BIBLE SOFTWARE ON THE WORKBENCH OF THE BIBLICAL SCHOLAR: ASSESSMENT AND PERSPECTIVE

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Abstract

This article pursues two objectives. First, it tries to explain why Bible software is still not accepted as an indispensable tool for textual analysis. Second, it suggests that modern Hebrew databases can truly impact the analytic methodology of biblical scholars and help to verify and falsify interpretative suggestions. To achieve these two objectives, I will first describe the role Bible software plays in today’s scholarship. By contrasting the aids that Bible software offers with the analytic needs of biblical scholars, it is possible to show clearly what current electronic tools need if they are to play an essential methodological role in the analytic work of the scholar. The second part of the article will then illustrate, in some detail, what the Hebrew database of the Eep Talstra Centre of Bible and Computer (ETCBC) could offer today to the Old Testament scholar and how a future implementation into Bible software could deliver an electronic tool that becomes indispensable for Old Testament scholarship.

Keywords: Bible software, exegesis, Gen 20

Introduction

Database producers of biblical Hebrew and Greek often approach their texts and digital tools in a different way than most users of Bible software. While database producers search for linguistic patterns from the smallest units (phonology: sound units) up to the highest language structures (text-grammar: grammatical backbone of texts), Bible software users predominantly use their databases as a digital extension of their analog tools (Hebrew/Greek texts, dictionaries, concordances, and grammars). Having been involved on both sides of the spectrum, I would like to demonstrate how the perspective of database producers, with their expertise in pattern recognition and data visualization,

1There are many different grammatical devices that function on the level of text organization. One of the devices is grammatical congruency of textual participants. When one clause has “Abraham” as subject (e.g., Gen 20:1a “Abraham travelled towards the Negeb”) and the subsequent clause utilizes a 3rd per. m. sg. pronoun “he” as subject (e.g., Gen 20:1b “And he lived between Kadesh and Shur”) the grammatical congruency between “Abraham” and “he” establishes a meaningful sequence of two clauses. If a 3rd per. f. pl. pronoun would have been used (instead of a 3rd per. m. sg. pronoun) and no 3rd per. f. pl. participant was introduced by one of the previous clauses, then there would be no meaningful sequence between the two clauses, and we would not be able to speak of a “text.”
could be beneficial for the research methodology and pedagogical strategies of the Bible software user.2

I will first start with a description of the status quo of Bible software usage. This will make the reader aware that the natural methodological limitations of analog tools have been transported into Bible software products and the general culture of Bible software usage (research and teaching). Second, I will look at the biblical scholar’s most characteristic methodical procedures when analyzing the biblical text. This enables us to see what type of textual data he or she is looking for. Third, I will discuss how the digital mindset of the database producer could help to transcend the analog boundaries of today’s Bible software and, more specifically, its usage in research and teaching. In my illustrations, I will focus on Old Testament scholarship and use the narrative in Gen 20 as an example.

The Present Bible Software Situation

In 1991, the first commercial version of Logos Bible Software was published, followed by BibleWorks in 1992 and Accordance in 1994.3 The United Bible Society published their first non-commercial Bible-translation software in 1997.4 Digitizing the biblical print medium had several advantages. First, it saved physical space, which allowed for the mobility of libraries. Second, it sped up the reading process by the utilization of links to biblical words with dictionary entries, which also lowered the bar for dealing with original languages. For example, with the linking of data sets, such as grammar, dictionary, and source text, the user no longer has to connect lexical information with concrete morphological realizations. Bible software users who are not able to read Hebrew and Greek are still able to look up the meanings of words in dictionaries without knowing different alphabets, spellings, or grammar (declinations, conjugations). Finally, it created the ability for users to search for words and word combinations, which basically enables a flexible electronic concordance. Classical, frequently used, and well trusted

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1I have been part of the Eep Talstra Centre of Bible and Computer (ETCBC) research group since 2006. See “Eep Talstra Center of Bible and Computer,” Vrije Universiteit Amsterdam, 2018, http://www.godgeleerdheid.vu.nl/nl/onderzoek/instituten-en-centra/eep-talstra-centre-for-bible-and-computer/index.aspx. During that time, research in Hebrew text-grammar, and verbal valence was carried out.


concordances became unnecessary since the Bible software is able to find the distribution of each single word in an instant.

**Essential Skills Do Not Require Digital Tools**

The abilities to save space, speed up reading, and search for words has improved the use of classical tools in research, such as primary Hebrew and Greek texts, grammars, and dictionaries. The “tradition of doing” has been boosted but not changed. While the process of textual analyses has sped up, the nature of the process remains unchanged. This can be illustrated with the example that follows.

With the digitized Hebrew Bible, the user now has an electronic concordance; however, the analog restriction of looking up words only has not been essentially overcome by Bible software. While it is possible to search for specific word combinations—for example, a genitive construction (e.g., “house of David”) or an attributive construction (e.g., “the great heavens”)—there is no support for investigating specific language usage in context. In concrete spoken and written language expressions, words generally do not contain meaning in themselves. It is the orchestrated combination of words (language pragmatics and valence) that generates the meaning for each word. For example, the dictionary definition of the word “bright” is not very helpful for understanding the different meanings that “bright” has in concrete linguistic expressions, such as the following: “Thomas has a bright idea,” “The sun is very bright today,” or “Look at the bright side!” In order to discover the specific meaning of the word “bright,” one would need to find out whether the word was used in colloquial language (first or second person account, direct speech tenses) or formal language (third person account, narrating tense), what type of subject was paired with “bright” in the expression, what punctuation ended the expression, etc. The two-dimensionality of

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6Stuart Douglas explains with caution, “The more of these sorts of works [he refers to concordances, lexica, grammars, and commentaries] you have via computer software, including online access, the faster your exegesis work can go because of the time saved in searching. On the other hand, speed is not always an advantage: searching through a book forces you to see things in context in a way that searching via search engines prevents you from doing” (Stuart Douglas, *Old Testament Exegesis: A Handbook for Students and Pastors*, 4th ed. [Louisville: Westminster John Knox, 2009], 3).

printed concordances did not equip the user to successfully ask these necessary questions, and unfortunately, the same problem still persists within the digital space of biblical software since the analog tools do not support the filtering of multidimensional linguistic expression.  

This shows how the digitization of biblical studies did not generally alter the exegetical methodology of the textual interpretive process. Electronic tools did not change the way things are done methodologically. They simply altered the speed in which they are done.

This becomes obvious when we compare textbooks for exegesis and biblical Hebrew published over the last twenty years. Very few of them refer to Bible software as a necessary tool that has changed our understanding of biblical languages or the processes of exegesis. Improvements in exegetical

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8David A. Michelson has stressed that only a small number of scholars—and I would like to add “Bible Software users and producers”—did “engage in critical reflection on how the information revolution has changed the parameters of their inquiry” (David A. Michelson, “Syriaca.org as a Test Case for Digitally Re-Sorting,” in Ancient Worlds in Digital Culture, ed. Claire Clivaz, Paul Dilley, and David Hamidović, Digital Biblical Studies 1 [Leiden: Brill, 2016], 62).

9Some of the few exceptions are the works of C. Hardmeier, W. Richter and Talstra. Talstra’s research group focused especially on a systematic, computer-assisted, bottom-up description of the Hebrew Old Testament text in which the formal characteristics of the text receive primacy over the functional characteristics. The database then became a tool to test interpretations of grammarians and exegetes. See Eep Talstra, II Kön. 3: Erüden zur Textgrammatik (Amsterdam: VU University Press, 1983).

10Most recent textbooks on exegesis list Bible software under the categories of “concordance” or “electronic concordance” without explaining their methodological role in the exegetical process. Uwe Becker introduces his reference to the Bible software products Accordance, BibleWorks, Logos, and the German Bible Society (Stuttgart Electronic Study Bible) by saying, “On the other side—and here their real value can be found—they contain powerful search function and replace, therefore, printed concordances. In this way, the original source texts can be searched for word relations, while these searches can be further specified with grammatical tags [markers] like person, conjugation, or stem. The reduced workload can be significant when compared to printed concordances.” See Uwe Becker, Exegese des Alten Testaments: Ein Methoden- und Arbeitsbuch, 2nd ed., UTB 2664 (Tübingen: Mohr Siebeck, 2008), 176. Becker’s description illustrates what I have mentioned in the opening section of this article. Helmut Utzschneider and Stefan Ark Nitsche list Accordance, BibleWorks, and the Stuttgart Electronic Study Bible under the category “Konkordanzen” together with Even-Shohsan, Mandelkern, Lisowsky, see Helmut Utzschneider and Stefan Ark Nitsche, Arbeitsbuch literaturwissenschaftliche Bibelauslegung: Eine Methodenlehre zur Exegese des Alten Testaments, 3rd ed. (Göttingen: Gütersloher Verlagshaus, 2001), 31. They do not provide any explanation about how to utilize the e-tools in a powerful way. J. C. Gretz treats the Bible software in the same way, see J. C. Gretz, ed., Grundinformation Altes Testament: Eine Einführung in Literatur, Religion und Geschichte des Alten Testaments, 4th ed., UTB 2745 (Göttingend: Vandenhoek & Ruprecht, 2010), 534. This approach can also be found in textbooks for the English-speaking world. Douglas Stuart and Gordon D. Fee treat Bible software as a digital library that can contain lexica, dictionaries, scholarly texts, commentaries, and grammars. As
methodology and language understanding over the last twenty years have generally not been caused by the digital revolution but by the great accumulation of primary and secondary sources in printed form and by the hermeneutic reflections influenced by postmodern language philosophy and linguistics.  

Therefore, the conclusion can be drawn that, while Bible software made our traditional practice of dealing with ancient Biblical texts easier, we do not necessarily have to incorporate it into the workflow of the biblical scholar. Consequently, Bible software only has a superficial impact on the outcomes of biblical research. This is the reason why Bible software is usually not used in the classroom for learning grammar or exegesis. When Bible software is used in the modern classroom, it is mostly for displaying Hebrew or Greek source texts, similar to the use of overhead projectors in the twentieth-century classroom. This is another example of how the analog experience is very much present in the digitized world of the biblical scholar. 

When commercial Bible software was initially developed, it was designed to digitally mirror the analog tools of theologians. With this imitation, the limitation of the “original” was transported as well: access to the graphical information of the sequence of words found in primary texts, analytic dictionaries, grammars, and dictionaries. Since the different texts were linked digitally, information was made available in very helpful ways. For example, primary texts were connected with the morphology of analytic dictionaries, which, in turn, were matched with dictionary entries. However, the nature of that information was static, making it impossible to efficiently and critically engage with the digital data. For example, some Hebrew dictionaries show two entries for the verb גלה. I-גלה has the meaning “reveal” and II-גלה has the meaning “deport.” Other Hebrew dictionaries do not regard גלה as having two


homographs, but rather treat the meanings “reveal” and “deport” as belonging to the very same verbal root. As a user of Bible software, one would like to investigate the biblical text in order to find out which meanings a Hebrew verb might have under different conditions. The user’s query will have to do more than just look up all occurrences of the word. Contextual questions need to be asked, such as, “Who is using the word?” “Who is revealed and what is revealed?” “Who is deported and who is deporting?” Unfortunately, these questions transcend the word boundary that came with the digitization of analog tools. Therefore, a critical investigation of dictionaries is as labor intensive as it was without Bible software.

In earlier versions of Bible software, the user had access to lexical and grammatical interpretation but not to primary data that could facilitate digitally supported independent studies that transcended linguistic word boundaries, taking into account more complex features, such as phrases, clauses, sentences, and text-grammar.

As a consequence, one can see that, with the growing sales of Bible software, many users developed biblical interpretation skills that were increasingly based upon lexical insights and not upon insights of contextual language use (see my earlier “bright” example). Educators had to warn users of Bible software that the “just-one-click-away-word-meaning” would not necessarily help them to understand a particular Bible passage.

These early electronic tools were not able to highlight the pragmatic nature of language beyond simple morphology. The rather subjective art of searching for keywords and rhetorical patterns was not balanced out with the search for language-pragmatic patterns and text-grammatical elements, generating reproducible, inter-subjective information. These language pragmatic patterns and text-grammatical elements are the grammatical features that help “build” a text (e.g., relative pronouns, such as “which,” that introduce relative clauses).

In summary, we can say that what Bible software has improved (and changed) are the techniques for publishing texts, the techniques of storing, and the techniques of distributing texts. Both text producers (scribes) and text administrators (librarians) have greatly benefitted from modern electronic tools in their work. However, in comparison, modern electronic tools in the form of Bible software hardly supported the analytic eye of the scholar (method). The core business, namely the craft of analyzing ancient texts, was only

14A detailed description of changes that come with the digitization of media, as well as a discussion on promising improvements and critical trends in modern Bible software, can be found in Eep Talstra, “On Scrolls and Screens. Bible Reading between History and Industry,” in Critical Thinking and the Bible in the Age of New Media, ed. Charles M. Ess (Lanham, MD: University Press of America, 2004), 291–309. Logos and other Bible software products focus much more on integrating new data than realizing the tool-suggestions of scholars. It seems that the market shares are defined by the quantity of e-resources offered by the different products and not by the quality of analytic tools by which e-resources can be searched linguistically. The market thinks in library terms and not by thinking in methodological terms (scholar’s perspective). See also Michelson, “Syriaca.org,” 62, 80.
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insignificantly affected by electronic media. Referring to digital humanities in general, Van Rompay put it this way: “Admittedly, and impressive number of new texts have been published in the recent decade, but when it comes to the basic tools of language and literature, it is difficult to argue that the present-day student is much better off than her or his fellow students of eighty or one hundred years ago.”

Visualization of Inter-subjective Data of Primary Texts

While classical Bible software gave users digital access to the interpretations of different grammars, dictionaries, and commentaries, it did not substantially assist them in systematically investigating the data of primary texts on diverse linguistic levels (morphology, syntax, text-grammar). This kept them from being able to critically engage with traditional interpretations and arrive at new lexical, grammatical, and text-interpretive conclusions.

With the postmodern critique of the historical critical method of textual analysis (New Philology), it has become more and more important to analyze texts by focusing on their ability to communicate. While the subjectivity of the interpreter cannot be ignored, any interpretation needs to be grounded in reproducible observations in and about the text. It then is essential that any interpretation be based upon inter-subjective data, such as empiric data that is of binding character for any textual interpreter independent of his applied hermeneutic meta-theory. Christof Hardmeier and Regine Hunziker-Rodewald put it this way:

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16 A good example is the verb שָׁבַּד, “sanctify,” in its Hebrew passive form (Exod 29:43; Lev 10:3; 22:32; Num 20:13; Isa 5:16; Ezek 20:41; 28:22, 25; 36:23; 38:16; 39:27). While most Bible translations translate the passive with “to be sanctified” (e.g., “the [sanctuary] will be sanctified by the LORD” [Exod 29:43]), they change their translation strategy at the moment where the LORD is subject of the passive שָׁבַּד, translating “I (the LORD) vindicate my holiness/manifest my holiness.” This inconsistent translation strategy is also reflected in common dictionaries (see “שָׁבַד” and “שָׁבַד,” HALOT 1066–1067 and “שָׁבַד,” BDB 872). Unless a distributive syntactical oriented valence research that includes semantic values (e.g., of subjects [e.g., divine vs. non-divine]) is able to justify the different translation strategies of dictionaries and Bible translations, the translation of the passive שָׁבַד should be consistent and independent of theological preconceptions. In this way Ezekiel’s predication of the LORD with the passive שָׁבַד will be recognized as outstanding (“I [i.e., the LORD] will be sanctified through you”). His “anti-traditional” usage of the passive שָׁבַד, then, requires exegetical explanations.


The purpose of a text-empirical exegesis is to be found in a methodically controlled observation and description of the textual track. And therefore, the linguistic signals that direct the communication-pragmatic construction of meaning and the specific operations that guide direct speech as well as narrative texts, have to receive all the attention. The methodical approach is primarily focused on the textual surface, wherein the subtly described specific language-shape operates as a starting point for the re-enactment of the textual meaning construction. 

If Bible software is to do more than just speed up what the classical exegete does anyway, it should contribute to further improvement of how exegetical methodology is done. Here, the linguistic pattern recognition focus of database producers will help to transcend the analog restrictions of the classical workflow. Before such an “update” is possible, however, we need to understand the types of questions and observations the scholar is confronted with. This will help to find out what type of patterns the scholar is looking for and in what way modern databases can assist the scholar with pattern recognition tools. I will therefore try to systematize the type of observations the scholar must make when dealing with the biblical text.

One could group the empirical data the scholar is looking for into the following six categories:

First, texts contain participants which are organized by the three-level person-related information-axis: 1st per. (sg. + pl.), 2nd per. (sg. + pl., f. + m.), and 3rd per. (sg. + pl., f. + m.).

Second, texts contain clauses organized by phrases that establish the grammatical relations of syntax (subject, object, predicate, etc.).

Third, texts are built by a sequence of clauses which are organized into a text-grammatical hierarchy on three different axes: (a) grammatical clause connections, such as subordination (e.g., [i] He went into the house, [ii-subord] because it was cold) or coordination (e.g., [i] He went into the house, [ii-coord] and he prepared supper); (b) textual domains, such as narrative texts or discursive text (e.g., direct speech); and (c) textual relief, such as foreground-background elements (e.g., [i-foreg] He went into the house, [ii-backg] after he had parked the car).

Fourth, texts possess discursive dynamics, such as interrogative clauses (How . . . ?), optative clauses (Could you . . . ), and instructive clauses (Go . . . !), which reveal the type of relations the textual participants are having. Also, the distribution of textual participants over the different grammatical roles (subject, object, complement [e.g., indirect objects], adjunct) reveals much about their narrative functions.

Fifth, there are also space- and time-markers in texts. Texts relate to narrated space and time as markers of textual organization. Watching the spatial and temporal markers is therefore important.

Sixth, *lemma distribution* is another significant aspect of texts. Texts are made up of words, and words receive their specific meanings in specific contexts of language use. The scholar is therefore searching for keywords, phraseological peculiarities, and the distribution of verbal lemmas with their particular valences.

All of the categories mentioned above are of an empirical nature and therefore function as inter-subjective references for any interpretative suggestion. Of course, much more information is needed in order to arrive at concrete interpretations of texts. That additional information is not located in the texts themselves, but comes from comparative primary data or theories about the writers’ historical context or their state of knowledge. However, text-external information must correspond to the inter-subjective, text-internal data.

Genesis 20, the story of the patriarch Abraham, his wife Sarah, and king Abimelech, will be used as a case study. This chapter tells us that Abimelech is a gentleman who never would have intended to marry Sarah if he had known that Sarah was already married to Abraham. However, Abraham's fear and bias about the possible immorality of a king who might threaten him with death bring about a complex situation in which all parties suffer tremendous physical and emotional pain. As a textual example, Gen 20 will help to clarify the types of empirical observations the scholar could make and to investigate the extent to which Bible software could improve the process of information gathering, contributing to the interpretative tasks of the scholar.

**Participant Data**

Regarding the textual participants and syntactical organization of Gen 20, the most frequent actors (i.e., syntactical subjects [explicit nominalization] of predicates) in the narrative sections are Abimelech (six times), Abraham (four times), and God/Elohim (four times). Sarah is the fourth dominant participant in the narration. However, she remains passive, as she appears only in the syntactical role of object (two times) and complement (two times). With a database that contains syntactical information (e.g., ETCBC database), this participant-relevant information could be visualized. Several

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20Gen 20:2, 4, 8–10, 15. Abimelech also appears once in the object position (v. 17) and once in the complement position (v. 3). In both cases, Elohim fulfills the subject role.
21Gen 20:1–2, 11, 17. Abraham also appears three times in the complement position; Abimelech calls Abraham (v. 9), Abimelech speaks to Abraham (v. 10), and Abimelech gives gifts to Abraham (v. 14).
22Gen 20:2, 6, 13, 17. Elohim appears once in the complement position, where Abraham prays to God (v. 17).
23Gen 20:2, 14. In both cases, Abimelech is the subject.
24Gen 20:2, 16. In both cases, Sarah is marked as an addressee within a direct speech introduction.
25The ETCBC database has formerly been known as the Werkgroep Informatica Vrije Universiteit (WIVU) database. With the retirement of Eep Talstra, the WIVU
Bible software products do provide an option for visual filters; however, they are reduced to morphology (word-level information) and not syntactical units in combination with lemmas (e.g., Abraham as a subject). The functionality of the latter should not be a problem for Bible software that uses syntactically encoded databases. The third version of the Stuttgart Electronic Study Bible (using the ETCBC database), Logos 7 Bible Software (using the Andersen-Forbes database), Accordance 12 Bible Software (using the Holmstedt-Abegg or newly implemented ETCBC database), and Paratext 8 Source Language Tool (using the ETCBC database) allow users to mark syntactical units in combination with specific lemmas. However, such marking is only achievable via the formulation of a specific query. The appendix contains screenshots of the four discussed Bible software products. Each of them shows how the highlighting of Abraham in subject position is accomplished. 

In order to avoid a series of single queries, I envision a toolbox that allows the user to mark all explicit subjects by color coding identical lemmas (e.g., Abraham [red]; Abimelech [blue]). Since references to subjects are not only established by nominalizations, the toolbox should also allow for colored marking of other forms of participant-references. With modern databases, participant-tracking features could be offered that would suggest the participant referenced by pronominalization (e.g., “he” in reference to Abraham) and finite verbs. Herewith, participants could be identified visually when they are addressed by other grammatical means apart from nominalization (i.e., personal pronouns, demonstrative pronouns, etc.). Table 1 shows the text-grammatical hierarchy of Gen 20:1–5 produced by the program “syn04types.” This program is part of the ETCBC infrastructure and calculates

has been renamed as the Eep Talstra Centre of Bible and Computer (ETCBC). The ETCBC will continue to investigate the linguistic value of the Hebrew Bible and how it cross-references textual interpretation. The database has been implemented on different commercial and non-commercial platforms. Accordance Bible Software has offered the ETCBC database since 2016 as one of their resources. Logos Bible Software was the earliest adopter of the database, but has not updated it for almost ten years, thus making it of little use. The latest noncommercial implementation (and perhaps, for the average user, the most intuitive) can be found in the Source Language Tool of Paratext 8. Since 2014, the ETCBC database is readily available to the public at https://shebanq.ancient-data.org/. While SHEBANQ covers the need of researchers, the ETCBC has been successfully utilized on the Bible Online Learner, covering the needs of language instructors and learners. See “What Is Bible Online Learner?”, Bible Online Learner, n.d., https://bibleol.3bmoodle.dk/.

26Within the present funded (Netherlands Organization for Scientific Research) “Data and Tradition” research project (see “Data and Tradition. The Hebrew Bible as a linguistic corpus and as a literary composition,” Netherlands Organization for Scientific Research, 2018, https://www.nwo.nl/en/research-and-results/research-projects/i/54/5954.html), the ETCBC research group is developing a computer-assisted, participant-tracking tool. This will enrich the database with an additional layer that contains information about the grammatically possible references to textual participants by means of pronominalization and verbal forms.
each clause’s dependent mother clause.\textsuperscript{27} The following English example illustrates the procedure:

Table 1. English Text-grammatical Hierarchy Example

<table>
<thead>
<tr>
<th>Sequence of Clause</th>
<th>Clause Dependencies</th>
<th>Text-grammatical Hierarchy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl-1: Tom woke up.</td>
<td>Cl-1 uses an imperfect tense and can therefore be classified as belonging to a narrative text (N).</td>
<td>Cl-1 = N Tom woke up.</td>
</tr>
<tr>
<td>Cl-2: And he went to the shower.</td>
<td>Cl-2 is dependent on Cl-1 as the identity of “he” depends on the participant “Tom” in Cl-1.</td>
<td>Cl-1=N And he went to the shower.</td>
</tr>
<tr>
<td>Cl-3: And he dressed up.</td>
<td>Cl-3 is parallel to Cl-2 as it uses the same clause type and is in the same way dependent on Cl-1.</td>
<td>Cl-1=N And he dressed up.</td>
</tr>
<tr>
<td>Cl-4: To go to school.</td>
<td>Cl-4 is dependent on Cl-3 as it is an infinitive clause that gives the purpose to the action described in Cl-3.</td>
<td>Cl-1=N To go to school.</td>
</tr>
<tr>
<td>Cl-5: And he had breakfast.</td>
<td>Cl-5 is dependent parallel to Cl-3 as it uses the same clause type and is in the same way dependent on Cl-1.</td>
<td>Cl-1=N And he had breakfast.</td>
</tr>
</tbody>
</table>

The text-grammatical hierarchy in figure 1 (below) shows the verse number in the first column (from right to left), the text-type (N=narrative, Q=quotation) in the second column, and the succession of clauses (CA1, CA2, etc.)\textsuperscript{28} in the third column.

A possible visualization of the participants, Abimelech (dark grey) and Abraham (light grey), is presented in figure 1. The most important codes that will be used in the next paragraphs are the following: <Su> for subject, <Ob> for object, <Pr> for predicate, <Co> for complement, <PC> for predicate complement, <Is> for interjection, and <Aj> for adjunct.

\textsuperscript{27}For a description of the program and information about the integration of syn04types within the ETCBC program environment, see Cody Kingham, “ETCBC Data Creation,” ETCBC, 3 April 2018, http://www.etcbc.nl/datacreation/.

\textsuperscript{28}To be exact, each line does not show a clause, but a clause atom. In most cases, a clause atom is identical to a clause. However, the concept of clause atoms (CA) is necessary in order to properly describe the phenomenon of interrupted clauses (e.g., [CA1: Steve] [CA2: who lives in Germany] [CA3: was born in the USA]). The complex sentence in the example consists of two clauses. The first clause consists of CA1 and CA3. The second clause consists of CA2. The first clause is interrupted by the second clause, splitting the first clause into CA1 and CA3.
Besides tracking participants in a way that takes nominalization (e.g., "Abraham"), pronominalization (e.g., "he"), and suffixation into account, it is important for the discourse analysis to visualize the distribution of participants between the 1st per., 2nd per., and 3rd per. related markers. After the participant tracking feature is built into a database, it should not be a problem to visualize participants according to their distribution over person-related markers. In the case of Gen 20, it will help to see the contrast of Abraham’s 1st per. (dark grey) and Abimelech’s 1st per. distribution (light grey) in the textual hierarchy of the ETCBC database (see fig. 2). While Abimelech has five speeches with eight self-references, Abraham’s two speeches contain a total of twelve self-references. This inter-subjective data can be used to make a strong argument for an interpretation that contends that Abraham’s attitude and argumentation is self-centered.
Figure 2. Textual Hierarchy of Genesis 20:1–18 by the ETCBC Database.
Text-grammatical Hierarchy

Once a text-grammatical hierarchy is available, the next step would be to analyze how our specific text relates to general patterns of language pragmatics. Thus, the questions that become important concern the way in which Hebrew narrative texts are normally constructed and the comparison of that to our selected passage. As a result, a pattern-sensitive Bible software should be able to inform the user that the discourse progression in verses 9–11 is unusual (see fig. 3).

Figure 3. Discourse Progression in Genesis 20:9–11.

A direct speech introduction for Abimelech is in CA43 (וֹלָם, "and he said to him"), followed by his direct speech (CA44–49). Following the pragmatic norms of constructing biblical Hebrew discourse, the next "and he said," would introduce Abraham's answer to Abimelech's speech. However, this is not the case. Surprisingly, CA50 introduces anew a direct speech of Abimelech. It is only in verse 11 that Abraham responds to Abimelech. This unusual construction has been recognized by different scholars. Robert Alter infers from this phenomenon that, after verse 9, Abraham keeps silent, therefore, Abimelech continues to question Abraham, using the words מָה, “what” (v. 9), and מֶה, “what” (v. 10). These kinds of constructions that deviate from the general rule of language pragmatics should be recognized by computer-

29The repetition of the formula for introducing direct speech, with no intervening response from Abraham, is pointedly expressive. Abimelech vehemently castigates Abraham (with good reason), and Abraham stands silent, not knowing what to say. And so Abimelech repeats his upbraiding, in shorter form (v10). See Robert Alter, Genesis: Translation and Commentary (New York: Norton, 1996), 94.
assisted programs of analysis. If a database that contains information about the standard rules of language pragmatics were incorporated into a Bible software, it could allow the user to see those cases with visualization features. This could be done by syntactical queries that search for rare patterns. An example of such a query is constructed with the ETCBC database on the SHEBANQ web service. Part of the query for Gen 20:9–11 is shown below:  

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\text{select all objects where} \\
\text{[clause domain = "N"} \\
\text{[phrase function = Pred} \\
\text{[word [word lex = "DBR"]} \\
\text{OR [word lex = ">MR"]} \\
\text{OR [word lex = "QR"]]} \\
\text{]} \\
\text{]} \\
\text{[phrase FOCUS function = Subj} \\
\text{[word AS samesubject]} \\
\text{]} \\
\text{]} \\
\text{[phrase FOCUS function = Cmpl} \\
\text{[word AS samecomplement]} \\
\text{]} \\
\text{[clause domain = "N"]* {0-1} [clause domain = "Q"]* {1-50} [clause domain = "N"] [phrase function = Pred} \\
\text{[word [word lex = "DBR"]} \\
\text{OR [word lex = ">MR"]} \\
\text{OR [word lex = "QR"]]} \\
\text{]} \\
\text{]} \\
\text{[phrase FOCUS function = Subj} \\
\text{[word lex = samesubject.lex]} \\
\text{]} \\
\text{]} \\
\text{[phrase FOCUS function = Cmpl} \\
\text{[word lex = samecomplement.lex]} \\
\text{]} \\
\text{]} \\
\text{]}\]  

\[\text{30The query syntax and query results can be viewed at https://shebanq.ancient-data.org/hebrew/query?version=2017&id=491.}\]
With this type of intuitive Bible software, the scholar cannot only be assisted in his or her analysis of words and morphological patterns but also in his or her analysis of actual language usage. The computer's ability to detect patterns on higher linguistic levels would help to control the user's interpretative process and to make him or her aware of textual peculiarities that only a well-experienced scholar might notice.

**Discursive Dynamics**

When analyzing patterns of argumentation within a text, certain discursive dynamics need to be recognized. Though argumentation is sometimes subtle, mostly, it is anchored in empiric, linguistic data. Interrogative pronouns, optative particles, and other particles that draw attention (e.g., הִנֵּה, "behold") play a crucial role in the construction of the argumentative dynamics of a text. For example, figure 4 shows how, by means of interrogation, a specific pattern is created between Abimelech and Abraham. CA44–46 reveals a pattern of movement in the argumentation from מָה, "what," to כִּי, "that," as does CA51–52. Detecting this pattern helps the reader to become aware of the tense emotional atmosphere in the text.

**Figure 4.** Significant Particles in Genesis 20:9–10.

Additionally, the הִנֵּה, "behold," interjections trigger attention. They serve a similar function as they give a specific spin to the dynamics of Abimelech's speech to Sarah (see fig. 5). By means of הִנֵּה, the speaker of this passage tries to directly influence the participant who is being addressed.

**Figure 5.** Significant Interjections in Genesis 20:16.
Keeping in mind the pattern recognition tools of database producers, modern Bible software could profit not only from making lexical marking available to the user but also from visualization patterns found on the diverse linguistic levels. In addition, features that allow the user to visualize those textual markers that are responsible for the dialogical atmosphere (e.g., הִנֵּה, "behold!"; והָה, "surely!"; אֲהָה, "alas!"; interrogations; etc.) and argumentative strategy (e.g., אָם, "if"; כִּי, "because"; לָכָן, "therefore") could greatly support the scholar’s work. While the data and tools would be available generally, the user should be allowed to manipulate and create his or her own list of markers, allowing for independence from a fixed set of markers, along with any potential theoretical assumptions that are attached to them. Database architecture that distinguishes between the description of form and the interpretation of function are foundational for future research. In this way, the theoretical assumptions that are heavily present in the interpretation of linguistic functions would not have to be adopted by the researcher who might prefer a different linguistic model. However, the availability of a formal data description would allow the researcher to test theories (i.e., data interpretations) based upon it. The ETCBC database has been developed with just such a distinction in mind and therefore has been able to serve as a research tool for numerous scholars who represent different linguistic approaches.31

Space and Time Markers

Space and time markers are also important because of their use in identifying the demarcation of textual units. Both of these kinds of markers serve to inform the reader when a new space and time contribute to the installation of a new scene in the narration. In verse 1, the clause וַיִּסַּע אֵֻבְרָם, "from there Abraham journeyed," makes it clear that a new chapter in the grand narration of Genesis is opened (see fig. 6).

![Figure 6](image)

Figure 6. Genesis 20:1 Introducing a New Chapter of the Grand Narration in Genesis.

A collection of typical space (e.g., שם, "there"; בּוֹה, "here"; city names; and locatives) and time (e.g., בָּקָר, "morning"; עֶרֶב, "evening"; עַת, "now"; and עֶד,...
“until”) markers should be made available, allowing the scholar to automatically visualize these elements. In this way, the user is invited to look beyond the dictionary meaning of specific words and see them functioning on the level of discourse. Again, these lists of markers should be able to be manipulated by the user. An important role should be played by Reinier de Blois’s (UBS) Semantic Dictionary of Biblical Hebrew (SDBH). Plans have been made to integrate the SDBH into the ETCBC database. A first realization of this can be seen in the Source Language Tool of Paratext 8. Such an integration would also help the user both to understand better and explore further the interrelation between semantics and grammar in the context of valence.

**Lemma Distribution and Valence**

While standard Bible software programs offer the user lexical information for Hebrew and Greek texts, the information is usually semantic and etymological. However, in order to come to grips with a text and its peculiarities, it is important to go beyond the lemma level and reach the phrase level, which reveals how concrete lemmas are actually used in a syntactic surrounding. Therefore, the scholar’s interest is in finding out whether a specific formulation of a particular lemma within a particular syntactic surrounding is typical or exceptional. For the scholar to benefit from such insights, he or she would need to have access to a database that contains valence information (e.g., ETCBC database). Figure 7 showcases the interpretative importance of valence information in Gen 20:2.

![Figure 7](image)

**Figure 7. Importance of Valence in Genesis 20:2.**

Usually, the reader would rush over verse 2 without using the dictionary, since כָּלָכָל, “take,” belongs to the basic five hundred Hebrew words that are learned in introductory Hebrew classes. Therefore, chances are high that he or she would overlook the fact that there is something significant to be observed in the construction כָּלָכָל + <Ob>, with the object being a female proper name. The most dominant valence pattern consists of the construction כָּלָכָל + <Ob> and should be translated as “to take X.” However, an inventory of the different valence patterns clarifies that when the <Ob> contains a proper female name, the construction is expanded by the complement הָשָּׁלְמָה לְאִ, “as woman/wife.”


33See a discussion of the issue in Dyk, Glanz, and Oosting, “Analysing Valence Patterns,” and Glanz, Oosting, and Dyk, “Valence Patterns.”
rendering the meaning “to take X as wife = to marry X”. The construction נל + <Ob> (with female proper name) + הנשא-ַת <Co>, then, is the usual formulation used for describing the act of marrying. In the case of Gen 20:2, we do not find the construction we would expect, as the <Ob> contains a female proper name “Sarah.” Due to this observation, one would need to discuss whether the text wants to indicate that Abimelech took Sarah by treating her as if she was an object without rights. At this point, the imagination of the reader has no limits. Did Abimelech rape her? Did he make a maidservant out of her? Or did he “take” her in order to marry her? But if that was the case, why is the construction not rendered in a more straightforward way? The fact is that the text leaves it open to the reader to imagine what Abimelech intended to do with Sarah. At the end of the story, it seems clear that Abimelech married Sarah and had not touched her yet. Could it be that the text wants the reader to imitate the suspicion that Abraham had in thinking that Abimelech was not a God-fearing person? Whatever the answers are, the text contains underdetermined data that triggers exegetical questions that deserve attention.

If a modern Bible software program wants to assist the scholar in generating inter-subjective, empirical data of a given text that transcend the word

34When executed with SHEBANQ, a query that looks for clauses containing נל in predicate function (as finite verb, participle, or infinite construction) along with a single female proper name that is functioning as the object will result in fifteen cases (Gen 20:2; 24:61, 67; 25:20; 28:9; 34:26; Exod 6:20, 23; 18:2; 1 Sam 25:43; 1 Kgs 4:15; 16:31; Hos 1:3; Ruth 4:13; 2 Chr 11:18). See https://shebanq.ancient-data.org/hebrew/query?version=2017&id=493; https://shebanq.ancient-data.org/hebrew/query?version=2017&id=494. Of those fifteen cases, ten cases express the idea of marrying (Gen 24:67; 25:20; 28:9; Exod 6:20, 23; 1 Sam 25:43; 1 Kgs 4:15; 16:31; Ruth 4:13; 2 Chr 11:18). Of those ten cases, six consist of the construction נל + <Ob> (female proper name) + הנשא-ַת (functioning as indirect object). The remaining two cases (Gen 24:67; Ruth 4:13) have the construction נל + <Ob> (female proper name). The הנשא-ַת complement is missing. However, directly after the נל clause, a clause follows that contains the construction יד + Supp (functioning as complement) + הנשא-ַת (functioning as indirect object). Thus, all ten cases present or represent the valence pattern נל + <Ob> (female proper name) + הנשא-ַת <Co> (to take X as wife = to marry X). Finally, five cases remain which do not contain הנשא-ַת or any other הנשא construction (Gen 20:2; 24:61; 34:26; Exod 18:2; Hos 1:3). Of those cases three (Gen 24:61; 34:26; Exod 18:2) clearly do not bear the meaning of marriage. The servant of Abraham brings Rebekah to Isaac (Gen 24:61). Dinah is rescued from her brothers, that is they took her from Sichem (Gen 24:61). Jethro brings Zipporah to Moses (Exod 18:2). The two remaining cases are dubious: Gen 20:2 (the case discussed in this article) and Hos 1:3. Going through the narration of Gen 20, the reader finally understands that Abimelech did marry/intended to marry Sarah. A similar reading experience happens in Hosea where the reader is first left uncertain about Hosea’s plans with Gomer, the prostitute, but finally understands that he really did marry Gomer.
boundary, a database would have to be implemented by which it is made possible for the reader to explicate relevant valence information (e.g., while hovering over a phrase with his or her cursor). In Gen 20:2, the program could inform the reader that, in most cases where נָּחַק relates to an <Ob> that contains a female proper name, a <Co> in the form of נָּחַקָּלְ-אִ is present.

Concrete Suggestions

We have seen how the eye of the exegete could receive much more support from modern Bible software if software vendors and their databases would try to give more attention to the methodological needs of biblical scholars. Much improvement has been achieved for the work of the librarian and scribe; however, it is time to enter the specific realm of the scholar who does not produce or store texts, but studies them.

Modern databases and Bible software could help to draw more attention to the inter-subjective empirical data of texts by providing excellent pattern recognition tools for the user. Creating visual colored codes for textual coherence, incoherence, and irregularity would help set boundaries for the subjective selection of data that fits one’s own hermeneutic bias. Modern Bible software would then allow the scholar to focus much more on reproducible data observation and much less on only accessing textual interpretations in commentaries, grammars, and lexica. What we need would be an improvement on two levels: (1) the database and (2) the graphical user interface. In the following paragraphs, I will try to summarize my vision for future computer-assisted tools (e.g., Bible software and web-based services) that give attention to the exegetical processes activated when synchronic text analysis is performed.

Richer Databases

Regarding database content, the scholar would be greatly assisted if, in addition to morphological and lexical information, the following information was available: 35 (1) syntactical information: a text that is fully analyzed on the level of its grammatical relations (e.g., subject, predication, etc.); 36 (2) valence information: a text that contains a full analysis of verbal valence (e.g., core, complement [i.e., object, indirect object, etc.]); (3) semantic roles/lexical sets: a text that codes lemmas in such a way that they are grouped in lexical sets (e.g., proper person names, cardinals, verbs of moving, etc.) and semantic roles (e.g., animate or inanimate); 37 and (4) text-grammatical information:

35 The categories “grammatical relation,” “valence,” and “semantic roles” are taken from C. J. Sikkel, “Valency in the WIVU Database (Version 1.7)” (research paper, Vrije Universiteit Amsterdam, 2010), 9–12.

36 The latest version of Accordance (12.2.4.0) has integrated the ETCBC database in an excellent way. Grammatical relations on the clause level are well displayed and offer the user comprehensible vitalizations. A very similar strategy is followed by the Source Language Tool of Paratext 8.

37 Again, the lists of lexical sets and semantic roles should be modifiable by the user (without changing the database).
displaying the text-grammatical hierarchy with its textual domains (narrative-discursive), its textual reliefs (foreground-background) and its formal relations (coordination-subordination).

It is, however, not just a matter of product (i.e., what kind of data needs to be added) but also and foremost a matter of production (i.e., how to add the requested data). The process of adding data related to syntax, valence, semantics, and text-grammar must follow a method that safeguards the consistency of the added analyses and thus guarantees the status of the data as inter-subjective and empirical.\textsuperscript{38} The only way to guarantee a high level of consistency of the data is by utilizing the computer as a tool that assists and controls the human interpretation by resting on pattern recognition. Deep reflection about the database architecture would be required in order to upgrade the computer from being simply a digital storage place to being an integral part of the production of data. A database model that follows a bottom-up approach is to be preferred. Such an approach deduces higher linguistic-level interpretations from the computer-assisted analysis of lower linguistic levels, which provides greater consistency of those higher linguistic-level interpretations.\textsuperscript{39} This is of great importance because the added information can only become valuable for in-depth analyses of biblical texts if a high level of consistency can be guaranteed.\textsuperscript{40}

\textit{Intelligent Graphical User Interfaces (GUI)}

Since databases are available for the scholar, intelligent graphical user interfaces (GUI) and visualization options are needed. In the case of the ETCBC database, its implementation in present Bible software (particularly Logos 7) has been unfortunate.\textsuperscript{41} A better integration would have allowed for more options of data-retrieval and visualizations (e.g., textual hierarchies). Because of market-strategic considerations of Bible software companies, not enough time was invested in developing good tools that allow the scholar to access relevant text-information that goes beyond morphology and basic syntax. This is particularly true for the latest versions of Logos Bible Software (versions 5, 6, and 7), which appear to no longer invest in tools that seek to serve the research-oriented user base (biblical scholars). Logos also made no commitments to update its linguistics databases for scholars in the next version (version 8).\textsuperscript{42}

38\textsuperscript{See Glanz and Hardmeier, “Nachwort,” 91–97.}

39\textsuperscript{See Doedens, \textit{Text Databases}, 85–105. See also Kingham, “ETCBC Data Creation.”}

40\textsuperscript{See n31.}

41However, the implementation done in Accordance 12 is promising. There are still some issues that need to be resolved (e.g., proper presentation of clause relationships), but Accordance 12 strives—in contrast to Logos 7—in toward full display and searchability of all database functions and features. The best implementation of the ETCBC database within the framework of Bible software has been done by the non-commercial Paratext 8 platform and its Source-Language-Tools.

42This has been confirmed in e-mail correspondence between Logos, the German Bible Society, and me, as an ETCBC representative.
Having used Gen 20 as a case study, the following types of questions and query-commands should be possible for general exegetical analysis within specific sections of the software’s GUI. I will organize central questions that an exegete might ask into five categories. Each category will show concrete query-commands followed by information about the status of command-realization in the most advanced Bible software products available in 2018 (Stuttgart Electronic Study Bible 3 [SESB3], Logos 7 Bible Software [LGS7], Accordance 12 Bible Software [ACRD12], and Paratext 8 Source-Language-Tool [P8SLT]). The appendix contains several screenshots which illustrate the results possible within the different software products. Finally, I will suggest a GUI that would allow for an organized handling of these standard exegetical questions.

Possible Query-commands on Syntax and Grammar

• “Show me which verbs have Abimelech as the subject.” This feature is only partially available in SESB3, LGS7, ACRD12, P8SLT for those cases where Abimelech is explicitly mentioned. Due to the lack of participant tracking analysis, a complete realization of the command is not possible.

• “Show whether Sarah appears in the subject position in Gen 20.” This feature is only possible in SESB3, LGS7, ACRD12, P8SLT for those cases where Sarah is explicitly mentioned. This is not the case in Gen 20 and therefore she cannot be found by any commercial product yet. Present participant tracking research carried out by the ETCBC research group resulted in limited automatic participant detection.

• “Show all attributive clauses which have a mother clause containing Abraham in the object, subject, or complement position.” While it is possible to find the mother clause of an attributive clause in SESB3 and P8SLT, only SHEBANQ can find the mother clause containing Abraham as a proper name and is elaborated by means of an attributive clause. LGS7 and ACRD12 are not able to find relevant constructions.

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43The following results were generated by the different Bible software products when searching for cases in which Abimelech is the only subject of a predicate phrase: SESB3 with the ETCBC database generated seventeen occurrences in Genesis (the query construction and results can be revisited at https://shebanq.ancient-data.org/hebrew/query?version=2017&id=425). See screenshot 3. LGS7 with the Andersen-Forbes database generated sixteen occurrences in Genesis (strangely, the case in Gen 26:26 is not found by the query set up). See screenshot 6. ACRD12 with the ETCBC database generated seventeen occurrences in Genesis. See screenshot 7. P8SLT with the ETCBC database generated seventeen occurrences in Genesis. See screenshot 8.

44See screenshot 9.


46While the LGS7 database does contain information about relative clauses, several query variations are not able to pull out the desired data. It seems that the query builder does not communicate well with the database. I assume that the reason this bug has not been fixed yet is simply because the majority of users are not aware of these dysfunctions since they generally use Bible software for word searches only. This has been confirmed by a Logos Bible Software lead programmer. Due to the missing ability
• “Show me where the discourse deviates from the general patterns of discourse structure.” Such marking can be made available based on a set of complex syntax searches that have to be put together. Since the necessary information for successfully writing these queries is available in the ETCBC database (clause-types, clause-relations, and text-types), it is a matter of time and financing to make them available to Bible software users. The open-access SHEBANQ service is able to perform such queries.  

Possible Query-commands on Textual Organization

• “Visualize the narrative and discursive text sections.” This feature is only available in the SESB3 and SHEBANQ.

• “Visualize foreground and background (i.e., visualize where progression of the narration and the progression of the discourse are interrupted).” This feature is not implemented in any Bible software. However, the ETCBC database does contain the necessary information for the development of such a feature.

• “Visualize the entire text-grammatical hierarchy of the relevant textual passage.” This feature is not implemented in any Bible software. However, the ETCBC database does contain the necessary information for such a feature. Accordance is presently working on such implementation. SHEBANQ (see fig. 8), as well as Bible Online Learner (see fig. 9), allow for the text-grammatical display, although not in a fully satisfactory way.

to define two clauses as belonging to one sentence, one cannot find relevant data in ACRD12. While ACRD12 does have the ETCBC database implemented, the clause relations are not yet correctly interpreted. Accordance programmers are still working on fixing this problem. In addition, the relation operators available in ACRD12 are all designed for clarifying the relation between words. This is a good example of how Bible software users are utilizing Bible software within the limits that come with analog tools (i.e., word boundaries).


These questions are asked via a separate graphical box called “textual hierarchy.”

The SESB3 allows one to search for clauses that belong to the “narrative” or “discursive” text-type. While it is possible to search for verbal tenses that indicate narrative or discursive texts in both LGS7 and ACRD12, this is not sufficient, since it does not allow one to find embedding of discursive texts in narrative texts and vice versa. See screenshot 10 which shows a search for two subsequent clauses that belong to two different text-types. In LGS7, one is able to search words (not clauses) that were tagged as discursive or narrative. However, the data does not seem to be analyzed correctly since the direct speech introduction (formulated in narrative tense “And Abraham spoke”) is treated as part of the direct speech. See screenshot 11.

Unfortunately, SHEBANQ does not allow for different color coding within the same query. Thus, every “FOCUS” element receives the same color. In order to color-differentiate between the different text domains, two queries have to be constructed: narrative domain marking (see https://shebanq.ancient-data.org/hebrew/query?version=2017&id=2667) and discursive domain marking (see https://shebanq.ancient-data.org/hebrew/query?version=2017&id=2668).
• “Visualize the presence of temporal and spatial markers.” This is currently not possible in any Bible software. However, since such a feature is based upon word lists, it would not be difficult to incorporate such a tool in today’s Bible software products.
Possible Query-commands on Lemmas and Valence

- “Show the valence patterns of הָלַך in which an object with a proper female name appears.” In SESB3, LGS7, ACRD12, and P8SLT, it is possible to search for a specific pattern, but it is not possible to display all valence patterns that come with a given verb. Such data is, however, easily retrievable with programs like val2csv used in the ETCBC research environment.

- “Show those clauses that belong to the text type ‘direct speech’ in which the 3rd per. participant is corresponding with the participant mentioned in the complement position of its direct speech introduction (utilizing a verb of speech).” This query should be asked via the syntax-search and requires participant tracking data. As a result, Gen 20:2 should show up. This query is not possible.

- “Searching for identical lemmas in different clauses.” While this is possible in SHEBANQ, LGS7 allows for searching different types of agreements (e.g., lexeme, gender, tense, etc.), but its execution is broken. Obviously, LGS7 does not regard this issue to be important enough to fix. ACRD12 is not able to define agreements between words when they are embedded in a syntactical structure. Again, residues of the analog mindset can be seen here. P8SLT is working on a new release that will allow for such searches.

Possible Query-commands on Participant Distribution

- “Visualize the distribution of person-related markers.” Not only personal pronouns (demonstrative, possessive, or personal) but also finite verbs (mark only the relevant afformative and preformative markers) should be encoded. This query is not possible.

- “List all involved participants in the form of their lexical identification (e.g., Abimelech, Abraham, and Sarah) and the number of times they are explicitly mentioned (e.g., Abimelech [six times], Abraham [four times], Elohim [four times]).” This query is not possible.

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51 These questions are asked via the syntax-search window.

52 The SESB3 query below shows how it is possible to search for an object phrase that contains a person’s name of feminine gender. The object phrase must connect with a predicate that has the word בָּשַׁב. See screenshot 4. With LGS7, it is not possible to search for proper names, but one can search for human entities that have feminine gender. The query results therefore also include objects like “woman,” “girl,” or “maidservant.” See screenshot 13. Since the implementation of the ETCBC database in ACRD12, powerful valence queries have become possible. See screenshot 14. However, some data feature relations are still not implemented correctly. For example, one cannot combine the noun class “proper name” with the gender “feminine.” Thus, the above search will find both “X takes Abraham” and “X takes Sarah.”


54 These questions are asked via a separate graphical box called “participant presence”; some of the questions can also be asked via the syntax-search.
• “Track participant X (e.g., Abimelech) and/or Y (Abraham) . . .” This feature is only available in SESB3, LG7, ACRD12, and P8SLT when the participant is known and when explicit mention (nominalization and re-nominalization) of the proper name is realized in the text. To search for pronominalizations of that proper name and references to the participant by means of finite verbal forms is not possible.

Possible Query-commands on Discourse Dynamics

• “Visualize all interrogations.” This feature is only possible in SESB3, LG7, ACRD12, and P8SLT when a dedicated query is formulated. SESB3 and LG7 offer visual filters that allow selective highlighting of a collection of morphological sets. But these filters do not allow one to put together lists of words.

• “Visualize all interjections.” This feature is only possible in SESB3, LG7, ACRD12, and P8SLT when a dedicated query is formulated. SESB3 and LG7 offer visual filters that allow selective highlighting of a collection of morphological sets. But these filters do not allow one to put together lists of words.

• “Add to the list of discursive dynamics the following words: אִם, ‘if’; לָכֵן, ‘therefore’; וַיַעַן, ‘because’; כִּי, ‘for’; and כּן, ‘thus’; and name this list ‘argumentative indications.’” SESB3 and LG7 offer visual filters that allow selective highlighting of a collection of morphological sets. But these filters do not allow one to put together lists of words.

• “Visualize the grammatical function-distribution of participants (e.g., how often is Abraham the subject? how often is he the object? and how often is he the complement?).” This query is not possible.

A Possible Graphical User Interface

Figure 10 illustrates how the GUI could look if the above listed commands and command groupings were realized on the old Libronix software platform. Every element that is highlighted in the black border is still missing in present Bible software.

55These questions are asked via a separate graphic box called “discourse dynamics.” The questions can also be asked via the syntax-search.
Figure 10. Possible GUI Realized on the Old Libronix Software Platform.

If these graphic boxes were made available in addition to the existing syntax-search window, the user would be enabled to read the text in layers and visualize the different components of a text (syntax, text-grammar, textual participants, and discourse dynamics) whenever he or she was ready to do so.
Conclusion

I have tried to sketch the limitations of today’s Bible software products by looking at them from the perspective of the analytic work of biblical scholars. I have argued that Bible software vendors need to give attention to the specific needs of researchers, if they want to serve as a modern tool on the exegetical workbench without present analog restrictions. In a modern digital world, the creative minds of Bible software producers should break through the limited methodologies of the analog world. What has been outlined in this article demands strong investment in further research, enabling fine database production. Only then can databases be delivered to the scholarly world and stimulate the data-controlled quality of interpretative outcomes. This can become a reality once more consistent, empiric, inter-subjective data is made into visual illustrations, allowing it to be utilized for verification and falsification purposes. Thus, observations (patterns or deviation from patterns) can be retrieved throughout the entire textual corpus very quickly and without much analog labor.

Apart from the content side of Bible software (databases), GUIs need to be designed by programmers who are well informed about the databases at hand and are familiar with the types of texts and questions with which the scholar is confronted. In this way, one can safeguard that the information contained in the databases becomes accessible to the scholar when using Bible software.

In the end, more attention needs to be given to educating students and scholars about how to work with such computer-assisted, research tools as I have described here. While programs themselves should offer learning experiences in language acquisition and text reception, we need textbooks for exegesis—Hebrew and Greek—showing how and why computer-assisted tools are to be integrated as an important tool for textual analysis and as a training companion for language acquisition and reading-skill development. Only then will modern electronic tools truly assist in exegesis, transcending the limitations of the analog workbench and stimulating the longheld Judeo-Christian tradition of methodological reflection.