becomes more literal. Clearly, more research is required in this respect. This approach of measuring literalness is the basis of the approaches of Barr and Tov, as proved above. However, the Helsinki school also based their elementary statistical analyses on this premise.
- Regarding the compilation of the sample data sets, the author would have been much more satisfied if all the words/elements for which significant text-critical variants could be found in manuscripts in the same textual tradition could have been excluded from the sample data sets. That would imply working not from the annotations in the CATSS data base, but preferably from textual editions of the format of the Hebrew University Bible Project and the Göttingen Series.
- Finally, the author still has great hopes for a research project with the scope of the work of Andersen and Forbes on this subject. However, a lot of work will first have to be done on the definition of the criteria, the refinement of the data set (including the coding of textual variants) and the determination of the statistical processes to be used.³ The research done in this dissertation just uncovered the tip of the iceberg.

The author is satisfied, however, that a possible solution was suggested to the old chicken-and-egg problem regarding the original texts and translation technique. In addition, it was proven possible to identify translation units and the translation techniques followed in these units. It will not be disputed that the approach followed in this study can be developed much further. Researchers will have to take note, however, of the fact that advanced statistical analysis may offer a solution to the problem formulated in chapters 1 and 2.

2. The Different Criteria

It is not by accident that the concepts of criteria, translation techniques and translation units featured in this study. As was demonstrated in chapter 2, finding the identity of a translator of a section of the LXX is not going to be easy. Only some of the different phenomena embodied in the translation can serve to identify the translator. The identity of those phenomena and the ways in which to locate them

³ A number of very interesting works have been published in this regard. Future researchers may well have to work with methods using Kleene Algebra, Markov Chains, etc. (See, for example, the works of Gani and Saunders, 1976; and Koppelaar, 1984.)

are only now in the process of being defined.⁴ The phenomena at present used to identify authors rely on the original texts being available as data.

At present, the original texts have not yet been determined to any major extent. However, translation technique can probably be established using representative samples of the present texts. After the translation technique has been identified, researchers can then mount a search for the original texts involved in the translation process. The *Vorlage*, the Old Greek and the translation technique will all have to be utilized in order to find the translator.

Therefore, determining the Old Greek and the *Vorlage* is of primary importance. Establishing the *Vorlage* by retroverting the text of the LXX depends more on the translation technique of the translator than on his identity, even taking into account the great benefits to be gained from understanding the doctrine of the translator (Cook, J. 1993b). It is therefore argued that the search for the translator, his doctrine and his social environment should only be attempted **after** the original texts, or large parts thereof, have been determined. In this context, translation units and translation technique should be the current objects of research.

2.1 The Tov Criteria

The different Tov criteria were designed to span the boundaries of grammatical, semantic and lexical criteria, and to measure the literalness of the translation technique.⁵ These criteria performed well regarding the fact that they rendered results, and that there is some agreement in the results obtained. In some respects, better results were obtained using these criteria than were obtained using the grammatical criteria.

However, the CATSS data base had to be pushed to its limits in order to accommodate these criteria. In fact, some of the criteria could only be partially accommodated by the data base, and some not at all. In addition, the criteria measuring the non-literal translations could not be used at all. It should be considered compiling a data base specifically designed to accommodate the Tov criteria, as this more holistic approach to translation technique may be of great value in the future.

2.2 The CATSS Criteria

The reader should keep in mind that some of the CATSS criteria have been incorporated in the Tov criteria.⁶ It was not always possible to implement the remaining criteria successfully. All in all, the

⁴ See section 1.1.1.6 of chapter 2.

⁵ See chapter 3.

⁶ See chapter 4.

CATSS criteria did not live up to the expectations of the author. Some more work may be needed to define criteria that would suit the contents of the CATSS data base even better.

2.3 The Grammatical Criteria

The results of the grammatical criteria were studied with some interest, as these criteria are based on a totally different approach. The relationship between the two texts was measured using the tools the translator had to use, viz. the grammar of the Hebrew and Greek languages. While the results are definitely interesting, especially regarding the difference in the results obtained from the number of the verb and person of the verb, they are certainly not satisfactory. It seems as if some more work is needed in the definition of the different grammatical criteria.

2.4 Future Considerations

If one accepts that different criteria can render different results, the choice of criterion/criteria can determine the outcome of a study. This author is of the opinion that a lot of work still has to be done regarding the formulation of criteria.

An ideal criterion/set of criteria would describe the translation technique of a section of the Bible in such a way that the translation process is accurately and comprehensively described. It was suggested in chapter 2, section 2.2.1.2.2, that the mapping used in the original translation process may be of enormous value to research. In order to determine this mapping, scholars will have to experiment using different types of criteria, both in isolation as well as in combination with each other. This author would like to suggest that the criterion/combination of criteria that indicates the highest level of literalism, would probably reflect the translation technique used in the translation process most accurately.

Finally, as was said many times in the body of the dissertation, it must be possible to apply the results of the research in practice. Determining translation technique can only be of value if it serves to help with the text-critical and religious-philosophical problems experienced with the LXX. The results must be of such a nature that it can be used by scholars in both fields mentioned in chapter 1, viz. studying the *Vorlage* of the LXX and studying the minds of the translators and revisors as to doctrine, philosophy etc.

A second point that should receive future attention is the reason as to why the different criteria all rendered different results. Some suggestions have been made in the body of the dissertation. The question remains mainly unanswered, however.

3. Summation

Johann Cook asked the author during the final stages of writing this dissertation whether determining translation technique can indeed supply answers to the questions at hand. The answer is an unequivocal yes. The author is of the opinion that, if translation technique and translation units are to be described, the statistical approach will render the most reliable results regarding translation technique.

A question mark may, however, be placed behind the use of translation technique as a method with which textual variants are evaluated, *Vorlage* is determined and the mind of the translator is researched. The (admittedly subjective) impression of this researcher, is that the results regarding the translation technique of different criteria can be of enormous benefit to a scholar attempting to evaluate a text-critical variant. These results must, however, always be a subdivision of the information used to address the problem. The results of the translation technique reflected by different criteria are not to be used in isolation. Neither is it the aim of this dissertation to describe a way in which text-critical variants are to be assessed.

Eventually, the translation technique of different criteria should be used as intended. A competent scholar will have to consider all the information available, including the results rendered by the criteria measuring translation technique, and use all the input as *Bausteine* (Tov, 1987b: 348) in an effort to get to the bottom of the problem.

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Appendix 1: Transliteration

Tables for the Hebrew¹

aleph)	prefixed	/
beth	B	and attached	
gimmel	G	elements	
daleth	D		
he	H	patah	—
waw	W	qametz	=
zayin	Z	hireq	.
heth	X	tsere	&
tet	+	segol	;
yod	Y	qubuts	^
kaph	K	shewa	:
lamed	L	holem	%
mem	M		
nun	N	dagesh	*
samek	S	maqeph	-
ayin	(
pe	P		
tsade	C		
qof	Q		
resh	R		
sin	&		
shin	\$		
taw	T		

¹ The transliteration table for the consonants is from Tov, 1986: 6.

The table for the vowels is from the documentation supplied to the CATSS team by the Maredsous project. The Maredsous project uses other codes for the consonants. These codes have been converted to those of the CATSS data base for the purposes of this dissertation. As can be seen, one of the sigla, &, is used in both tables, and may cause problems if the researcher is not aware of this fact.

Appendix 2: Transliteration Tables for the Greek²

alpha	A	acutus	/
beta	B	gravis	\
gamma	G	circumflex	=
delta	D	smooth breathing)
epsilon	E	rough breathing	(
zeta	Z	diaeresis	+
eta	H	iota subscript	| or "
theta	Q		
iota	I		
kappa	K		
lamda	L		
mu	M		
nu	N		
ksi	C		
omicron	O		
pi	P		
rho	R		
sigma	S		
tau	T		
upsilon	U		
phi	F		
chi	X		
psi	Y		
omega	W		

² The transliteration table for the consonants is from Tov, 1986: 6-7.

Appendix 3: List of Text References and Corresponding Lines of the Parallel Alignment

Each line of the CATSS data base in text format contains one formal equivalent of the Hebrew-Greek alignment. Each of those lines was allocated one record in the data base file, and was numbered in the order they were encountered in the text file. These record numbers were used by Statgraphics when the distribution of the various criteria across the book was plotted. The table below gives the text reference and the record number the specific verse begins at. Using this table in conjunction with the different graphs, the reader can identify specific verses at which specific phenomena occur.

<u>REFERENCE</u> | <u>RECORD</u>			
	De. 01:17 | 216	De. 01:34 | 464	De. 02:05 | 683
De. 01:01 | 1	De. 01:18 | 239	De. 01:35 | 471	De. 02:06 | 705
De. 01:02 | 21	De. 01:19 | 247	De. 01:36 | 487	De. 02:07 | 718
De. 01:03 | 30	De. 01:20 | 268	De. 01:37 | 505	De. 02:08 | 741
De. 01:04 | 49	De. 01:21 | 279	De. 01:38 | 516	De. 02:09 | 756
De. 01:05 | 64	De. 01:22 | 298	De. 01:39 | 530	De. 02:10 | 780
De. 01:06 | 74	De. 01:23 | 319	De. 01:40 | 551	De. 02:11 | 789
De. 01:07 | 85	De. 01:24 | 329	De. 01:41 | 558	De. 02:12 | 798
De. 01:08 | 108	De. 01:25 | 338	De. 01:42 | 581	De. 02:13 | 818
De. 01:09 | 126	De. 01:26 | 355	De. 01:43 | 598	De. 02:14 | 828
De. 01:10 | 136	De. 01:27 | 362	De. 01:44 | 609	De. 02:15 | 852
De. 01:11 | 146	De. 01:28 | 376	De. 01:45 | 625	De. 02:16 | 862
De. 01:12 | 158	De. 01:29 | 397	De. 01:46 | 636	De. 02:17 | 871
De. 01:13 | 165	De. 01:30 | 404	De. 02:01 | 642	De. 02:18 | 875
De. 01:14 | 174	De. 01:31 | 420	De. 02:02 | 656	De. 02:19 | 881
De. 01:15 | 182	De. 01:32 | 442	De. 02:03 | 660	De. 02:20 | 905
De. 01:16 | 200	De. 01:33 | 448	De. 02:04 | 668	De. 02:21 | 918

De. 02:22 | 933	De. 03:12 | 1338	De. 04:10 | 1782	De. 04:37 | 2239
De. 02:23 | 949	De. 03:13 | 1356	De. 04:11 | 1812	De. 04:38 | 2251
De. 02:24 | 960	De. 03:14 | 1376	De. 04:12 | 1827	De. 04:39 | 2263
De. 02:25 | 980	De. 03:15 | 1397	De. 04:13 | 1841	De. 04:40 | 2280
De. 02:26 | 998	De. 03:16 | 1400	De. 04:14 | 1855	De. 04:41 | 2304
De. 02:27 | 1009	De. 03:17 | 1417	De. 04:15 | 1873	De. 04:42 | 2313
De. 02:28 | 1017	De. 03:18 | 1430	De. 04:16 | 1890	De. 04:43 | 2333
De. 02:29 | 1029	De. 03:19 | 1450	De. 04:17 | 1902	De. 04:44 | 2344
De. 02:30 | 1049	De. 03:20 | 1465	De. 04:18 | 1914	De. 04:45 | 2352
De. 02:31 | 1068	De. 03:21 | 1488	De. 04:19 | 1927	De. 04:46 | 2365
De. 02:32 | 1084	De. 03:22 | 1513	De. 04:20 | 1952	De. 04:47 | 2385
De. 02:33 | 1094	De. 03:23 | 1521	De. 04:21 | 1966	De. 04:48 | 2400
De. 02:34 | 1103	De. 03:24 | 1526	De. 04:22 | 1987	De. 04:49 | 2411
De. 02:35 | 1117	De. 03:25 | 1548	De. 04:23 | 2002	De. 05:01 | 2423
De. 02:36 | 1125	De. 03:26 | 1561	De. 04:24 | 2021	De. 05:02 | 2443
De. 02:37 | 1148	De. 03:27 | 1581	De. 04:25 | 2029	De. 05:03 | 2449
De. 03:01 | 1165	De. 03:28 | 1598	De. 04:26 | 2049	De. 05:04 | 2464
De. 03:02 | 1181	De. 03:29 | 1614	De. 04:27 | 2073	De. 05:05 | 2472
De. 03:03 | 1205	De. 04:01 | 1618	De. 04:28 | 2088	De. 05:06 | 2491
De. 03:04 | 1222	De. 04:02 | 1641	De. 04:29 | 2106	De. 05:07 | 2500
De. 03:05 | 1242	De. 04:03 | 1661	De. 04:30 | 2117	De. 05:08 | 2506
De. 03:06 | 1255	De. 04:04 | 1680	De. 04:31 | 2131	De. 05:09 | 2523
De. 03:07 | 1268	De. 04:05 | 1687	De. 04:32 | 2147	De. 05:10 | 2544
De. 03:08 | 1274	De. 04:06 | 1705	De. 04:33 | 2175	De. 05:11 | 2550
De. 03:09 | 1291	De. 04:07 | 1727	De. 04:34 | 2187	De. 05:12 | 2565
De. 03:10 | 1299	De. 04:08 | 1743	De. 04:35 | 2214	De. 05:13 | 2573
De. 03:11 | 1313	De. 04:09 | 1759	De. 04:36 | 2225	De. 05:14 | 2579

De. 05:15 2606	De. 06:09 2999	De. 07:11 3378	De. 08:12 3796
De. 05:16 2628	De. 06:10 3004	De. 07:12 3388	De. 08:13 3804
De. 05:17 2646	De. 06:11 3025	De. 07:13 3406	De. 08:14 3817
De. 05:18 2648	De. 06:12 3044	De. 07:14 3429	De. 08:15 3827
De. 05:19 2650	De. 06:13 3056	De. 07:15 3439	De. 08:16 3847
De. 05:20 2652	De. 06:14 3065	De. 07:16 3458	De. 08:17 3860
De. 05:21 2657	De. 06:15 3074	De. 07:17 3478	De. 08:18 3870
De. 05:22 2679	De. 06:16 3090	De. 07:18 3489	De. 08:19 3889
De. 05:23 2703	De. 06:17 3097	De. 07:19 3501	De. 08:20 3910
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¹ This bibliography only contains works that had a fundamental influence on the research done in this dissertation, and those explicitly referred to. In the course of this study more than 500 works were studied in depth, and the total bibliography collated amounts to more than 3 500 works. (This list also includes all the works consulted concerning computer programs and data bases. Often fundamental clues to the solutions were found in these works.) It is obviously impossible to list all these works in a bibliography of a dissertation.

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