Time Adverbial and Verb Collocations in Biblical Hebrew

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**Introduction**

One of the most productive areas of Biblical Hebrew grammar is that of time expression, as shown by continual research on the Biblical Hebrew verb.[[1]](#footnote-1) Yet, considerably little attention has been paid to time adverbials.[[2]](#footnote-2) This despite the fact that time adverbials serve important roles in establishing time reference in language.[[3]](#footnote-3) In Biblical Hebrew, they can anchor discourse,[[4]](#footnote-4) modify event time or aspect,[[5]](#footnote-5) and direct pragmatic focus.[[6]](#footnote-6) While most major grammars mention time adverbials, there is as of yet no comprehensive treatment on their form and function.[[7]](#footnote-7) Grammars tend to treat time adverbials as a series of isolated features, divided amongst adverbs, adverbial accusatives, or prepositions.[[8]](#footnote-8) This approach leads to an atomistic focus, and fails to explain how the various components interact and mutually function as sentence arguments.

This study addresses these shortcomings by treating time adverbials as adjuncts composed of entrenched, constructional patterns.[[9]](#footnote-9) The patterns can be identified statistically by calculating collocation frequencies between the units. Combined with techniques from computational linguistics and Construction Grammar, these patterns make a quantitative approach to semantic analysis possible.[[10]](#footnote-10) This project will provide a comprehensive inventory of time adverbial constructions in Biblical Hebrew along with their sentential and textual functions. This brief essay provides a preliminary sampling of that effort.

Hebrew grammars divide time adverbials into three separate rubrics of adverbs, adverbial accusatives, and prepositions.[[11]](#footnote-11) The adverbs include עַתָּה, טֶרֶם, שִׁלְשׁוֹם, מָחָר, and עוֹד.[[12]](#footnote-12) Adverbial substantives are considered under "adverbial accusatives."[[13]](#footnote-13) Though historically related to early Northwest Semitic cases,[[14]](#footnote-14) the Biblical Hebrew accusative is now only marked syntactically.[[15]](#footnote-15) It is an "optional" adjunct to the verb which indicates time, location, manner, or other specifications.[[16]](#footnote-16) Terms often attributed to the time accusative include יוֹם, בֹּקֶר, צָהֳרַיִם, and שָׁנָה, which can appear in larger noun or prepositional phrases.[[17]](#footnote-17) The grammars usually ascribe no more than two senses to time substantives. They convey either 1. points in time ("when?") or 2. durations ("how long?").[[18]](#footnote-18) Grammarians nest information about time positioning under sections on prepositions, namely, בְּ, לְ, כְּ, אַחַר/אַחֲרֵי, עַד, בַּיִן, לִפְנֵי, and מִקֵץ.[[19]](#footnote-19) Prepositions orient an event ("trajector") in relation to a time noun ("landmark").[[20]](#footnote-20) Temporal prepositions are considered metaphorical extensions from the spatial sphere.[[21]](#footnote-21)

There are only two studies dedicated to time adverbials in Biblical Hebrew, those of DeVries (1975) and Brin (2001).[[22]](#footnote-22) DeVries's study explores יוֹם as "the basic unit of time" in "Hebrew thought."[[23]](#footnote-23) He discerns two main constructions for past, present, and future: בַּיוֹם הַהוּא (past/future) and הַיוֹם / הַיוֹם הַזֶה (present).[[24]](#footnote-24) Brin's later work is more expansive. He recognizes that time adverbials depend on reference points, a person, event, or period known from the text or history.[[25]](#footnote-25) Functionally, the points locate events later, simultaneous, or preceding them.[[26]](#footnote-26) He identifies יוֹם as the quintessential time, with 2,317 occurrences.[[27]](#footnote-27) X-יְמֵי (plural) indicates a duration relative to X, while X-יוֹם (singular) indicates a point relative to X.[[28]](#footnote-28) Brin treats an assorted variety of time markers. דוֹר indicates "pieces of history"; לְפָנִים and בְּרִאשׁוֹנָה are distant past.[[29]](#footnote-29) Under "durations" Brin lists מִן...וְעַד,מַעְלָה /מִן...וְהָלְאָה, and עַד הַיוֹם הַזֶה.[[30]](#footnote-30) He classifies רֶגַע, קָרוֹב, מָחָר, תְּמוֹל, לָיְלָה, and יוֹם as "brief" units and לֹא קָרוֹב, לְעִתִּים, אַחֲרוֹן, רָחוֹק, לְעוֹלָם, and לְעַד as "long periods."[[31]](#footnote-31) He notes the primary calendrical units יוֹם, שְׁבוּעַ, חֹדֶשׁ, שָׁנָה and the seasons זֶרַע וְקָצִיר, קוֹר וְחוּם, קַיִץ וְחֹרֶף.[[32]](#footnote-32) Under expressions for past Brin lists לְרִאשֹׁנָה, לְפָנִים, מֵעוֹלָם, בְּטֶרֶם, עוֹלָם מִימֵי, יְמֵי קֶדֶם, and דוֹר ודוֹר.[[33]](#footnote-33) For present are הַיוֹם, בָּעֵת הַזֹּאת, הָאֵלֶּה בַּיָּמִים, עַתָּה, הַפַּעַם, and עַד הַיוֹם הַזֶה.[[34]](#footnote-34) Finally, for "future" he gives מָחָר andהַדּוֹר הָאַחֲרוֹן.[[35]](#footnote-35)

DeVries and Brin primarily examine historical-exegetical issues and not linguistic concerns. In a 1997 article, Van der Merwe, recognizes the lack of such data, and calls for an approach informed by studies of time adverbials in linguistics.[[36]](#footnote-36) For instance, Quirk identifies six different times in English: 1. time position, 2. forward span, 3. backward span, 4. duration, 5. frequency, and 6. relationships (e.g. "up to that time").[[37]](#footnote-37) Harkness distinguishes between "anchor-dependent" (e.g. "last year," speech-time dependent) and "anchor independent" (e.g. "in 1978").[[38]](#footnote-38) Van der Merwe outlines several questions yet to be answered in Biblical Hebrew, including whether certain syntactic features in time adverbials correlate with duration, frequency, and position meanings; whether syntactic classes correlate with dependent/independent anchors; whether position in the sentence affects time semantics; and whether there are differences between temporal and non-temporal adjuncts.[[39]](#footnote-39) Answering these questions requires the "compilation of a taxonomy of BH temporal adjuncts."[[40]](#footnote-40) These questions are the impetus for the present study.

Addressing these diverse concerns requires a new linguistic framework. Traditional grammar divides language into distinct regimes of syntax, semantics, and pragmatics, as well as morphemes, words, phrases, and sentences.[[41]](#footnote-41) It is for this reason that information about time adverbials is scattered across disparate sections of the grammars. Yet time adverbials, as do many forms, show little regard for these boundaries.[[42]](#footnote-42) Particles such as עַתָּה and אָז, for instance, regularly shift from temporal to pragmatic sense, depending on syntactic patterns.[[43]](#footnote-43) The demonstrative force of הַ in הַיוֹם, for example, is limited to time adverbials.[[44]](#footnote-44) Likewise, words appear to ignore word classes. When יוֹם is used without modifiers, it functions like a bare adverb (e.g. מִיוֹם in Ezek 48:35); vice versa, when עוֹלָם is used with a plural noun ending, it functions like a noun (e.g. עוֹלָמִים, Ps 61:5). Likewise, the separation of words and phrases begins to break down when examining idiomatic expressions and regular collocations.[[45]](#footnote-45) These phenomena suggest that syntactic, semantic, and pragmatic meaning derive from complex patterns rather than word-inherent classes.

The key insight of Construction Grammar is that there are no word-inherent, universal grammatical categories.[[46]](#footnote-46) Rather, individual languages consist of unique pattern-to-meaning pairings. Every unit in a language, from morphemes to sentence arguments, consists of fixed or schematic patterns.[[47]](#footnote-47) An "adverb" is therefore not an inherent word class, but a pattern of use which a given word can become associated with.[[48]](#footnote-48) These patterns, like lexemes, carry syntactic, semantic, and pragmatic meaning. Thus Construction Grammar makes no sharp distinction between the three modules.[[49]](#footnote-49) The boundary between grammar and lexicon is likewise blurred as forms are shown to be inter-dependent and associated.[[50]](#footnote-50) The table below illustrates the lexeme-syntax continuum in Biblical Hebrew time adverbials.

# Figure : Continuum of Fixity and Schematicity between Time Adverbials in Biblical Hebrew[[51]](#footnote-51)

fixed

fixed

schematic

|  |  |
| --- | --- |
| morpheme | ִים (pl), ַיִם (du), ָם / וֹם (adv)[[52]](#footnote-52) |
| word | מָחָר, לָיְלָה, עַתָּה |
| complex word | מִקֵּץ, לְעוֹלָם, לִפְנֵי, וְעַתָּה |
| idiom (filled) | בֵּין הָעַרְבֳּיִם |
| idiom (partially filled) | בֶּן + cardinal + time; (age)  time + time (e.g. יוֹם יוֹם, "day by day") |
| attributive time NP | הַ + time + הַ + attr |
| macrosyntactic indicator | וַיְּהִי + time |
| durative aspectual | ø + quantification + time + verb |

Constructions at the top of the table are more fixed whereas those on the bottom have more complex, schematic parts. Constructions function idiomatically: the ִים morpheme is paired with plural meaning; מִקֵּץ has lost its usual sense of "detachment" and is appended to durations;[[53]](#footnote-53) the plural יָמִים conveys a duration rather than merely "plural" days;[[54]](#footnote-54) וַיְּהִי + time conveys pragmatic meaning, orienting the reader by setting the narrative time.[[55]](#footnote-55) These examples exhibit the same unpredictability attributed to the lexicon.[[56]](#footnote-56)

This study uses the tools of collocation analysis, namely, statistical association measures and computer algorithms, to identify time constructions. This approach is grounded on a usage-based view of language.[[57]](#footnote-57) The more often a given construction is used in a certain way, the more entrenched the connection becomes in a user's mind.[[58]](#footnote-58) Constructions frequently collocate with semantically informative patterns.[[59]](#footnote-59) For example, plural morphemes and cardinal numbers co-occur frequently in Biblical Hebrew due to their interdependent meaning.[[60]](#footnote-60) Dependency can be operationalized with a statistical measure of association.[[61]](#footnote-61) Empirical cognitive linguistics are currently using such measures in lieu of grammaticality judgments to test linguistic theories.[[62]](#footnote-62) The method is especially well-suited for a dead language. Furthermore, this approach enables an investigation into the interdependencies of Hebrew time adverbial components.

A collocational investigation of time adverbials in Biblical Hebrew requires broad access to corpus data. The *BHSA* of the Eep Talstra Centre for Bible and Computer is a scholarly, open source database that contains labels on phrases with time adverbial function.[[63]](#footnote-63) The database covers the whole Hebrew Bible. The time data has been manually checked for accuracy for this project.[[64]](#footnote-64) The data is processed and counted in Python using a corpus analysis tool, Text-Fabric, alongside statistics packages.[[65]](#footnote-65) The statistical method of Collostruction Analysis is used to detect the associations.[[66]](#footnote-66)

For this analysis "time adverbial" shall refer to any phrasal, clause constituent which contributes time reference to a verbal event. This pilot study excludes adverbials headed by more pragmatic particles: אָז, עַתָּה, כֵּן, and אַךְ. Linguistic concepts are represented in small caps. The analysis has four goals: 1) catalogue and count the distribution and diversity of time adverbials, 2) develop a data-driven semantic taxonomy, 3) measure positional tendencies within sentences, 4) measure collocational tendencies with verbs. Theoretical guidance is provided by Haspelmath's study of time adverbials in world languages, Fillmore's constructional analysis of time adverbials, and Croft's analysis of verbal event frames.[[67]](#footnote-67)

**Time Adverbials in Biblical Hebrew**

The analysis of time adverbials in Biblical Hebrew begins with an exploratory overview of the identity and distribution of phrases marked for adverbial time in the *BHSA*. The *BHSA* divides the Hebrew text into word, phrase atom, phrase, clause atom, clause, and sentence objects.[[68]](#footnote-68) The phrase object is the largest functional unit without predication while clauses are the most basic unit with predication. Every phrase in the database has a feature called "function," which describes its argument role in its enclosing clause. A total of 29 functions are encoded, including predicate (i.e. main verb), subject, object, complement, time, location, and adjunct (where adjunct contains adverbials which are neither time nor location).[[69]](#footnote-69) *BHSA* phrases also have a "type" (typ) feature which tells its formal type, i.e. np ("noun phrase"), pp, advp.

The approach of this analysis is data-driven and inductive. The data-driven method is connected with usage-based language theory. The model predicts that very common forms function as prototypes through which novel uses are made.[[70]](#footnote-70) It is hypothesized that the same dynamics are active in the making of Hebrew time adverbials. As such, it will be shown that rarer forms can exploit common structures by extending or modifying them.[[71]](#footnote-71) The analysis also depends on the principle that forms that are more semantically associated co-occur more frequently.[[72]](#footnote-72)

A final word is necessary about the statistical methodology. It is common in Hebrew studies to use raw counts of a form. However, raw counts can hide surprising differences in distribution. For example, if "Form 1" occurs 9 of 10 uses with another Form X (90%), it is more significant than that of a Form 2 having 18 of 100 uses with Form X (18%). Corpus linguists recognize four frequencies as relevant for determining significance between two forms: [[73]](#footnote-73)

# Figure : Contingency Table for Co-occurrence Data[[74]](#footnote-74)

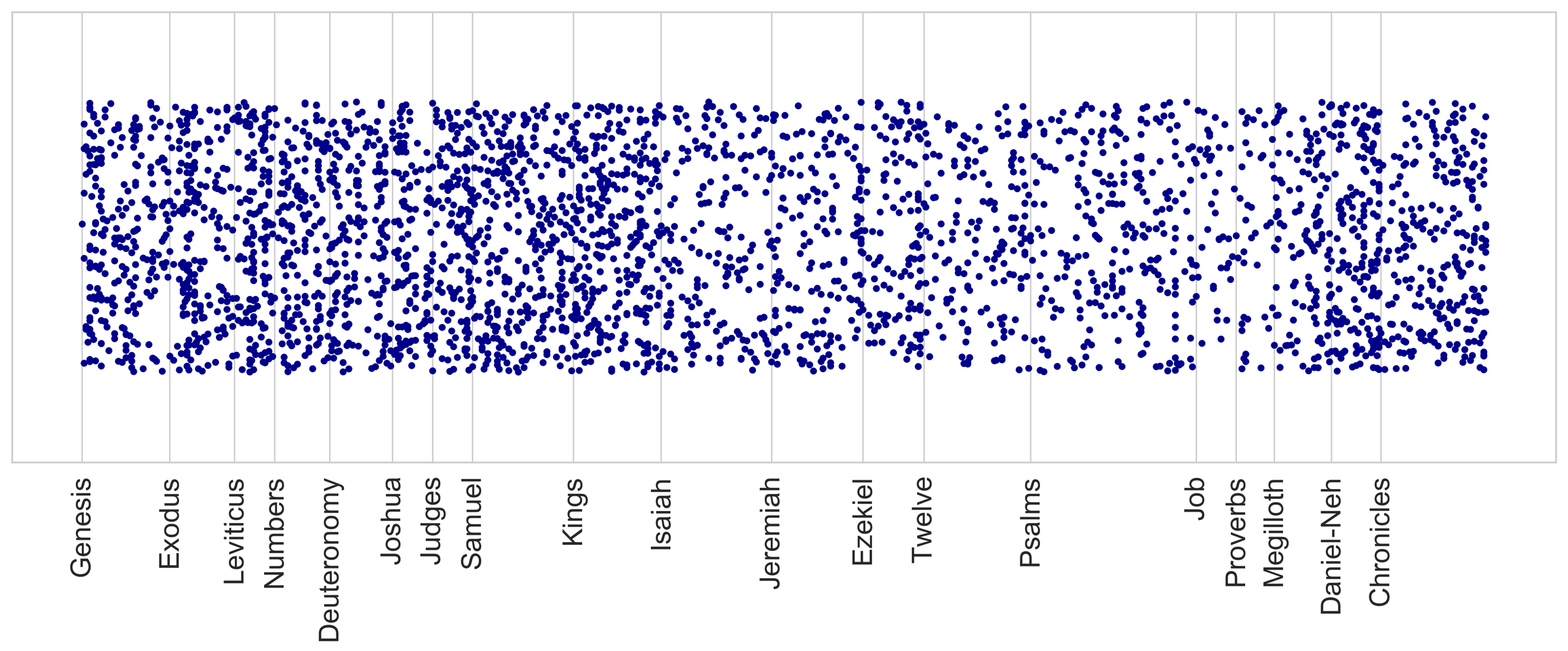
|  |  |  |
| --- | --- | --- |
|  | **Target Form** | *All Other Target Forms* |
| **Co-occurring Form X** | frequency A | frequency B |
| *All Other Co-occurring Forms* | frequency C | frequency D |

Given these four counts, a number of significance tests can be applied. This project uses log-transformed Fisher's Exact scores.[[75]](#footnote-75) The test returns a score which must meet a threshold for significance. The conventional level is < 5% likelihood of being attributable to random chance, i.e. a score > 1.3 or < -1.3 for the Fisher's test.[[76]](#footnote-76)

The *BHSA* contains a total of 249,383 Hebrew phrases and 3,961 with an adverbial time label. The total comes to 3,376 after merging superfluous phrases and removing excluded adverbs.[[77]](#footnote-77) These phrases constitute the starting point for the analysis.

The idea that time adverbials are "optional" gives the impression that they are less than vital components.[[78]](#footnote-78) time adverbial distribution paints a different picture. This strip chart visualizes all 3,376 time adverbials throughout the Hebrew Bible by chapter.

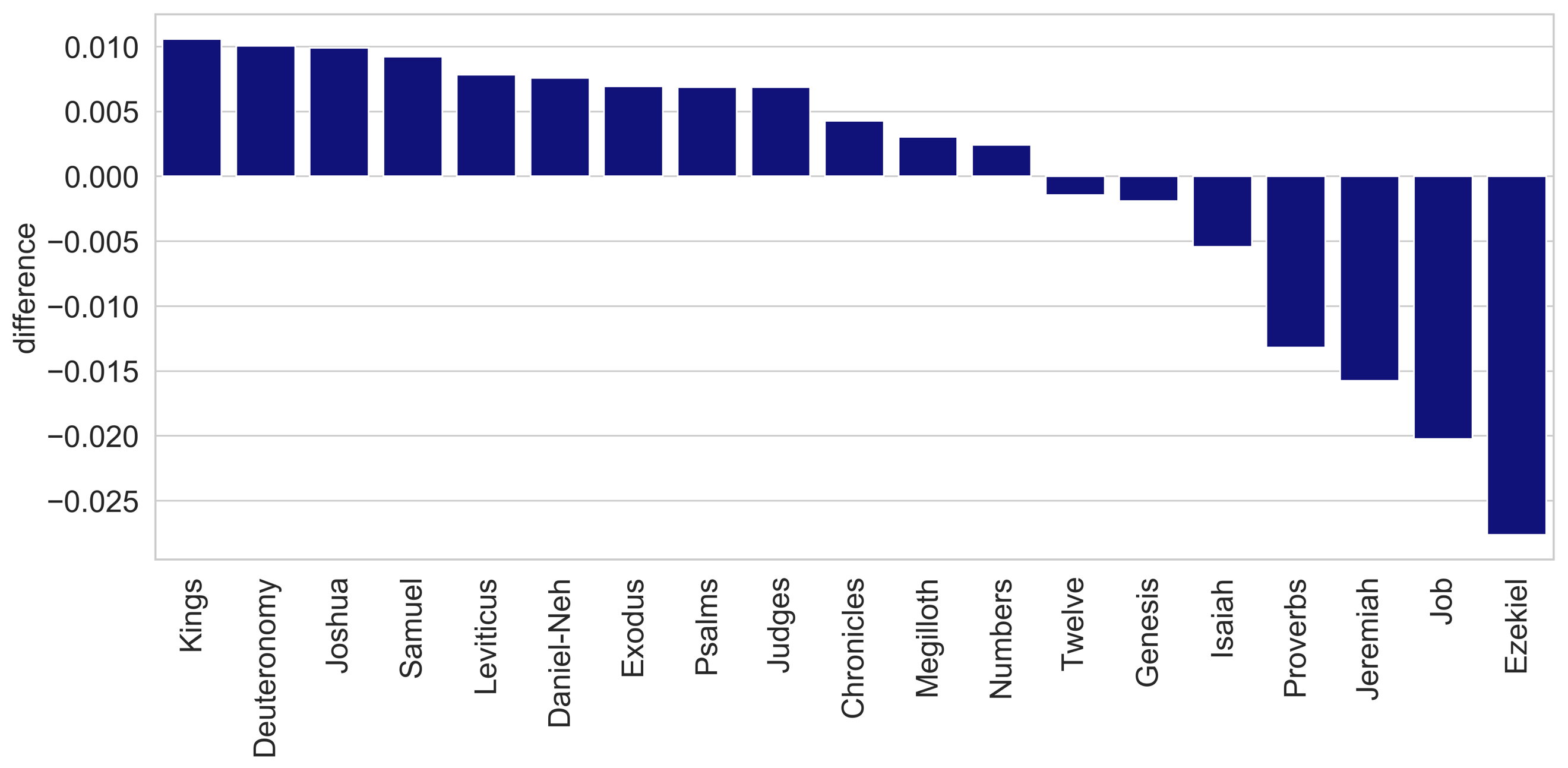
# Figure : Adverbial Time Distribution from Chapter to Chapter throughout the Hebrew Bible (Y-axis is random)



time is spread throughout the corpus, though there are differences in concentration. Notably, time enjoys strongest attestation in narratives. This confirms Hebraist intuitions that time serves a special role in anchoring narratives.[[79]](#footnote-79)

A more precise measure of distribution is needed to directly compare distributions. Deviation of Proportions can tell whether a given book is overrepresented or underrepresented in its frequency of time adverbials. The value is based on a corpus part's proportional representation.[[80]](#footnote-80) For example, Genesis accounts for 7% of all phrases in the Hebrew Bible. Based on a random distribution, it is expected to account for 7% of time adverbials. Anything more or less shows deviation from the expected proportion. The formula is applied and shown below.

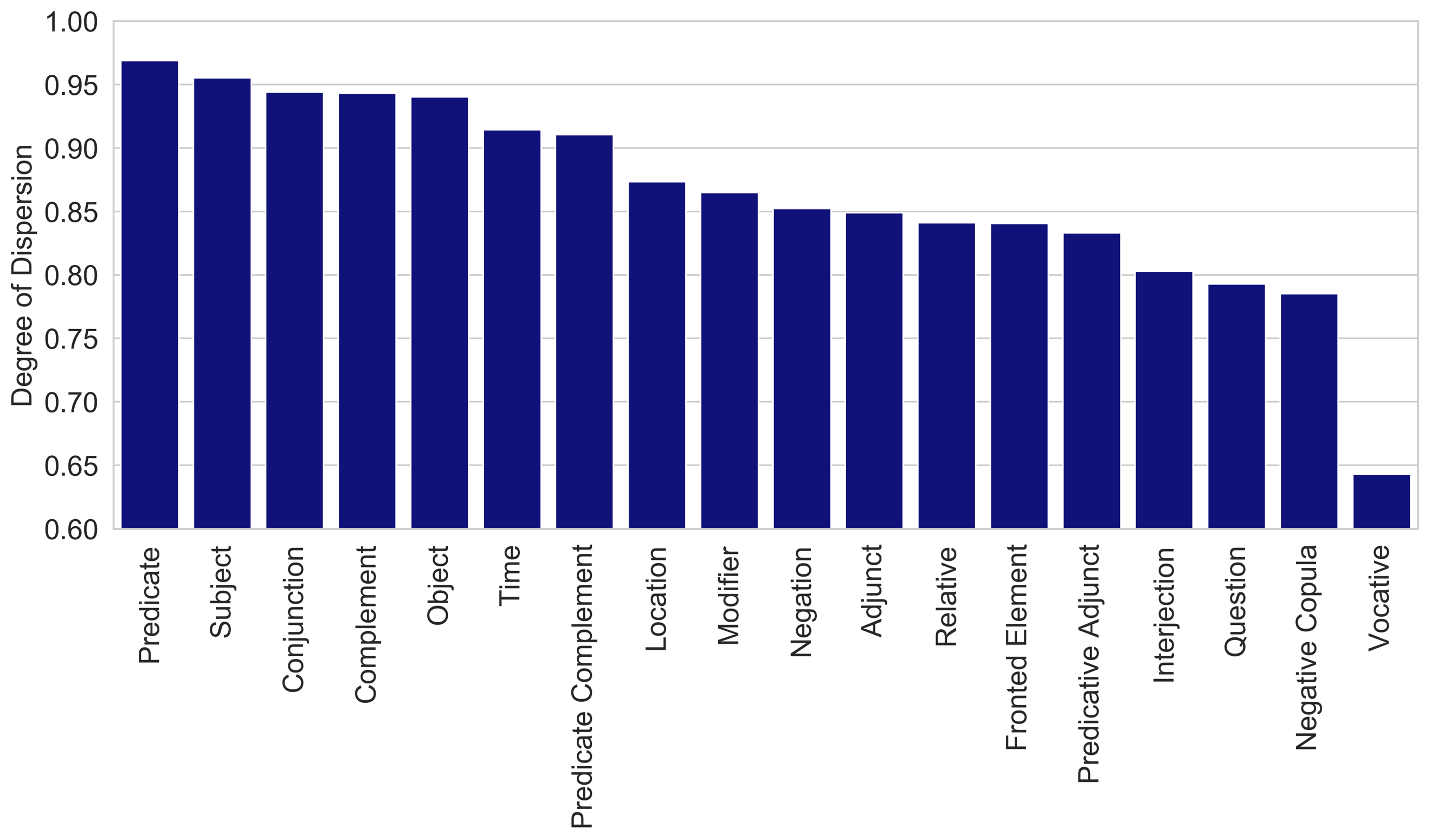
# Figure : Deviation of Proportions for Time Adverbials per Book (grouped)



Consistent with the strip chart, narrative books show higher preference for time than poetic books (but see Psalms). Kings has the greatest, with 1% higher than expected, while Ezekiel has 3% (0.0275) less than expected. Exploring these disparities, and whether they have functional implications for time is an area for the full project.

It is also possible to compare time distribution against other arguments. Degree of Dispersion is a measure for the distribution of forms throughout parts of a corpus.[[81]](#footnote-81) It uses Deviation of Proportion to quantify distributional evenness. The result is a decimal, from 0-1, that describes how well-distributed a form is relative to a random spread, with 1 being perfectly even and 0 being completely uneven. [[82]](#footnote-82) The chart below shows the distribution of time compared to other major sentence arguments.

# Figure : Degree of Dispersion for Sentence Arguments in *BHSA* (higher is more evenly distributed)



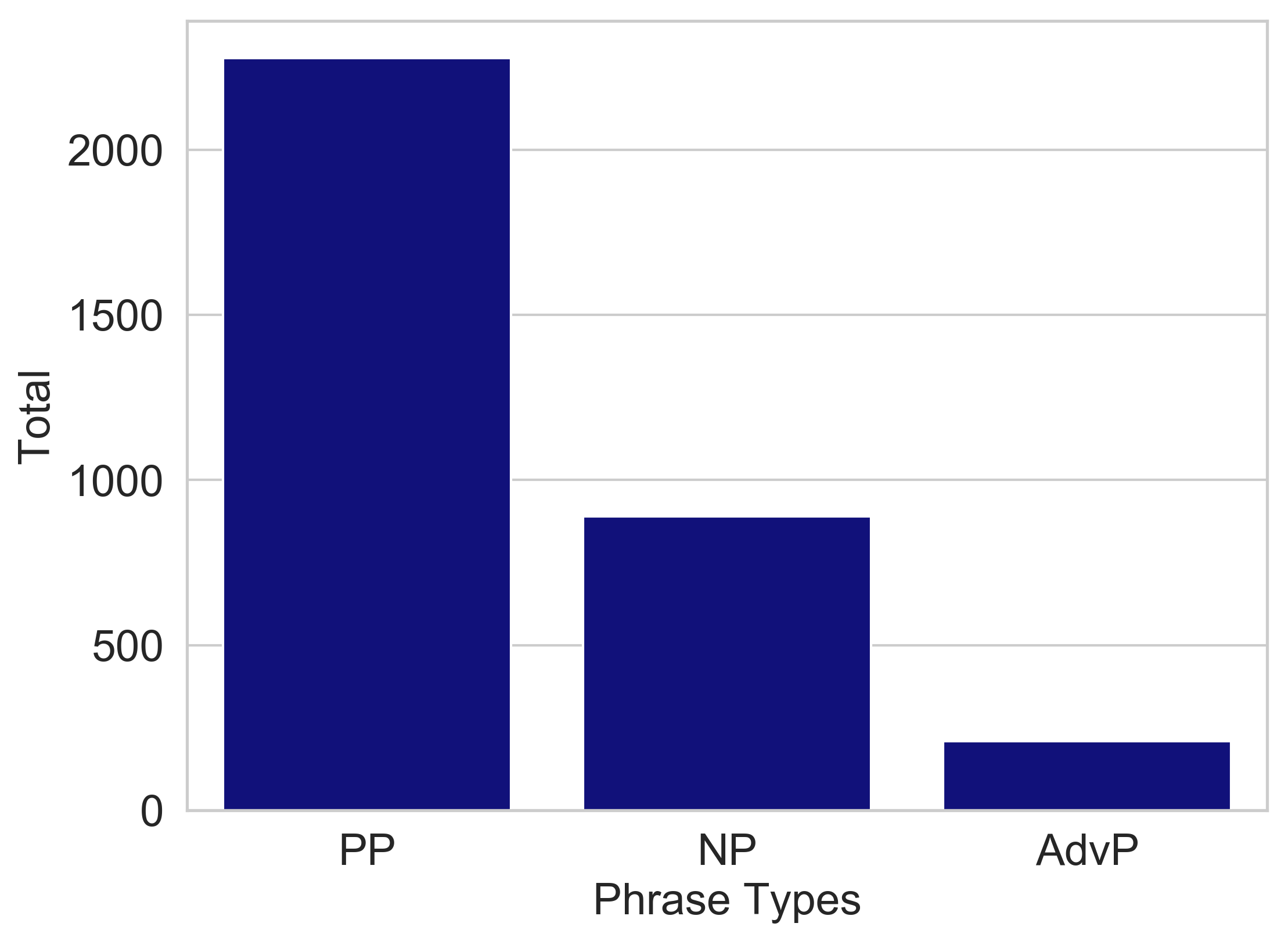
The data shows that time (0.91) is comparable to key arguments such as object (0.94) and complement (0.94). It is slightly more evenly distributed than location (0.87). The difference between time and other adjuncts (0.85) is greater, with a difference of 0.07 (7%). This data reveals the time adverbial to be an important component in Biblical Hebrew. "Optional" it may be from the perspective of verb meaning,[[83]](#footnote-83) but it cannot be so for the language as a whole.

The goal of developing a taxonomy of time adverbials begins with an inductive exploration of their structure. The distribution of formal types is shown in the table and plot below.

# Figure : Time Phrase Types

|  |  |
| --- | --- |
|  | Total |
| PP | 2277 |
| NP | 890 |
| AdvP | 209 |

# Figure : Time Phrase Types Barplot

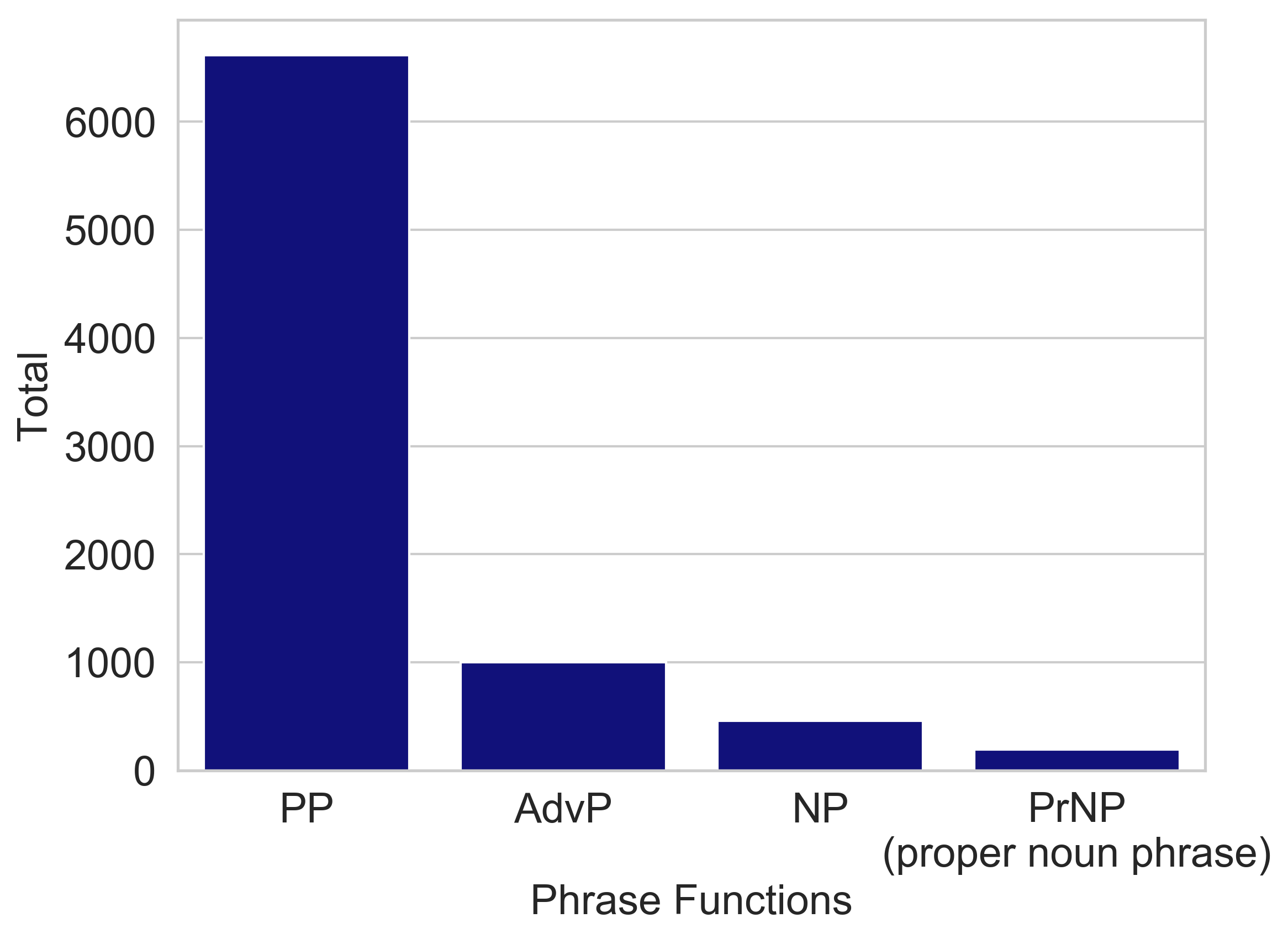


Note that the adverb phrase (advp) has 421 less cases due to the removal of the particles, however even with them included it remains the third most frequent. There are syntactic differences between the np and advp, as will be shown. The prepositional phrase (pp) dominates time with 2,277 or 67% of all forms. The distribution is comparable to location, which consists of 80% pp:

# Figure : Location Phrase Types[[84]](#footnote-84)

|  |  |
| --- | --- |
|  | Total |
| PP | 6612 |
| AdvP | 1002 |
| NP | 461 |
| PrNP | 191 |

# Figure : Location Phrase Types Barplot



The difference in pp distribution between location and time is statistically significant, with an association score of -45 (i.e. < -1.3 threshold) showing negative association.[[85]](#footnote-85) The attraction of np to time is greater, with a score of 198, showing positive association(> 1.3 threshold). Thus, the pp plays a slightly smaller role in time. The np, though, plays a larger role in time. The cause of this difference is the zero-marked time np for durative function, to be discussed.[[86]](#footnote-86) Despite the differences, predominance of pp in both time and location offers a clue that Biblical Hebrew, like other languages, encodes the two similarly.[[87]](#footnote-87)

The table below shows the top 50 semantic heads throughout all time adverbials. The adopted definition of head is Croft's "primary information bearing unit," i.e. "content words."[[88]](#footnote-88)

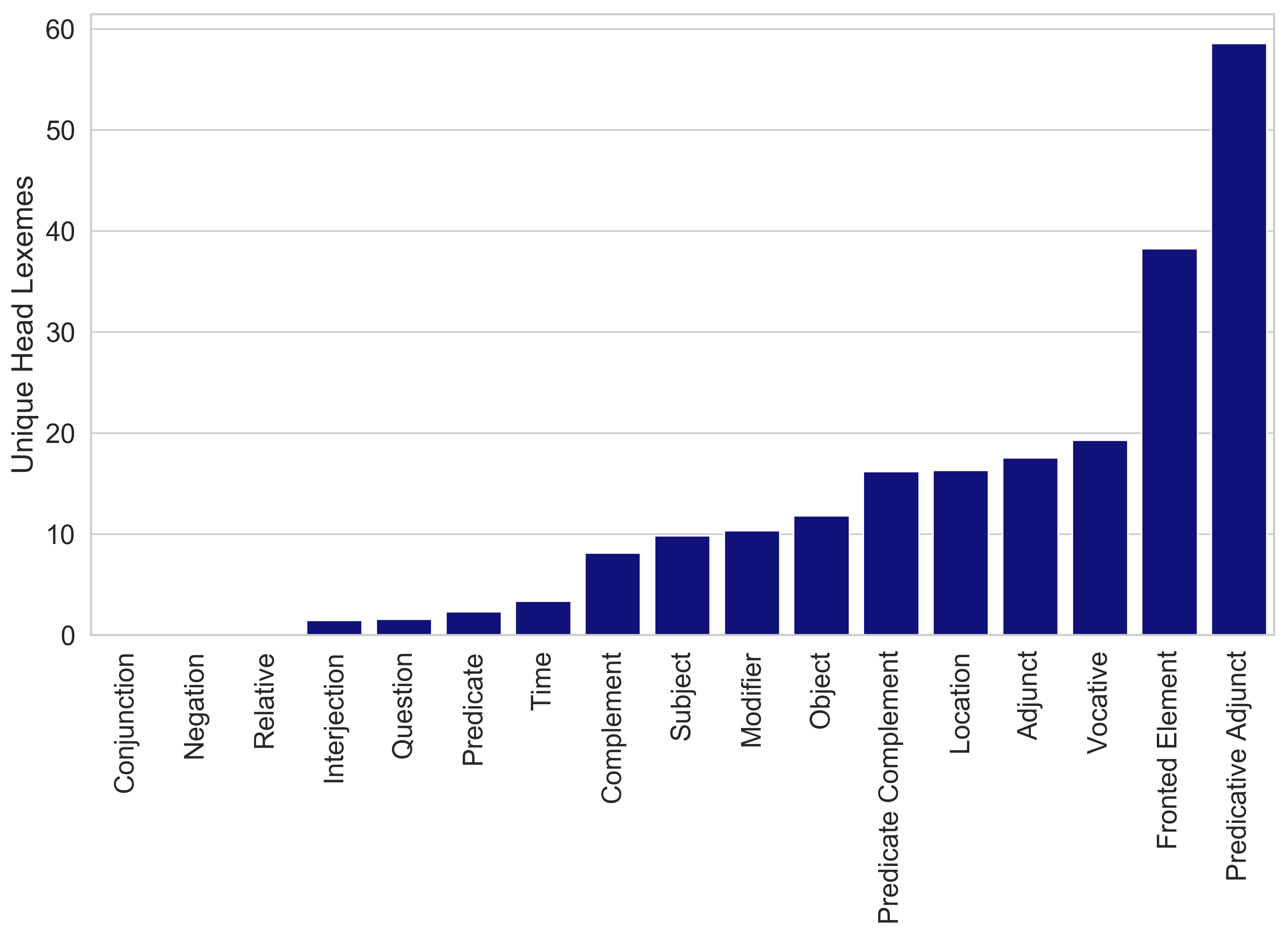
# Figure : Top 50 Semantic Heads for Time Adverbials

|  | Total |
| --- | --- |
| יֹום | 1524 |
| שָׁנָה | 376 |
| עֹולָם | 197 |
| עֵת | 165 |
| לַיְלָה | 139 |
| בֹּקֶר | 133 |
| עֶרֶב | 82 |
| חֹדֶשׁ | 79 |
| אַחַר | 67 |
| יֹומָם | 38 |
| מָחָר | 38 |
| תָּמִיד | 33 |
| מָוֶת | 31 |
| נֵצַח | 28 |
| מָתַי | 25 |
| מָחֳרָת | 25 |
| פָּנֶה | 23 |
| דֹּור | 21 |
| עַד | 20 |
| רִאשֹׁון | 18 |
| תְּמֹול | 17 |
| צָהֳרַיִם | 14 |
| מֹועֵד | 14 |
| דָּבָר | 14 |
| אָן | 14 |
| אֶחָד | 11 |
| שַׁבָּת | 9 |
| רֶגַע | 8 |
| נְעוּרִים | 8 |
| חַיִּים | 7 |
| שָׁבוּעַ | 7 |
| אֶתְמֹול | 6 |
| הֵנָּה | 6 |
| בֶּטֶן | 5 |
| שְׁבִיעִי | 5 |
| נֶשֶׁף | 5 |
| רֹאשׁ | 5 |
| אַרְבַּע | 5 |
| רֵאשִׁית | 5 |
| תְּחִלָּה | 5 |
| יֶרַח | 5 |
| אֶמֶשׁ | 4 |
| שָׁלֹשׁ | 4 |
| מַלְכוּת | 4 |
| תְּשׁוּבָה | 4 |
| זֹאת | 4 |
| קֶדֶם | 4 |
| אַחֲרֹון | 4 |
| קַיִץ | 4 |
| טֶרֶם | 4 |

As recognized by DeVries and Brin, יוֹם is by far the most common head in Biblical Hebrew time adverbials.[[89]](#footnote-89) In addition to יוֹם, other times include שָׁנָה, לַיְלָה, בֹּקֶר, עֶרֶב, חֹדֶשׁ, צָהֳרַיִם, נֶשֶׁף, יֶרַח, and קַיִץ. These consist of what Haspelmath calls the "canonical" times, the most prevalent units across world languages.[[90]](#footnote-90) These are reference points known from "the human natural environment on earth," deriving from "the alternation of light and dark, changes in the shape of the moon, and changes in the path of the sun across the sky."[[91]](#footnote-91) Other terms are more cultural, such as שַׁבָּת and שָׁבוּעַ.[[92]](#footnote-92) Nouns not intuitively associated with time include מָוֶת, נְעוּרִים, חַיִּים, בֶּטֶן, and מַלְכוּת. These suggest references related to the life cycles or reigns of people. Cardinal numbers like אֶחָד, אַרְבַּע, and שָׁלֹשׁ, as well the ordinal שְׁבִיעִי, suggest the use of positions along a number line as reference points.[[93]](#footnote-93) The list contains more adverbial words such as עוֹלָם, עֵת, מָחָר, פָּנֶה (positional use), נֵצַח, דּוֹר, תְּמוֹל, מוֹעֵד, רֶגַע, אֶתְמוֹל, רֵאשִׁית, תְּחִלָּה, אֶמֶשׁ, תּשׁוּבָה, קֶדֶם, אַחַרוֹן, and טֶרֶם, terms that designate various time points, durations, or positions. Two interrogatives are also present, מָתַי and אָן, as well as the deictic particle הֵנָּה.

The intuition that the heads of time are semantically specialized can be tested by comparing how diverse time head lexemes are versus other arguments. The chart below demonstrates that time is more comparable to the predicate than location or other adjuncts.

# Figure : Unique Head Lexemes for Sentence Arguments Per 100 Uses[[94]](#footnote-94)



The data thus gives empirical backing for the sense that time words are lexicalized specifically for time function.[[95]](#footnote-95) It is also intriguing that time is as selective as predicates, given the close relation between temporality and verbal action.

67% of all time adverbials begin with a preposition (2,277). The prepositions are often "stacked." The chart below shows all attested prepositions and raw counts. Prepositions are lemmatized, stripped of accents, and dot-separated to ignore minor differences.

# Figure : Attested Prepositions and Preposition Chains in Time Adverbial pps

|  | Total |
| --- | --- |
| ב | 1269 |
| עד | 314 |
| ל | 294 |
| מן | 155 |
| אחר | 84 |
| כ | 49 |
| מן.קץ | 19 |
| ב.אחרית | 15 |
| ל.מן | 14 |
| ב.עוד | 11 |
| מן.קצה | 10 |
| ל.פנה | 9 |
| בין | 8 |
| ל.קץ | 5 |
| עד.ל | 3 |
| את | 2 |
| על | 2 |
| ב.תוך | 2 |
| ל.פנה.מן | 1 |
| ל.ראשׁ | 1 |
| עד.אחר | 1 |
| מן.קצת | 1 |
| עד.מן | 1 |
| עד.בלת | 1 |
| מן.ל | 1 |
| אל | 1 |
| ב.ראשׁ | 1 |
| כ.מן | 1 |
| בלת | 1 |
| ל.מן.ב | 1 |

בְּ dominates the list, accounting for 56% of cases. The list contains other prepositions frequently discussed: עַל, לְ, מִן, כְּ, and בַּיִן.[[96]](#footnote-96) It also includes functional prepositions such as אַחַר, קֵּץ, אַחֲרִית, פָּנֶה, תָּוֶךְ, רֹאשׁ, and קְצָת. Two terms are not strictly prepositions but rather adverbial modifiers, עוֹד and בֵּלֶת; these few cases (13) are so coded to aid head selection.[[97]](#footnote-97) There are a number of surprises: אֵת, עַל, and אֶל.[[98]](#footnote-98)

Prepositions "express primarily the spatial relationships between trajectors and landmarks."[[99]](#footnote-99) In temporal expressions, the spatial relationship is metaphorically extended to a two-dimensional timeline.[[100]](#footnote-100) The primary event, headed by a verb, assumes the role of trajector in adverbial time. The preposition relates the event to a specific time head, the landmark.[[101]](#footnote-101) The diagram illustrates the three primary relationships between event and time by a preposition.[[102]](#footnote-102)

# event inside time (simultaneous)

event & time

# event after time (anterior)

event

time

# event before time (posterior)

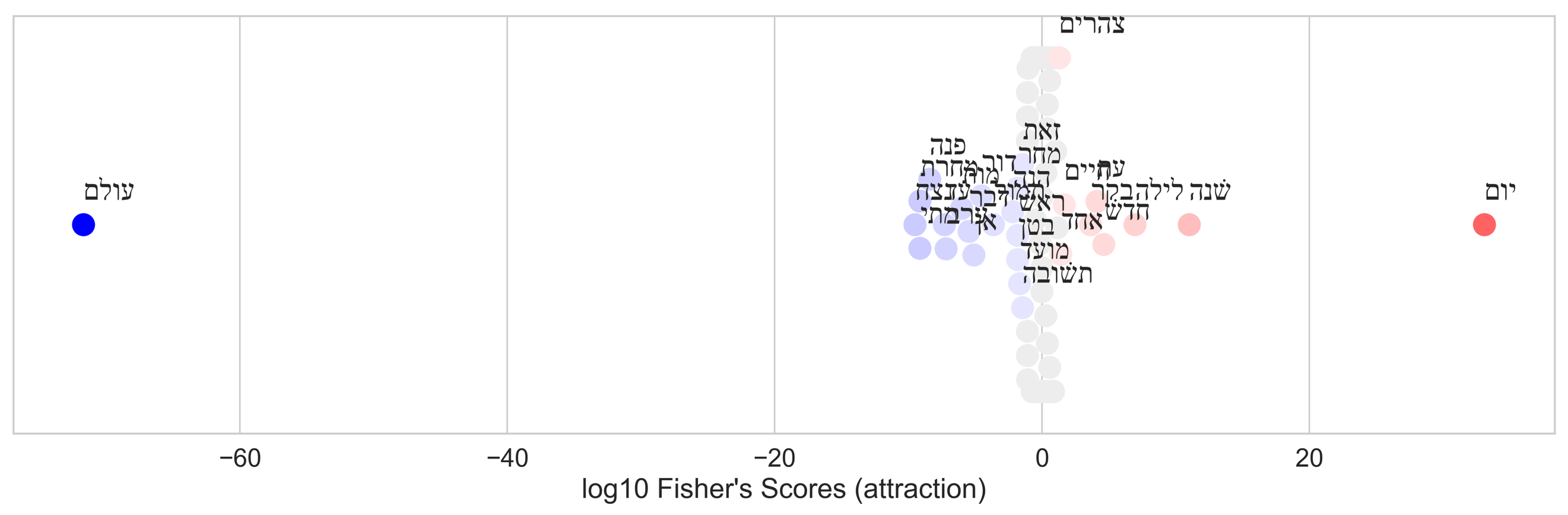
time

event

In Hebrew, the simultaneous relationship is expressed with בְּ. The anterior can be expressed with אַחַר. The posterior relationship can be made with מִן.[[103]](#footnote-103) These basic positions can be extended to include durations towards a time by use of לְ or עַד.[[104]](#footnote-104)

The semantics of prepositions affect their collocational preferences for time words. The preferences are statistically detectable. They help detect subtle nuances that are not self-evident, providing a first step toward a semantic taxonomy of time adverbials. The prepositions and their co-occurrences with governed time words are counted. Those relationships are modeled below with Fisher's significance scores and "swarmplots." Red indicates attraction and blue repulsion. Statistically neutral terms are in grey. Time terms are lemmatized and accent-stripped for clarity.

# Figure : Collocational Attractions to בְּ, Swarmplot

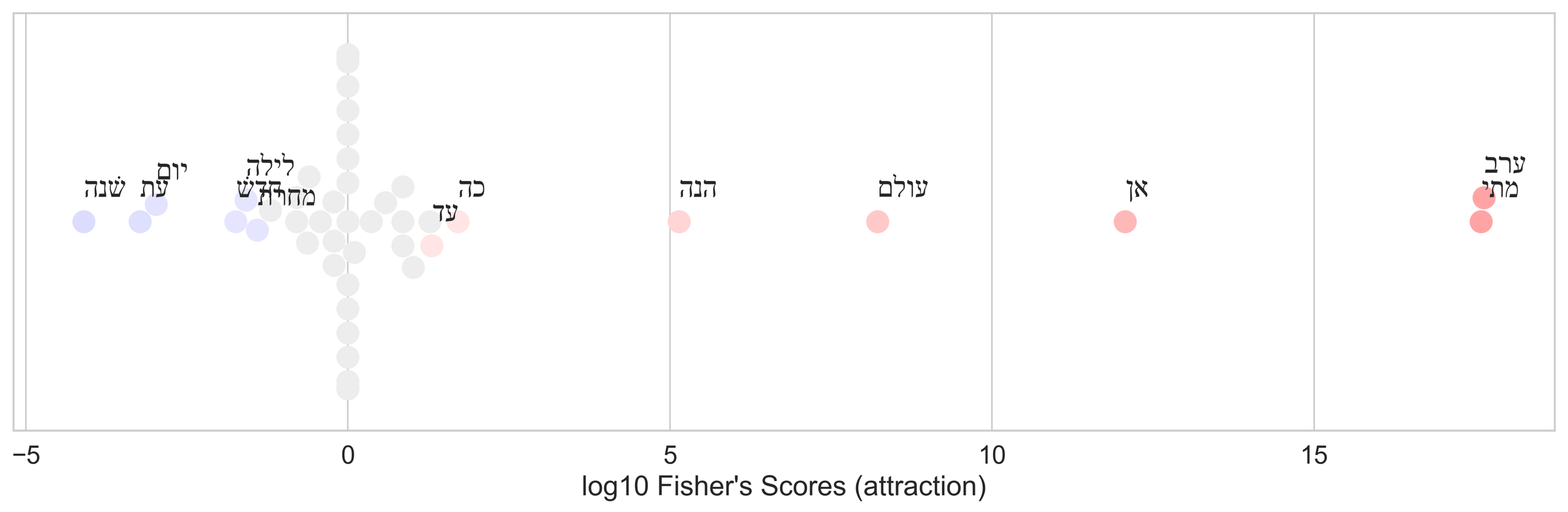


# Figure 14: Top 10 Attracted Times to בְּ (Fisher's >1.3 is significant)

|  | Fisher's Score | Raw Counts |
| --- | --- | --- |
| יום | 33.11 | 666 |
| שׁנה | 11.02 | 146 |
| עת | 6.96 | 47 |
| בקר | 4.63 | 46 |
| לילה | 4.11 | 116 |
| חדשׁ | 3.64 | 93 |
| ערב | 1.67 | 7 |
| ראשׁון | 1.41 | 6 |
| צהרים | 1.31 | 11 |
| חיים | 1.14 | 5 |

בְּ prefers canonical time periods, יוֹם, שָׁנָה, בֹּקֶר, לָיְלָה, חֹדֶשׁ, and עֶרֶב. The simultaneous sense is strongly amenable to these time points.

# Figure : Collocational Attractions to עַד, Swarmplot

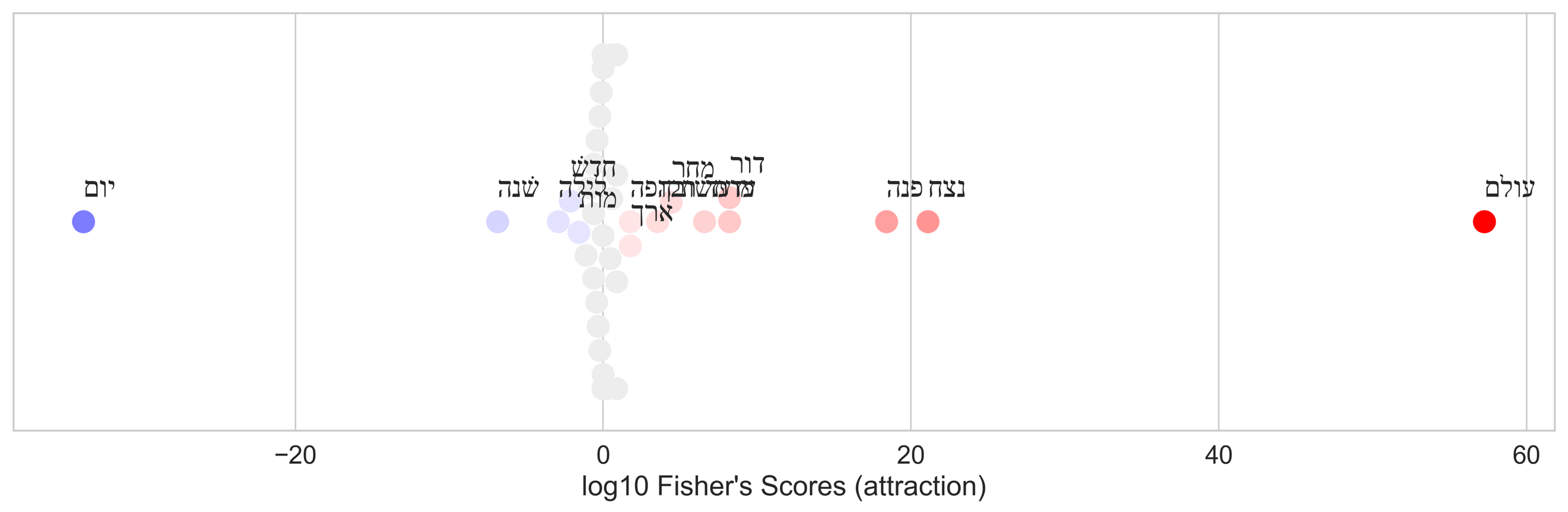


# Figure : Top 10 Attracted Times to עַד (Fisher's >1.3 is significant)

|  | Fisher's Score | Raw Counts |
| --- | --- | --- |
| ערב | 17.64 | 44 |
| מתי | 17.59 | 23 |
| אן | 12.07 | 14 |
| עולם | 8.22 | 55 |
| הנה | 5.14 | 6 |
| כה | 1.71 | 2 |
| עד | 1.30 | 6 |
| מה | 1.27 | 2 |
| אור | 1.02 | 2 |
| אלה | 0.85 | 1 |

The semantics of עַד suggest a duration extending to a time. The time can be either a point or duration, although עַד prefers points. For instance, it is associated with עֶרֶב (17.64), a term that is likewise associated with בְּ.[[105]](#footnote-105) Other points are deictic like הֵנָה and כֹה. But the preference is not absolute, since עַד also collocates with durations like עוֹלָם and unbound particles מָתַי and אָן.[[106]](#footnote-106)

# Figure : Collocational Attractions to לְ, Swarmplot

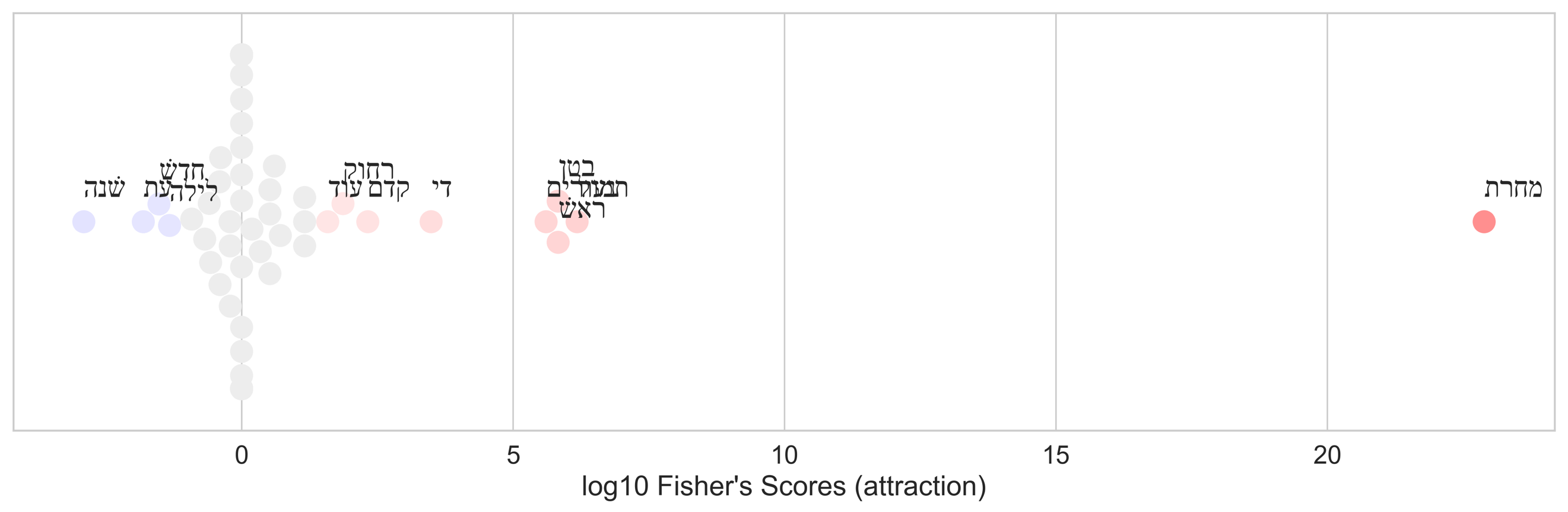


# Figure : Top 10 Attracted Times to לְ (Fisher's >1.3 is significant)

|  | Fisher's Score | Raw Counts |
| --- | --- | --- |
| עולם | 57.26 | 111 |
| נצח | 21.10 | 25 |
| פנה | 18.42 | 22 |
| דור | 8.21 | 14 |
| עד | 8.21 | 14 |
| מועד | 6.59 | 10 |
| מחר | 4.43 | 5 |
| תשׁובה | 3.54 | 4 |
| ארך | 1.77 | 2 |
| תקופה | 1.77 | 2 |

לְ prefers times that do not profile an endpoint, as seen by its preferences for עוֹלָם, נֵצַח, פָּנֶה (as in לִפְנֵי), עַד, אֹרֶךְ (indefinite), תְּשׁוּבָה, and תְּקוּפָה. Its association with תְּשׁוּבָה and תְּקוּפָה, both cycles (e.g. Ex 34:22, תְּקוּפַת הַשָּׁנָה; 2 Sam 11:1 לִתְשׁוּבַת הַשָּׁנָה), make the unbound preference clear.

# Figure : Collocational Attractions to מִן, Swarmplot



# Figure : Top 10 Attracted Times to מִן (Fisher's >1.3 is significant)

|  | Fisher's Score | Raw Counts |
| --- | --- | --- |
| מחרת | 22.88 | 22 |
| תמול | 6.18 | 7 |
| ראשׁ | 5.83 | 5 |
| בטן | 5.83 | 5 |
| נעורים | 5.61 | 6 |
| די | 3.49 | 3 |
| קדם | 2.32 | 2 |
| רחוק | 1.87 | 2 |
| עוד | 1.59 | 2 |
| רחם | 1.16 | 1 |

מִן shows a number of interesting collocations, most notably מָחֳרָת.

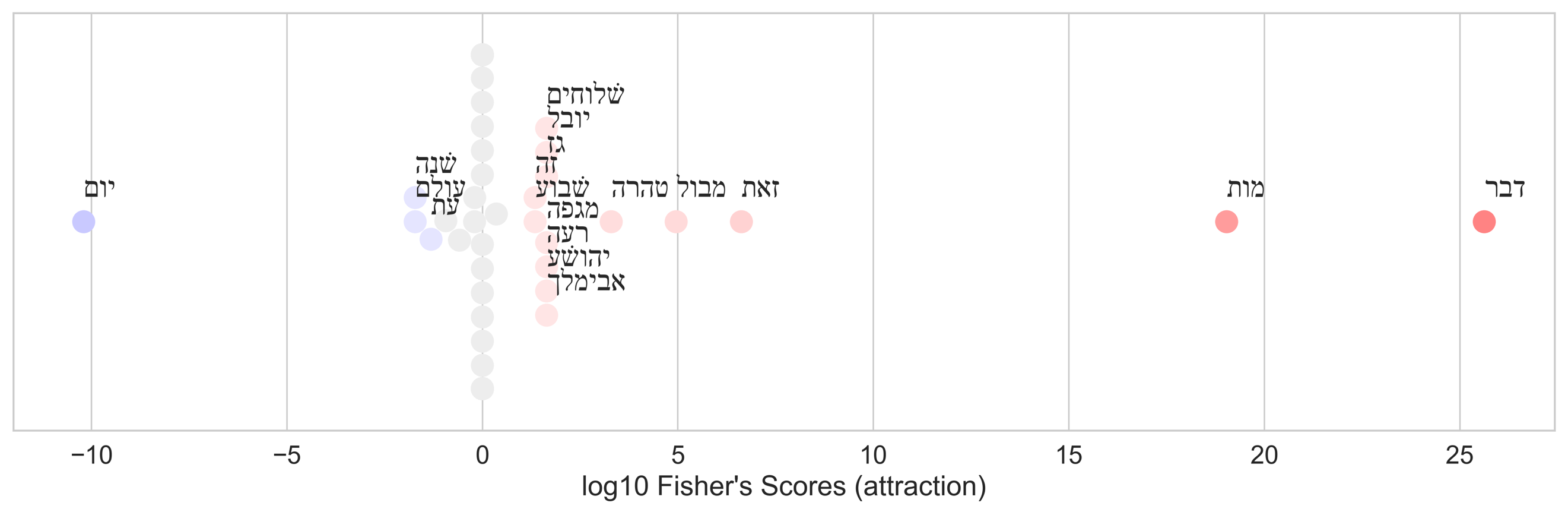
|  |
| --- |
| **Gen 19:34a** |
| וַֽיְהִי֙ מִֽמָּחֳרָ֔ת וַתֹּ֤אמֶר הַבְּכִירָה֙ אֶל־הַצְּעִירָ֔ה הֵן־שָׁכַ֥בְתִּי אֶ֖מֶשׁ אֶת־אָבִ֑י |
| "And it was since **tomorrow** [lit.], and the firstborn said to the younger, 'Look, I have slept yesterday with my father...'" |

This use of מָחֳרָת is noteworthy because it typically profiles a future time relative to speech. Yet in this case it is anchored to the previous day in the narrative. The semantics of מָחֳרָת are thus more flexible than the English "tomorrow." This is corroborated by the majority of מִמָחֳרָת being used with the *wayyiqtol*.[[107]](#footnote-107) Comparatively, the use of תְּמוֹל "yesterday," is restricted to speech sections and is anchored to speech time:[[108]](#footnote-108)

|  |
| --- |
| **Ex 4:10a** |
| וַיֹּ֨אמֶר מֹשֶׁ֣ה אֶל־יְהוָה֮ בִּ֣י אֲדֹנָי֒ לֹא֩ אִ֨ישׁ דְּבָרִ֜ים אָנֹ֗כִי גַּ֤ם מִתְּמֹול֙ גַּ֣ם מִשִּׁלְשֹׁ֔ם |
| "And Moses said to YHWH, 'Upon me, oh Lord, I am not a man of words, **neither since yesterday nor from three times ago**!'" |

Other times found with מִן include בֶּטֶן, נְעוּרִים, and רֶחֶם, referring to people's life cycles. רֹאשׁ, קֶדֶם, and רָחוֹק express distant past.[[109]](#footnote-109)

# Figure : Collocational Attractions to אַחַר, Swarmplot



# Figure : Top 10 Attracted Times to אַחַר (Fisher's >1.3 is significant)

|  | Fisher's Score | Raw Counts |
| --- | --- | --- |
| דבר | 25.62 | 15 |
| מות | 19.04 | 16 |
| זאת | 6.62 | 4 |
| מבול | 4.96 | 3 |
| טהרה | 3.3 | 2 |
| אבימלך | 1.64 | 1 |
| שׁלוחים | 1.64 | 1 |
| יהושׁע | 1.64 | 1 |
| יובל | 1.64 | 1 |
| רעה | 1.64 | 1 |

אַחַר prefers דָּבָר, with several attested occurrences of the expression,אַחֲרֵי הַדּבָרִים הָאֵלֶּה.[[110]](#footnote-110) The persons אֲבִימֶלֶךְ and יְהוֹשֻׁעַ correspond with מוֹת, all indicating time after a person's death.[[111]](#footnote-111)

Associations between prepositions and times gives a partial picture of adverbial semantics. In order to construct a comprehensive taxonomy, a greater variety of forms must be accounted for. The primary constructional patterns of time adverbials can be seen by applying a tokenization clustering strategy. The strategy generates a surface token of each time by stripping the surface text of vowels, accents, and spacing. The tokenizer adds consonantal ה in cases where an article is vocalized. This process allows similar forms to cluster despite minor differences. The result is 1,140 unique tokens from 3,376 unique time instances.[[112]](#footnote-112)

# Figure : Top 50 Time Adverbial Surface Tokens

|  | Total |
| --- | --- |
| ב.ה.יום.ה.הוא | 203 |
| ה.יום | 191 |
| ל.עולם | 85 |
| ב.ה.בקר | 78 |
| עד.ה.יום.ה.זה | 71 |
| ב.יום | 69 |
| שׁבעת.ימים | 63 |
| עד.עולם | 53 |
| כל.ה.ימים | 44 |
| כל.ה.יום | 42 |
| עד.ה.ערב | 41 |
| לילה | 41 |
| ב.ה.עת.ה.היא | 37 |
| ב.ה.יום.ה.שׁביעי | 36 |
| אחר | 34 |
| מחר | 31 |
| תמיד | 30 |
| ה.יום.ה.זה | 29 |
| ב.ה.ימים.ה.הם | 24 |
| ל.נצח | 24 |
| ארבעים.שׁנה | 23 |
| ב.ה.יום.ה.שׁלישׁי | 23 |
| עד.מתי | 23 |
| אחריו | 22 |
| ה.לילה | 21 |
| יומם | 20 |
| ב.ה.ערב | 20 |
| מ.מחרת | 19 |
| ב.ה.עת.ה.הוא | 19 |
| ימים.רבים | 17 |
| יומם.ו.לילה | 16 |
| ב.ה.לילה | 16 |
| ל.פנים | 15 |
| ל.עלם | 15 |
| ב.ה.לילה.ה.הוא | 15 |
| ב.עצם.ה.יום.ה.זה | 14 |
| ב.ה.יום.ה.שׁמיני | 14 |
| שׁשׁת.ימים | 14 |
| ב.יום.ה.שׁבת | 13 |
| עד.אנה | 13 |
| ב.ימיו | 13 |
| ב.אחרית.ה.ימים | 12 |
| שׁבע.שׁנים | 12 |
| ל.עד | 12 |
| שׁשׁ.שׁנים | 12 |
| ב.כל.עת | 12 |
| ב.ה.בקר.ב.ה.בקר | 12 |
| עד.בקר | 11 |
| כל.ה.לילה | 11 |
| שׁלשׁת.ימים | 11 |

This top list accounts for 1,696 time instances, 50% of all cases. As such, it contains most of the key constructional elements for a time taxonomy.

time tokens display the importance of various specifications on the adverbial for anchoring time references and modifying the quality of the profiled time. The attributive construction, [ה] + time + ה + attributive, is very productive, accounting for 639 cases or 19% of all time adverbials. It includes demonstratives like ב.ה.עת.ה.היא, ב.ה.ימים.ה.הם, ב.ה.עת.ה.הוא, ב.ה.לילה.ה.הוא, and ב.עצם.ה.יום.ה.זה. Demonstratives account for 487 cases or 14% of the dataset. They either relate time simultaneous to (e.g. זֶה) or distant from (e.g. הִיא) speech time. The set also includes ordinals like ב.ה.יום.ה.שׁביעי, accounting for 153 cases or 4.5%. The ordinal relates time to a position on a calendrical number line.

Closely related to the demonstrative time construction is the standalone definite article, as seen in the tokens ה.יום and ה.לילה. The article anchors time to speech time, as evidenced by 76% of its uses occurring in speech sections.[[113]](#footnote-113) Standalone definites account for 221 time adverbials or 6.5% of the dataset. The demonstrative הַ, which is unique to time, shows how regular parts of the language are co-opted by the time construction for unique, idiomatic functions.

Tokens with no visible modifications on the time head, such as ב.יום, represent unique cases where an additional specifier is stored in a dependent clause.

|  |
| --- |
| 2 Sam 22:1 |
| וַיְדַבֵּ֤ר דָּוִד֙ לַֽיהוָ֔ה אֶת־דִּבְרֵ֖י הַשִּׁירָ֣ה הַזֹּ֑את בְּיֹום֩ הִצִּ֨יל  יְהוָ֥ה אֹתֹ֛ו מִכַּ֥ף כָּל־אֹיְבָ֖יו וּמִכַּ֥ף שָׁאֽוּל׃ |
| "And David spoke to YHWH the words of this song **on day when YHWH rescued** him from the palm of all his enemies and from the palm of Saul." |

|  |
| --- |
| Obad 1:12a |
| וְאַל־תִּשְׂמַ֥ח לִבְנֵֽי־יְהוּדָ֖ה בְּיֹ֣ום אָבְדָ֑ם |
| "And do not rejoice for the sons of Judah **on day of their destruction**." |

|  |
| --- |
| Lev 13:46a |
| כָּל־יְמֵ֞י אֲשֶׁ֨ר הַנֶּ֥גַע בֹּ֛ו יִטְמָ֖א |
| "**All the days which** **the** **disease is in it**, it will be unclean." |

The clause thus acts as the anchor point for the time reference. Three main constructions account for these cases: time head + construct + verbal clause, time head + relative + clause, time head + verbal clause (attributive). There are 152 cases in the dataset, or 4.5%.

The time + construct + np construction is also attested. These are cases when the np serves as an anchor, which is connected to an actant or event known in the text.

|  |
| --- |
| Gen 8:11a |
| וַתָּבֹ֨א אֵלָ֤יו הַיֹּונָה֙ לְעֵ֣ת עֶ֔רֶב |
| "And the dove came to him **toward the time of evening**." |

In this case עֶרֶב is relative to Noah and the narrative. This construction does not show up in the token list since the np can vary. The time + construct + np construction is productive, with 312 cases or 9% of the dataset.

The token ב.ימיו shows that pronominal suffixes can also serve to link a time adverbial to an actant in the text.

|  |
| --- |
| Gen 10:25a |
| וּלְעֵ֥בֶר יֻלַּ֖ד שְׁנֵ֣י בָנִ֑ים שֵׁ֣ם הָֽאֶחָ֞ד פֶּ֗לֶג כִּ֤י בְיָמָיו֙ נִפְלְגָ֣ה הָאָ֔רֶץ |
| "And to Eber was born two sons. The name of the first was Peleg, because **in his days** the land was divided." |

|  |
| --- |
| Deut 31:29a |
| כִּ֣י יָדַ֗עְתִּי אַחֲרֵ֤י מֹותִי֙ כִּֽי־הַשְׁחֵ֣ת תַּשְׁחִת֔וּן  וְסַרְתֶּ֣ם מִן־הַדֶּ֔רֶךְ אֲשֶׁ֥ר צִוִּ֖יתִי אֶתְכֶ֑ם |
| "For I know **after my death** that you will surely become corrupt and turn from the way which I have commanded you." |

|  |
| --- |
| Jer 35:7b1 |
| כִּ֠י בָּאֳהָלִ֤ים תֵּֽשְׁבוּ֙ כָּל־יְמֵיכֶ֔ם |
| "For in tents you shall dwell **for all your days**." |

These suffixes link the time head back to a participant previously mentioned in the text. There are 137 such cases in the dataset or 4%.

Terms without additional specification consist of stereotypical adverbs. These time heads are anchored to speech time, which is itself relative to a position within the textual event.

|  |
| --- |
| Exod 9:5 |
| וַיָּ֥שֶׂם יְהוָ֖ה מֹועֵ֣ד לֵאמֹ֑ר מָחָ֗ר יַעֲשֶׂ֧ה יְהוָ֛ה הַדָּבָ֥ר הַזֶּ֖ה בָּאָֽרֶץ׃ |
| "And YHWH appointed a time saying, **'Tomorrow** YHWH will do this thing in the land.'" |

These cases of null specification represent a syntactic pattern that can be considered an adverb construction, into which any word may be assimilated, even "nouns" like יוֹם:

|  |
| --- |
| Ezek 48:35 |
| וְשֵׁם־הָעִ֥יר מִיֹּ֖ום יְהוָ֥ה׀ שָֽׁמָּה׃ |
| "And the name of the city will be **from then**: YHWH is there." |

In this example, יוֹם functions like a deictic adverb, assuming a general sense of "time." This use is anchored to text time rather than to any specification, much like עוֹלָם:

|  |
| --- |
| Josh 24:2a |
| וַיֹּ֨אמֶר יְהֹושֻׁ֜עַ אֶל־כָּל־הָעָ֗ם כֹּֽה־אָמַ֣ר יְהוָה֮ אֱלֹהֵ֣י יִשְׂרָאֵל֒  בְּעֵ֣בֶר הַנָּהָ֗ר יָשְׁב֤וּ אֲבֹֽותֵיכֶם֙ מֵֽעֹולָ֔ם |
| "And Joshua said to all of the people, 'Thus says YHWH God of Israel, in the region beyond the river your fathers dwelled **from old**'." |

Cases like this demonstrate the advantage of a constructional approach. In total, there are 193 adverb constructions without prepositions and 344 with, totaling 537 cases or 16%.

The addition of the plural extends a time into a duration.

|  |
| --- |
| Gen 40:4 |
| וַ֠יִּפְקֹד שַׂ֣ר הַטַּבָּחִ֧ים אֶת־יֹוסֵ֛ף אִתָּ֖ם וַיְשָׁ֣רֶת אֹתָ֑ם וַיִּהְי֥וּ יָמִ֖ים בְּמִשְׁמָֽר׃ |
| "And the chief of the guard appointed Joseph to them. And he served them. And they were in prison for days." |

Durations without prepositions spread an event over the length of the duration, while prepositions locate events relative to the duration. Qualitative quantifiers (e.g. כל.ה.ימים, ימים.רבים) are also durational.

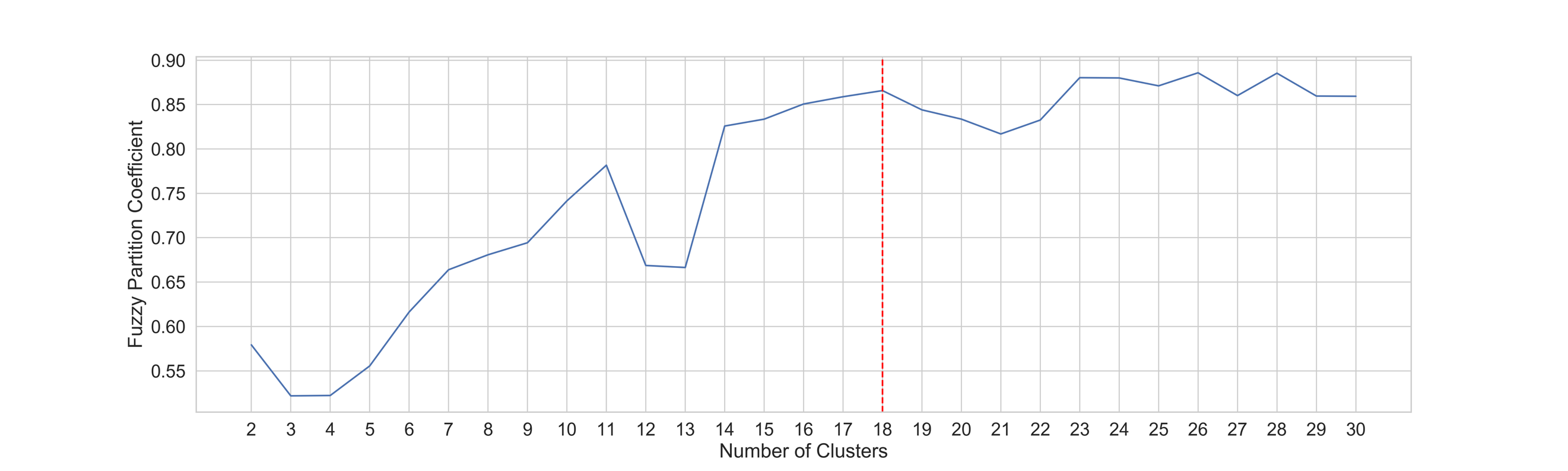
These various specifiers, alongside the prepositions, constitute the core toolkit of time adverbials. To test this, a second cluster method is applied. The table below contains an inventory of the features gleaned from tokens.

|  |  |
| --- | --- |
| **Feature** | **Abbreviation** |
| preposition (+/ø) | PPtime / time |
| definite article | H |
| attributive construction | attr\_patt |
| demonstrative | demon |
| suffix | sffx |
| construct | cons |
| construct + NP / VC (verbal clause) | cons+NP/VC |
| relative + NC (nominal clause) / VC | rela+NC/VC |
| + VC (no construct) | +VC |
| quantification | quant |
| quantification with cardinal | card |
| qualitative quantification | qual |
| plural | pl |
| dual | du |
| ordinal | ord |
| adjective | adjv |

Some tags overlap, such as "quantification" and "quantification with cardinal." This allows cases of quantification to be linked. Before counting the features, an additional restriction is made to select only those times which have only a single preposition and head element. This restricts complexity for this first stage, leaving 2,922 cases. The counts yield 83 unique combinations.

The goal of gathering this information is to see what formal clusters emerge from the data itself. A number of clustering methods are available for data with many variables. The method should reflect the diversity found in the data. C-Means is a fuzzy clustering algorithm, which allows for various degrees of membership for clusters.[[114]](#footnote-114) An item A, for instance, can be 40% aligned with one cluster but 90% aligned with another.[[115]](#footnote-115) Methodologically, C-Means seeks to maximize the goodness of fit between as many members as possible. One downside is that C-Means needs to be told how many clusters to make in advance. This can be mediated by iteratively running C-Means on an increasing number of clusters while measuring how good the fits are. This allows one to choose the ideal number of clusters.

# Figure : C-Means Time Adverbial Cluster Tests, from number of clusters = 2 to 30



The test shows that the ideal number of clusters is 18, since there is no significant gain after that. This number results in the following, listed with number of strong (>90% affinity) members.

# Figure : Time Adverbial Clusters based on C-Means and Specification Features

|  |  |  |
| --- | --- | --- |
| **Cluster Components** | **Example** | **Size** |
| PPtime.H.attr\_patt.demon | מן.ה.יום.ה.הוא | 382 |
| PPtime | כ.אתמול.שׁלשׁום | 344 |
| PPtime.H | ב.ה.יום | 276 |
| time.H | ה.יום | 221 |
| PPtime.construct.cons+NP | כ.מות.אחאב | 199 |
| time | תמיד | 193 |
| time.pl.quant.card | שׁבעת.ימים | 190 |
| PPtime.H.attr\_patt.ord.adjv | ב.ה.יום.ה.שׁביעי | 149 |
| time.quant.card | שׁתים.ו.שׁמונים.שׁנה.ו.שׁבע.מאות.שׁנה | 135 |
| PPtime.construct.cons+VC | ב.עת | 97 |
| PPtime.pl.sffx | אחר.שׁלוחיה | 78 |
| time.H.quant.qual | כל.ה.יום | 54 |
| PPtime.H.pl.attr\_patt.demon | ב.ה.ימים.ה.הם | 50 |
| time.pl.quant.qual.construct.cons+NP | כל.ימי.חייה | 39 |
| time.H.pl.quant.qual | כל.ה.ימים | 37 |
| PPtime.pl | מ.ימים.ימימה | 32 |
| PPtime.quant.card | ב.יום.אחד | 27 |
| PPtime.quant.qual | ב.כל.עת | 0 |

Note that the last cluster does not have any time adverbials with affinity above 90%. The qualitative quantifier without a definite article does not constitute a strong group. The remaining clusters contain 2,503 time adverbials, accounting for 74% of all times in the Hebrew Bible (except for the excluded adverbs). This confirms the hypothesis that these features are indeed the primary values used in modifying time, though there is yet room for others.

What do the components mean? Fillmore's Construction Grammar analysis of time constructions isolates the features shown below as inherent to time semantics.[[116]](#footnote-116)

distance

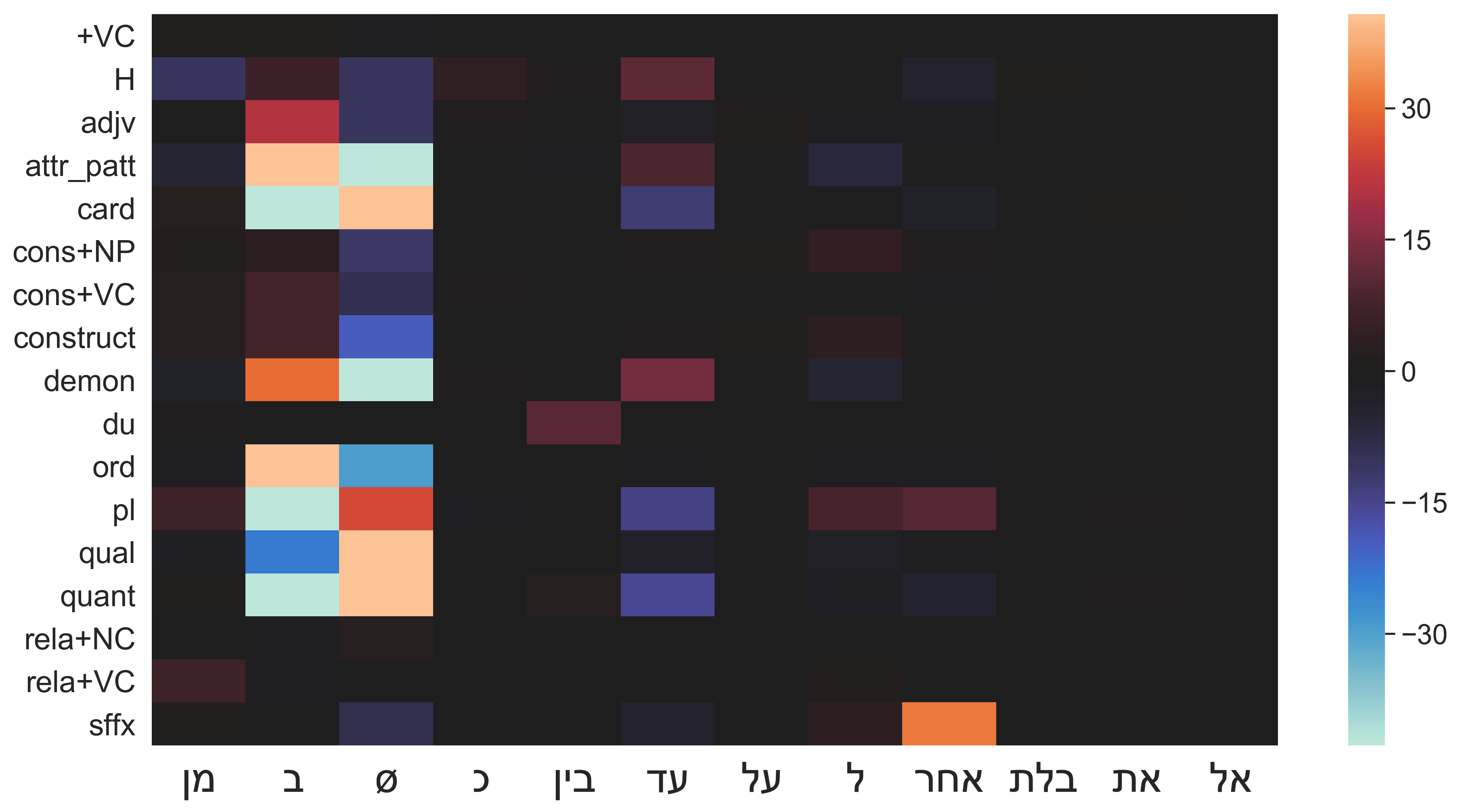
direction

# Figure : Fillmore's Vector Construction

All of the specifications seen up to this point fit into a specifier of direction (prepositions), distance (quantifiers), landmark (a time head), and target (anchors like demonstratives, suffixes, etc.).[[117]](#footnote-117) Fillmore notes that a target can be "Anaphoric, meaning that the Target is anchored to a temporal reference point recoverable in the ongoing discourse."[[118]](#footnote-118) That is certainly the case with the Hebrew reference points.

Before closing this section on time adverbial taxonomy, the model of temporal prepositions can be improved with the additional data. A test for associations between the prepositions and these specifications yields the heat chart below. Blue represents repelled constructions, while red represents attracted ones.

# Figure : Heatmap of Attractions between Adverbial Prepositions and Specifications (Fisher's Scores)



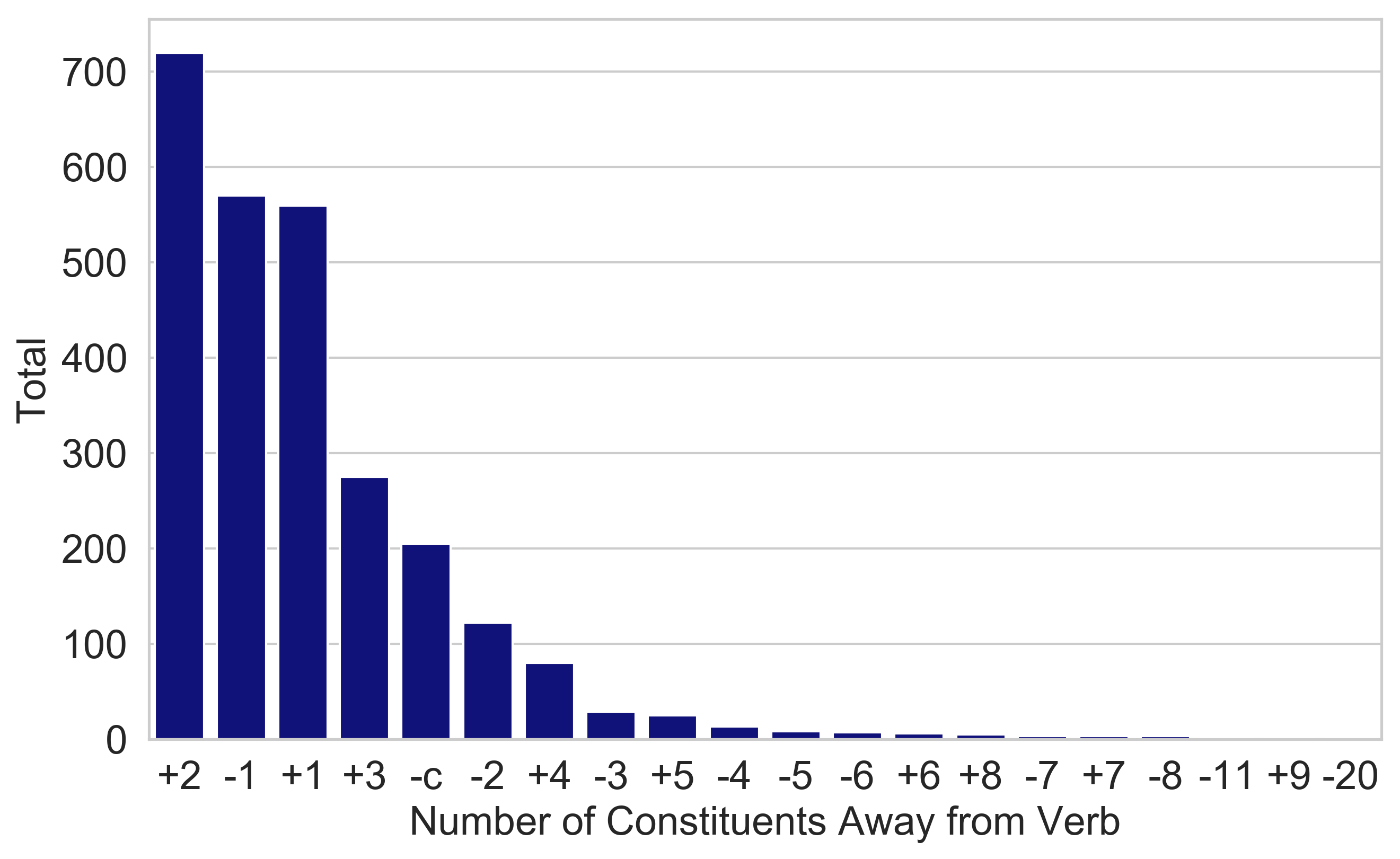
The data reveals informative semantic characteristics of the prepositions. Most notably, it shows an opposition between non-prepositional time (ø) and בְּ. This is not so surprising, given that non-prepositional time tends to be plural duratives, as confirmed by the strong attraction of ø to the plural and quantification. What is surprising however, is the apparent opposition between עַד and לְ. עַד is attracted to demonstratives and definiteness, markers of singularity, while לְ is attracted to plurals. This suggests a difference in the semantic profile of these two prepositions, despite their relative similarity. Namely, עַד prefers point-based time, while לְ prefers durative time. Further exploration, as well as others (e.g. אַחַר and suffixes, מִן and plurals), is left to the full project.

**Verb Collocations**

One of the greatest prospective payoffs for understanding time adverbials is the potential for shedding light on the verbal system. The interaction of verbal constructions with time show informative collocation patterns, just as the internal components of time do. This enables clearer forms to illuminate more opaque ones. Verbal tense and aspect offer complex challenges in and of themselves. This section seeks to offer, by way of preview, basic collocational interactions between time and verb constructions. Three areas in particular are previewed: the default position of time in the clause, verb tense collocations with time, and verb lexeme collocations with time.

The position of time in its clause plays a key role in its function.[[119]](#footnote-119) Gross, in his study of Biblical Hebrew adverbs, finds that adverbs in preverbal position are marked.[[120]](#footnote-120) Van der Merwe likewise finds an association between the preverbal and narratival anchoring. He identifies four types: 1. preceding clause with וַיְּהִי (and equivalents) + subsequent clause, 2. preverbal, 3. final position, 4, middle position.[[121]](#footnote-121) In 1 Samuel he counts 17% of type 1, 16% of type 2, 54% of type 3, and 14% of type 4.[[122]](#footnote-122) The post-verbal position is the most common, with 68% total. The data in *BHSA* very closely matches Van der Merwe's results, as seen below. Note that "-" means preverbal (fronted); the "-c" tag represents time adverbial clauses with וַיְּהִי and equivalents.

# Figure : Time Adverbial Distance from Verb (in number of phrase constituents)



|  | Total |
| --- | --- |
| +2 | 719 |
| -1 | 570 |
| +1 | 559 |
| +3 | 275 |
| -c | 205 |
| -2 | 122 |
| +4 | 80 |
| -3 | 29 |
| +5 | 25 |
| -4 | 13 |
| -5 | 8 |
| -6 | 7 |
| +6 | 6 |
| +8 | 5 |
| -7 | 3 |
| +7 | 3 |
| -8 | 3 |
| -11 | 1 |
| +9 | 1 |
| -20 | 1 |

Simplified verbal and preverbal counts are below along with their proportions. With Van der Merwe, the "-c" וַיְּהִי type is considered part of a subsequent clause and is preverbal.[[123]](#footnote-123)

# Figure : Simplified Time Adverbial Position Counts

|  |  |  |
| --- | --- | --- |
|  | Total | % |
| post-verbal | 1673 | 63 |
| preverbal | 962 | 37 |

The post-verbal uses account for 63% of all occurrences, strikingly close to Van der Merwe's 68% in 1 Samuel. The majority of cases, 75%, are only 1 or 2 constituents removed from the verb. Further research will expand on this and its functional effects.

One area not addressed by Van der Merwe is the potential for associations between position and verb tense. The table and heatmap show that position is associated with verb choice.

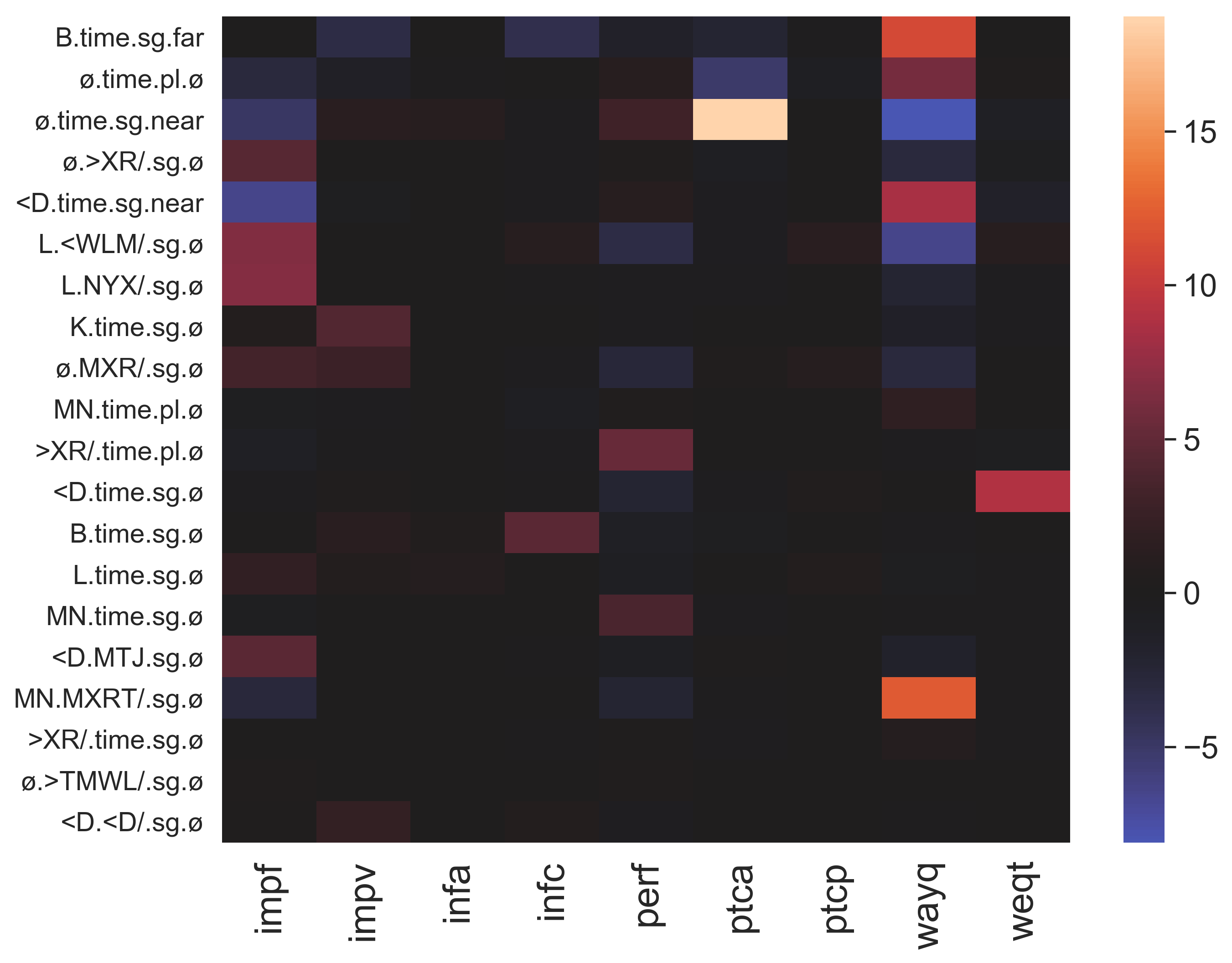
# Figure : Time Adverbial Position and Verb Tense Collocations (heatmap with Fisher's Sores)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | |  | postverbal (raw counts) | fronted  (raw counts) | | wayq | 469 | 141 | | perf | 366 | 317 | | impf | 355 | 421 | | weqt | 157 | 27 | | ptca | 147 | 37 | | infc | 102 | 2 | | impv | 65 | 12 | | ptcp | 8 | 3 | | infa | 4 | 2 | |  |

The heatmap contains the Fisher's association scores, with red or salmon representing strong associations and blue, black, or ice-color representing strong disassociations. The data shows that the *qatal* ("perf") and *yiqtol* ("impf") both have strong associations with preverbal time. The *wayyiqtol* and *weqetal*, on the other hand, strongly prefer postverbal time. The final project will explain the semantic causations behind these differences, but it is possible to glean some initial clues by looking at which time adverbials the tenses prefer.

Verb tense and time collocation tendencies can be retrieved by counting co-occurrences between tense and groups of time adverbials. The 18 main clusters identified in section 1 can be simplified into a 4 part tag, consisting of 1. preposition lexeme / ø, 2. time head (if adverb construction, then use the lexeme), 3. quantity (sg/pl),[[124]](#footnote-124) and 4. near/far demonstratives (הַ, זֶה, הִיא, etc.). Annotating time adverbials with these tags results in 102 unique combinations. The heatmap below contains the most "polarizing" time adverbials and their Fisher's associations with tenses. The Hebrew is transcribed for technical reasons.[[125]](#footnote-125)

# Figure : Heatmap of Time Adverbial Tag and Verb Tense Collocations\



Strong associations can be seen in *wayyiqtol*, *yiqtol*, *weqetal*. Most striking is the opposition between *yiqtol* and *wayyiqtol*, as seen below with their coordinated top associations.

# Figure : *Wayyiqtol*/*Yiqtol* Adverbial Associations, sorted for association

|  |  |
| --- | --- |
|  |  |

*Wayyiqtol* shows strong associations with מִמָּחֳרָת, בְּ + times with far demonstratives (e.g. בַּיוֹם הַהוּא), עַד + times with near demonstratives (e.g. עַד הַיוֹם הַזֶה), quantified times (duratives), and the adverb construction with לָיְלָה. The *yiqtol* has more associations with adverb constructions, especially לָנֶצַח, לְעוֹלָם, עַד־מָתַי, אַחַר, מַחַר, לְעַד, and טֶרֶם. In general, the *wayyiqtol* times indicate points near or far to narrative time whereas the *yiqtol* times prefer unbounded durations. This offers at least a preliminary and general confirmation of the well-known aspectual oppositions between *yiqtol* and *wayyiqtol*. Finally, the strong association between the active participle (ptca) is likewise intriguing, deriving from regular co-occurrence with the standalone הַ demonstrative, e.g. הַיוֹם, indicating time relative to the present text time.[[126]](#footnote-126)

The fact that that *wayyiqtol* with its punctual time preference also shows association with the durative construction (ø.time.pl.ø) shows that verb tense is not the only relevant factor in verb and time collocations. The lexical aspect content (*Aktionsart*) of the primary verb also plays a role. Lexical aspect refers to Vendler's classes of verbs as seen below:

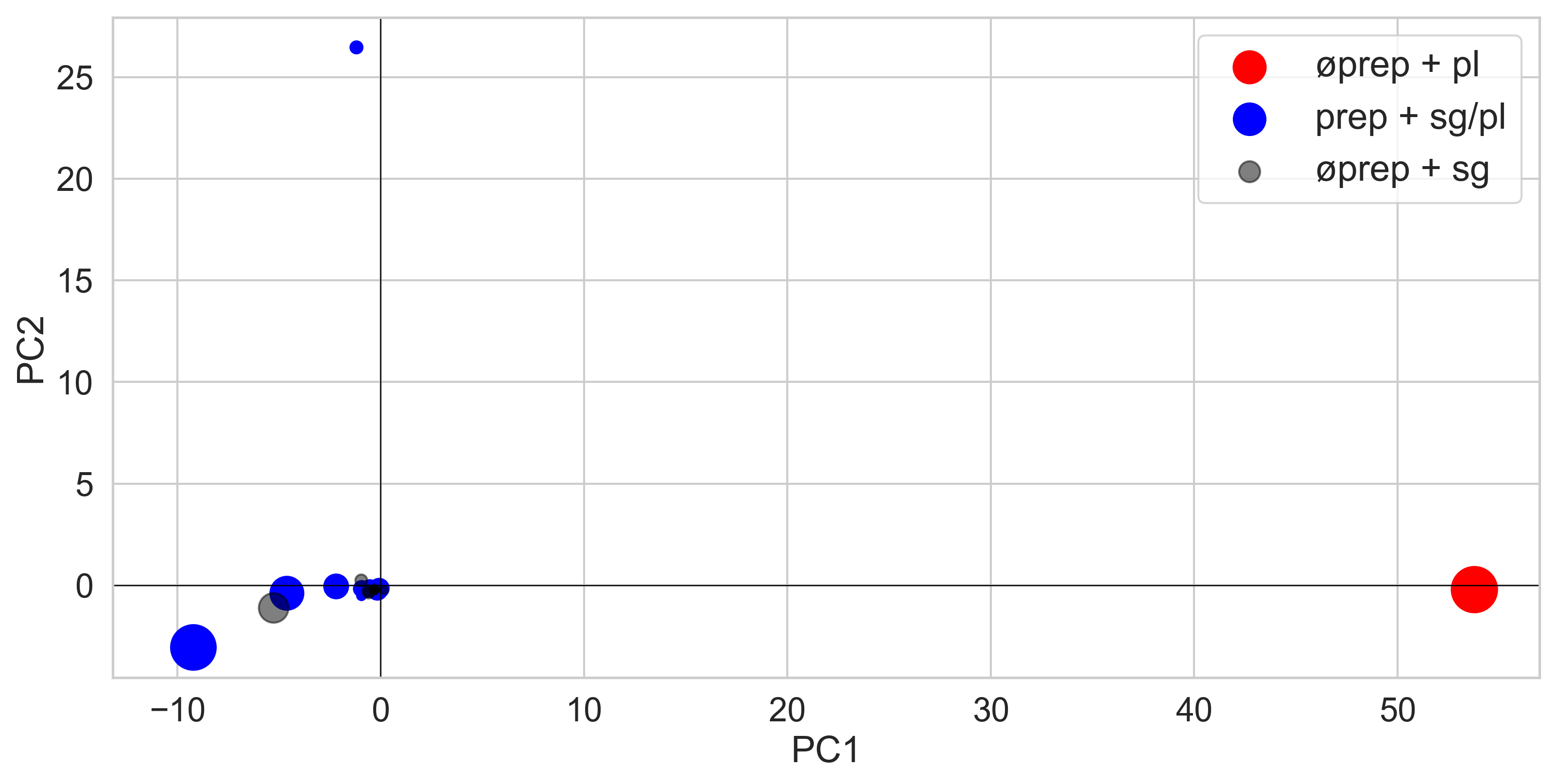
# Figure : Vendler's Lexical Verb Classes (+semelfactive)[[127]](#footnote-127)

|  |  |  |  |
| --- | --- | --- | --- |
| **Situations** | **Static** | **Durative** | **Telic** |
| State | + | + | - |
| Activity | - | + | - |
| Accomplishment | - | + | + |
| Semelfactive | - | - | - |
| Achievement | - | - | + |

Recent research has focused on a broader definition of lexical aspect to include other arguments in the clause, thus looking at a whole event rather than a single verb.[[128]](#footnote-128) The combinability of time adverbials with a given event is used as a test for the event's aspectual class.[[129]](#footnote-129) The durative construction (ø.time.pl.ø) is expected to collocate with events that are compatible with durativity (states, activities, accomplishments but not achievements).

In Biblical Hebrew, unmarked durative times are strongly separated from other adverbials on the basis of their verb collocation preferences. It is possible to show this using the 4-part time tags and association tests with verb lexemes. Principle Component Analysis is a statistical method that can reveal distances between items in a dataset based on the similarity and dissimilarity of their feature counts.[[130]](#footnote-130) The result is a two-dimensional space that can be plotted to visualize the differences. The graph below shows the resulting distance between durative adverbials and other adverbials. The size of the point is relative to the number of adverbials the point represents, with bigger points representing more.

# Figure : Principle Component Space for Verb Lexeme and Adverbial Collocation Preferences



The PCA algorithm separates the unmarked durative time constructions (red) on the basis of the following influences (loading scores):

|  |  |
| --- | --- |
|  | Influence (Loading Scores) |
| מלך.qal | 4.579893 |
| חיה.qal | 2.215228 |
| עבד.qal | 0.951635 |
| .ישׁבqal | 0.665403 |
| סגר.hif | 0.540989 |
| ירא.qal | 0.305794 |
| אבל.hit | 0.281892 |
| הלך.hif | 0.277388 |
| אכל.qal | 0.225016 |

The verbs מָלַךְ, חָיָה, עָבַד, יָשַׁב, אָבַל, and הָלַךְ are all states or activities which are expected to collocate with durative time adverbials. However there are some surprises, especially סָגַר and אָכַל, which are typically achievements and thus considered not associated with duration. Examples of those occurrences are shown below.

|  |
| --- |
| Lev 13:4b |
| וְהִסְגִּ֧יר הַכֹּהֵ֛ן אֶת־הַנֶּ֖גַע שִׁבְעַ֥ת יָמִֽים׃ |
| "And the priest shall close up the wound for seven days." |

|  |  |
| --- | --- |
| Gen 3:15b2 | |
| וְעָפָ֥ר תֹּאכַ֖ל כָּל־יְמֵ֥י חַיֶּֽיךָ׃ |
| "And dust you shall eat for all the days of your life." | |

These cases demonstrate how events which are normally achievements can be construed in different ways. The first case is an example of what Haspelmath calls the "purposive extent," in which the durative does not condition the aspect of the action, but rather of the resulting state.[[131]](#footnote-131) The latter case is an example where the action is construed as "habitual" and thus repeating.[[132]](#footnote-132) Note that these uses also contain an amenable verb tense (*weqetal* and *yiqtol*). Identifying further cases of these construals is a task for the complete project.[[133]](#footnote-133)

**Conclusions**

It has been shown that time adverbials are a vital component of Biblical Hebrew, possessing both a broad distribution across the corpus, as well as a productive repertoire for expressing temporality. Each part of a time adverbial construction is not random or isolated but exists in relationship to surrounding components. That is true both within time constructions and without. This essay has shown the potential promise a full description of time has for analysis of the verbal system. And it has demonstrated that broad and complex phenomena can be captured using state-of-the art computational linguistic techniques. A complete study will expand on this data, exploring the many exciting and intricate functions and tendencies of Biblical Hebrew time adverbials.

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2. "This is so much so that it creates the impression that BH did not have any conventions in this regard that were unique to it and that could be used to express significant [temporal] nuances in a BH narrative." Christo H.J. Van der Merwe, “Reconsidering Biblical Hebrew Temporal Expressions,” *ZAH* 10, no. 1 (1997): 42. [↑](#footnote-ref-2)
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8. See footnote 11. [↑](#footnote-ref-8)
9. E.g. Adele E. Goldberg, Devin M. Casenhiser, and Nitya Sethuraman, “Learning Argument Structure Generalizations,” *Cognitive Linguistics* 15, no. 3 (2004): 289–316; Susan Hunston and Gill Francis, *Pattern Grammar: A Corpus-Driven Approach to the Lexical Grammar of English*, vol. 4, Studies in Corpus Linguistics (Amsterdam: John Benjamins, 2000). [↑](#footnote-ref-9)
10. E.g. Natalia Levshina and Kris Heylen, “A Radically Data-Driven Construction Grammar: Experiments with Dutch Causative Constructions,” in *Extending the Scope of Construction Grammar*, ed. Ronny Boogaart, Timothy Colleman, and Gijsbert Rutten, Cognitive Linguistics Research 54 (Berlin: De Gruyter Mouton, 2014), 17–46. [↑](#footnote-ref-10)
11. Wilhelm Gesenius, Emiel Friedrich Kautsch, and A.E. Cowley, *Gesenius’ Hebrew Grammar*, Second. (Oxford: Clarendon Press, 1909), §100, 118; Paul Joüon and T. Muraoka, *A Grammar of Biblical Hebrew*, Subsidia Biblica 14/1-14/2 (Roma: Editrice Pontificio Istituto Biblio, 1996), §102a-c, 126i, 133; Bruce Waltke and M. O’Connor, *An Introduction to Biblical Hebrew Syntax* (Winona Lake: Eisenbrauns, 1990), §10.2.2c, 11.2, 39.3.1h; Carl Brockelmann, *Hebräische Syntax* (Neukirchen: Kreis Moers, Verlag der Buchhandliung des Erziehungsvereins, 1956), 92, 98–109; Bill T. Arnold and John H. Choi, *A Guide to Biblical Hebrew Syntax* (New York, N.Y: Cambridge University Press, 2003), 18–19, 103–110, 127; Ronald J. Williams and John C. Beckman, *Williams’ Hebrew Syntax*, 3rd ed. (Toronto: University of Toronto Press, 2007), 21, 137, 97–136; Jan Pieter Lettinga, *Grammaire de l’hébreu biblique* (Leiden ; Boston: Brill, 1999), 144, 177; Eduard König, *Historisch-Kritisches Lehrgebäude Der Hebräischen Sprache* (Leipzig: J.C. Hinrichs’sche Buchhandlung, 1895), 234, 262–265; Hans Bauer, Pontus Leander, and Paul Kahle, *Historische Grammatik Der Hebräischen Sprache Des Alten Testamentes* (Halle A.S.: M. Niemeyer, 1922), §80, 80l. [↑](#footnote-ref-11)
12. *Joüon*, §102b, 166k; *IBHS*, 39.3.1h. [↑](#footnote-ref-12)
13. See references in 1111. Gibson, however, refuses the terminology of "accusative." John C. L. Gibson, *Davidson’s Introductory Hebrew Grammar Syntax*, 4. ed. (Edinburgh: Clark, 1994), 24. [↑](#footnote-ref-13)
14. *IBHS*, §8.1. [↑](#footnote-ref-14)
15. Van der Merwe, Naudé, and Kroeze, *BHRG*, §33.1; *Joüon*, 440. [↑](#footnote-ref-15)
16. *GKC*, §118; *Joüon*, §126; *IBHS*, §39.3.1d; Brockelmann, *Hebräische Syntax*, 92; Arnold and Choi, *A Guide*, 18–21; Gibson, *Davidson’s*, 140. [↑](#footnote-ref-16)
17. *GKC*, §118i; *Joüon*, §126i; *IBHS*, §10.2.2c. [↑](#footnote-ref-17)
18. *GKC*, §118i,k; *Joüon*, 126i; Van der Merwe, Naudé, and Kroeze, *BHRG*, §33.3; Brockelmann, *Hebräische Syntax*, 92; Arnold and Choi, *A Guide*, 19; Williams and Beckman, *Williams’*, 21. But see the more nuanced approach of Waltke and O'Connor, who divide into "deictics" and "independents." *IBHS*, 39.3.1h. [↑](#footnote-ref-18)
19. Van der Merwe, Naudé, and Kroeze, *BHRG*, §39; *GKC*, §119; *Joüon*, §133; *IBHS*, §11; Brockelmann, *Hebräische Syntax*, 98–109; Williams and Beckman, *Williams’*, 97–136. [↑](#footnote-ref-19)
20. Van der Merwe, Naudé, and Kroeze, *BHRG*, §39.1.4. [↑](#footnote-ref-20)
21. Ibid.; *GKC*, §119a; *IBHS*, §11.2d; Brockelmann, *Hebräische Syntax*, 92. [↑](#footnote-ref-21)
22. DeVries, *Yesterday*; Brin, *The Concept of Time*. [↑](#footnote-ref-22)
23. DeVries, *Yesterday*, 38. [↑](#footnote-ref-23)
24. Ibid. [↑](#footnote-ref-24)
25. Brin, *The Concept of Time*, 25–51. [↑](#footnote-ref-25)
26. Ibid., 25. [↑](#footnote-ref-26)
27. Ibid., 52. [↑](#footnote-ref-27)
28. Ibid., 78–92. [↑](#footnote-ref-28)
29. Ibid., 58–64, 65–77. [↑](#footnote-ref-29)
30. Ibid., 95–124. [↑](#footnote-ref-30)
31. Ibid., 147–50. [↑](#footnote-ref-31)
32. Ibid., 153–166. [↑](#footnote-ref-32)
33. Ibid., 177–183. [↑](#footnote-ref-33)
34. Ibid., 184–185. [↑](#footnote-ref-34)
35. Ibid., 187. [↑](#footnote-ref-35)
36. Van der Merwe, “Reconsidering,” 1, 44–45. [↑](#footnote-ref-36)
37. Randolph Quirk, ed., *A Comprehensive Grammar of the English Language* (London ; New York: Longman, 1985), 528. [↑](#footnote-ref-37)
38. Janet Harkness, “Time Adverbials in English and Reference Time,” in *Essays on Tensing in English*, ed. Alfred Schopf, Linguistische Arbeiten 185, 228 (Tübingen: Max Niemeyer Verlag, 1987), 71–110. [↑](#footnote-ref-38)
39. Van der Merwe, “Reconsidering,” 48–49. [↑](#footnote-ref-39)
40. Ibid., 49. [↑](#footnote-ref-40)
41. E.g. *IBHS*, 49, 42–80. [↑](#footnote-ref-41)
42. E.g. Cynthia L. Miller-Naudé and Jacobus A. Naudé, “A Re-Examination of Grammatical Categorization in Biblical Hebrew,” in *From Ancient Manuscripts to Modern Dictionaries: Select Studies in Aramaic, Hebrew and Greek*, ed. Society of Biblical Literature, Tarsee Li, and Keith D. Dyer, Perspectives on linguistics and ancient languages 9 (Piscataway, NJ: Gorgias Press, 2017), 273–308. [↑](#footnote-ref-42)
43. Van der Merwe, Naudé, and Kroeze, *BHRG*, §40.6, 40.39. [↑](#footnote-ref-43)
44. Ibid., §24.4.4. [↑](#footnote-ref-44)
45. William Croft, *Radical Construction Grammar: Syntactic Theory in Typological Perspective* (Oxford ; New York: Oxford University Press, 2001), 15. [↑](#footnote-ref-45)
46. Ibid., 29–33. See also Martin Haspelmath, “Pre-Established Categories Don’t Exist: Consequences for Language Description and Typology,” *Linguistic Typology* 11 (2007): 119–132. [↑](#footnote-ref-46)
47. Adele E. Goldberg, *Constructions: A Construction Grammar Approach to Argument Structure* (Chicago: University of Chicago Press, 1995), 6–7; Croft, *Radical Construction Grammar*, 14–18. [↑](#footnote-ref-47)
48. For languages with productive adverb morphology, such as in English with -*ly*, adverbs are associated with the form. And just as novel words can be paired together with English -*ly* (e.g. "*That was done quite Cambridgely*"), Hebrew can use new words in adverb patterns. A specific example of this phenomenon is reviewed below with the "adverb" use of יוֹם. [↑](#footnote-ref-48)
49. "The constructional tail has come to wag the syntactic dog: everything from words to the most general syntactic and semantic rules can be represented as constructions." Croft, *Radical Construction Grammar*, 17. [↑](#footnote-ref-49)
50. Goldberg, *Constructions*, 7. [↑](#footnote-ref-50)
51. Derived from Goldberg with Hebrew examples added. See also Croft's version. Adele E. Goldberg, *Constructions at Work: The Nature of Generalization in Language*, Oxford linguistics (Oxford ; New York: Oxford University Press, 2006), 5; Croft, *Radical Construction Grammar*, 17. [↑](#footnote-ref-51)
52. *IBHS*, §39.3.1h. [↑](#footnote-ref-52)
53. Van der Merwe, Naudé, and Kroeze, *BHRG*, §39.14b. [↑](#footnote-ref-53)
54. Brin, *The Concept of Time*, 55. Obviously the extension to duration is motivated by the use of the plural. Though the derivation of constructions might be semantically motivated, the resulting meaning is not always predictable. Goldberg, *Constructions at Work*, 69–72. [↑](#footnote-ref-54)
55. Van der Merwe, Naudé, and Kroeze, *BHRG*, §40.25. [↑](#footnote-ref-55)
56. "According to Construction Grammar, a distinct construction is defined to exist if one or more of its properties are not strictly predictable from knowledge of other constructions existing in the grammar." Goldberg, *Constructions*, 4. [↑](#footnote-ref-56)
57. Nick C. Ellis, Matthew Brook O’Donnell, and Ute Römer, “Usage-Based Language: Investigating the Latent Structures That Underpin Acquisition: Usage-Based Language,” *Language Learning* 63 (March 2013): 25–51. [↑](#footnote-ref-57)
58. Goldberg, Casenhiser, and Sethuraman, “Learning.” [↑](#footnote-ref-58)
59. R. Xiao, “Collocation,” in *The Cambridge Handbook of English Corpus Linguistics*, ed. D. Biber and R. Reppen (Cambridge: Cambridge University, 2015), 106–124. [↑](#footnote-ref-59)
60. See the analysis below. [↑](#footnote-ref-60)
61. Natalia Levshina, *How to Do Linguistics with R: Data Exploration and Statistical Analysis* (Amsterdam: John Benjamins, 2015), 223–239. [↑](#footnote-ref-61)
62. Anatol Stefanowitsch, “Empirical Cognitive Semantics: Some Thoughts,” in *Quantitative Methods in Cognitive Semantics: Corpus-Driven Approaches*, ed. Dylan Glynn and Kertin Fischer, Cognitive Linguistics Research 46 (Berlin: De Gruyter Mouton, 2010), 355–380; Stefan Fuhs, “The Aspectual Coercion of the English Durative Adverbial,” in *Quantitative Methods in Cognitive Semantics: Corpus-Driven Approaches*, ed. Dylan Glynn and Kerstin Fischer, Cognitive Linguistics Research 46 (Berlin: De Gruyter Mouton, 2010), 137–154; Levshina and Heylen, “Experiments with Dutch Causative Constructions”; Stefan Th. Gries and Anatol Stefanowitsch, “Extending Collostructional Analysis: A Corpus-Based Perspective on ‘Alternations,’” *International Journal of Corpus Linguistics* 9, no. 1 (2004): 97–125. [↑](#footnote-ref-62)
63. *BHSA* stands for *Biblia Hebraica Stuttgartensia Amstelodamensis*. Dirk Roorda et al., *ETCBC/Bhsa* (Zenodo, 2019), accessed April 23, 2019, https://zenodo.org/record/2554324. [↑](#footnote-ref-63)
64. The check consisted of tagging 1140 representative surface forms for accuracy, as well as the correction of problematic cases. See the process in https://nbviewer.jupyter.org/github/CambridgeSemiticsLab/  
    BH\_time\_collocations/blob/master/analysis/preprocessing/chunking.ipynb. [↑](#footnote-ref-64)
65. Dirk Roorda, “The Hebrew Bible as Data: Laboratory - Sharing - Experiences,” in *Clarin in the Low Countries*, ed. J. Odijk and A. Van Hessen (London: Ubiquity Press, 2017); Eric Jones et al., *SciPy: Open Source Scientific Tools for Python*, 2001, http://www.scipy.org/; John D. Hunter, “Matplotlib: A 2D Graphics Environment,” *Computing in Science & Engineering* 9 (2007): 90–95. [↑](#footnote-ref-65)
66. Collostruction Analysis has been designed specifically for the non-normal distributions present in natural language. It relies on the nonparametric Fisher's Exact association test. It also has the express purpose of describing associations between lexical and grammatical units. Anatol Stefanowitsch and Stefan Th. Gries, “Collostructions: Investigating the Interaction of Words and Constructions,” *International Journal of Corpus Linguistics* 8, no. 2 (2003): 209–243. [↑](#footnote-ref-66)
67. Haspelmath, *From Space to Time*; Charles Fillmore, “Mini-Grammars of Some Time-When Expressions in English,” in *Complex Sentences in Grammar and Discourse: Essays in Honor of Sandra A. Thompson*, ed. Joan L. Bybee, Sandra A. Thompson, and Michael Noonan (Amsterdam: Benjamins, 2002); William Croft, *Verbs: Aspect and Causal Structure* (Oxford: Oxford University Press, 2012). [↑](#footnote-ref-67)
68. "Atom" objects are parts of whole objects which have gaps due to other intervening objects. Cody Kingham and Wido Van Peursen, “The ETCBC Database of the Hebrew Bible,” *Journal for Semitics* 27, no. 1 (2018): 3–6. [↑](#footnote-ref-68)
69. See features > function in the documentation. Dirk Roorda et al., “Biblia Hebraica Stuttgartensia (Amstelodamensis) Documentation,” Documentation, *ETCBC Github*, last modified April 10, 2019, accessed April 23, 2019, https://etcbc.github.io/bhsa/. [↑](#footnote-ref-69)
70. Goldberg, Casenhiser, and Sethuraman, “Learning”; Ellis, O’Donnell, and Römer, “Usage-Based Language.” [↑](#footnote-ref-70)
71. Adele E. Goldberg, *Explain Me This: Creativity, Competition, and the Partial Productivity of Constructions* (Princeton, NJ: Princeton University Press, 2019). [↑](#footnote-ref-71)
72. Stefanowitsch and Gries, “Collostructions.” [↑](#footnote-ref-72)
73. Adapted from Levshina, *Linguistics with R*, 223–224; Gries, “Dispersions and Adjusted Frequencies.” [↑](#footnote-ref-73)
74. Note that B here is slightly different from the example provided, as it represents here *all* other targets besides A. [↑](#footnote-ref-74)
75. This is the method of Collostruction Analysis established by Stefanowitsch and Gries. Stefanowitsch and Gries, “Collostructions.” [↑](#footnote-ref-75)
76. That is, the log10 of 0.05 combined with a positive or negative sign depending on expected values, as is done in Collostructional analysis. Ibid. [↑](#footnote-ref-76)
77. A few of the *BHSA* time phrases are unnecessarily split into two parts. These are merged in the "Chunking" notebook. https://nbviewer.jupyter.org/github/CambridgeSemiticsLab/BH\_time\_collocations/blob/master/analysis/  
    preprocessing/chunking.ipynb [↑](#footnote-ref-77)
78. E.g. Van der Merwe, Naudé, and Kroeze, *BHRG*, §33.1. [↑](#footnote-ref-78)
79. E.g. Van der Merwe, “Reference Time.” [↑](#footnote-ref-79)
80. Levshina, *Linguistics with R*, 82–85. [↑](#footnote-ref-80)
81. Gries, “Dispersions and Adjusted Frequencies,” 415–419. [↑](#footnote-ref-81)
82. Gries's original formula actually expresses the opposite, with 0 being perfectly distributed and 1 being uneven. However, I have adjusted the scores to more intuitively align evenness with size. This is done by simply subtracting each of Gries's original values from 1. [↑](#footnote-ref-82)
83. This assumption also needs to be tested. It is conceivable that for some verbs, especially cases like וַיְּהִי, the time adverbial is actually a necessary element. This is yet another area of investigation for the full project. [↑](#footnote-ref-83)
84. These counts include locational complement arguments, which are isolated by selecting all complement phrases headed by a word that is statistically associated with the location argument. See that process in the following notebook. https://nbviewer.jupyter.org/github/CambridgeSemiticsLab/BH\_time\_collocations/blob/master/analysis/  
    preprocessing/head\_function\_associations.ipynb [↑](#footnote-ref-84)
85. The association score is the Fisher's Exact p-value with log10 transformation, as per Collostructional Analysis. A negative sign is added to scores that have a lower than expected frequency (compared to a random distribution). Stefanowitsch and Gries, “Collostructions.” [↑](#footnote-ref-85)
86. The zero-marked durative is the typical form cross linguistically. Haspelmath, *From Space to Time*, 120–126. [↑](#footnote-ref-86)
87. Ibid., 17–21. [↑](#footnote-ref-87)
88. Croft, *Radical Construction Grammar*, 258. See also Stephen L. Shead, *Radical Frame Semantics and Biblical Hebrew: Exploring Lexical Semantics*, BibInt 108 (Leiden: Brill, 2011), 104. [↑](#footnote-ref-88)
89. Note that the number of יוֹם reflected here, 1,524, is lower than Brin's count of 2,317 since this count only includes adverbial uses of time. Brin, *The Concept of Time*, 52. [↑](#footnote-ref-89)
90. Haspelmath, *From Space to Time*, 25–26. [↑](#footnote-ref-90)
91. Ibid., 25. [↑](#footnote-ref-91)
92. Ibid., 26. [↑](#footnote-ref-92)
93. Note that these cases are not quantifier uses, since quantifier uses are excluded as semantic heads. [↑](#footnote-ref-93)
94. The math is derived from the following article. “Normalizing Word Counts,” *The Grammar Lab*, accessed April 26, 2019, http://www.thegrammarlab.com/?p=160. [↑](#footnote-ref-94)
95. Van der Merwe, “Reconsidering,” 45. [↑](#footnote-ref-95)
96. Van der Merwe, Naudé, and Kroeze, *BHRG*, §39; *GKC*, §119; *Joüon*, §133; *IBHS*, §11; Brockelmann, *Hebräische Syntax*, 98–109; Williams and Beckman, *Williams’*, 97–136. [↑](#footnote-ref-96)
97. The final version of the project will optimize and reclassify these cases. [↑](#footnote-ref-97)
98. Exod 13:7; Deut 9:25 (אֵת); 1 Sam 25:8; Neh 12:22 (עַל); 2 Sam 23:13 (אֶל). [↑](#footnote-ref-98)
99. Van der Merwe, Naudé, and Kroeze, *BHRG*, §39.1.4. [↑](#footnote-ref-99)
100. Haspelmath, *From Space to Time*, 23–24. [↑](#footnote-ref-100)
101. Ibid., 23–42. [↑](#footnote-ref-101)
102. As derived from Haspelmath. Ibid., 32–35. [↑](#footnote-ref-102)
103. Van der Merwe, Naudé, and Kroeze, *BHRG*, § 39.2, 39.14. [↑](#footnote-ref-103)
104. Ibid., §39.11, 39.19; Haspelmath, *From Space to Time*, 35. [↑](#footnote-ref-104)
105. The association of עֶרֶב with בְּ is weaker, however, with a score of 1.67, just above the threshold of 1.3. [↑](#footnote-ref-105)
106. מָה is also present, though it is not statistically significant. [↑](#footnote-ref-106)
107. Gen 19:34; Exod 9:6, 18:13, 32:6, 32:30; Num 17:6, 17:23; Josh 5:11, 5:12; Judg 6:38, 9:42, 21:4; 1 Sam 5:3, 5:4, 11:11, 18:10, 20:27, 31:8; 2 Sam 11:12; 2 Kgs 8:15; Jer 20:3; 1 Chr 10:8. The remainder of cases appear in law-code instructions and are likewise anchored to a position in the discourse rather than the time of speech. Those are found at Lev 19:6, 23:11. [↑](#footnote-ref-107)
108. Others: Exod 21:29, 21:36; Deut 4:42, 19:4, 19:6; Josh 3:4, 20:5. [↑](#footnote-ref-108)
109. The uses of רֹאשׁ are Isa 40:21, 41:26, 41:4, 48:16; Prov 8:23. [↑](#footnote-ref-109)
110. E.g. Gen 22:20, 48:1; Josh 24:29; 2 Chr 32:1. [↑](#footnote-ref-110)
111. See Josh 24:31; Judg 10:1. [↑](#footnote-ref-111)
112. The full table can be downloaded at https://github.com/CambridgeSemiticsLab/BH\_time\_collocations/  
     blob/master/analysis/paper\_data/firstyear/raw\_tokens.xlsx. [↑](#footnote-ref-112)
113. The figure is calculated from the data in https://nbviewer.jupyter.org/github/CambridgeSemiticsLab/  
     BH\_time\_collocations/blob/master/analysis/time\_constructions2.ipynb [↑](#footnote-ref-113)
114. Josh Warner et al., *Jdwarner/Scikit-Fuzzy: Scikit-Fuzzy 0.3.1* (Zenodo, 2017), accessed April 26, 2019, https://zenodo.org/record/1002946. [↑](#footnote-ref-114)
115. The percentage is not cumulative by relative to the cluster itself. [↑](#footnote-ref-115)
116. Fillmore, “Mini-Grammars of Some Time-When Expressions in English,” 38. [↑](#footnote-ref-116)
117. See also Harkness's discussion of anchors. Harkness, “Time Adverbials in English and Reference Time.” [↑](#footnote-ref-117)
118. Fillmore, “Mini-Grammars of Some Time-When Expressions in English,” 34. [↑](#footnote-ref-118)
119. Van der Merwe, “Reference Time.” [↑](#footnote-ref-119)
120. Walter Gross, *Die Satzteilfolge im Verbalsatz alttestamentlicher Prosa : untersucht an den Büchern Dtn, Ri und 2Kön / von Walter Gross ; unter Mitarbeit von Andreas Disse und Andreas Michel.*, Forschungen zum Alten Testament ; 17 (Tübingen: Mohr, 1996). [↑](#footnote-ref-120)
121. Van der Merwe, “Reference Time,” 512–513. [↑](#footnote-ref-121)
122. Ibid., 514. [↑](#footnote-ref-122)
123. Ibid., 503. [↑](#footnote-ref-123)
124. Where "singular" can also mean absence of a plural indicator. [↑](#footnote-ref-124)
125. The transcription is that of the ETCBC. A transcription table can be accessed at: https://annotation.  
     github.io/text-fabric/Writing/Hebrew.html. [↑](#footnote-ref-125)
126. Gen 41:9; Exod 13:4, 34:11; Deut 2:18, 4:40, 4:8, 5:1, 6:6, 7:11, 8:1, 8:11, 9:1, 10:13, 11:13, 11:26, 11:27, 11:28, 11:32, 11:8, 12:8, 13:19, 15:15, 15:5, 19:9, 26:16, 27:1, 27:10, 27:4, 28:1, 28:13, 28:14, 28:15, 29:11, 29:14, 29:17, 29:9, 30:11, 30:16, 30:2, 30:8, 31:21, 32:46; Josh 23:14; 1 Sam 9:20, 19:11; 2 Sam 19:6, 19:7; 1 Kgs 8:28, 20:13; 2 Kgs 2:3, 2:5, 4:23; Jer 28:16; Zech 9:12; Ruth 3:2. [↑](#footnote-ref-126)
127. Derived from Carolota S. Smith, *The Parameter of Aspect*, second., Studies in Linguistics and Philosophy 43 (Dordrecht: Kluwer Academic Publishers, 1997), 20. [↑](#footnote-ref-127)
128. Croft, *Verbs*. [↑](#footnote-ref-128)
129. See Zeno Vendler, *Linguistics in Philosophy* (Ithaca: Cornell University Press, 1967); Smith, *Parameter of Aspect*. [↑](#footnote-ref-129)
130. I. T. Jolliffe, *Principal Component Analysis*, 2nd ed., Springer series in statistics (New York: Springer, 2002). [↑](#footnote-ref-130)
131. Haspelmath, *From Space to Time*, 48–50. [↑](#footnote-ref-131)
132. Croft, *Verbs*, 97. [↑](#footnote-ref-132)
133. Croft's work on event structure is especially helpful on this topic and will be a reference point for the complete analysis. Croft, *Verbs*. [↑](#footnote-ref-133)