religions

MDPI

Article

Style and Influence: Computing Hebrews and the Early Christian Stylistic Fingerprint

Erich Benjamin Pracht [1,*] and Thomas McCauley [2]

[1] School of Culture and Society, Aarhus University, 8000 Aarhus, Denmark
[2] Math Department, Arlington High School, Arlington, MA 02476, USA; tommymccauley@gmail.com
* Correspondence: ebp@cas.au.dk

Abstract: Using Hebrews as a test case, we investigate how an author's participation in his literary network influences his writing habits. Our theoretical framework is that no author writes in a vacuum: all authors recycle stylistic habits from their literary contemporaries. We develop and implement a statistical procedure to trace stylistic influences, both in terms of which texts in an author's literary network are influential and also in terms of which text-features are suggestive of influence. Stylistic units of analysis in this study are two-word sequences (N-Grams), 40 of which recur in Hebrews as a function of influence from the author's literary network. We find that the author of Hebrews shares stylistic micro-patterns particularly with his co-religionists, which indicates that, already in New Testament times, the literature of emerging Christianity was developing a distinctive stylistic fingerprint, the features of which were transferred from one author to another.

Keywords: Hebrews; influence; style; stylometry; intertextuality; corpus linguistics

check for updates

Academic Editors: Susanne Luther, Birke Siggelkow-Berner and Clarissa Breu

Received: 12 November 2024
Revised: 26 December 2024
Accepted: 5 January 2025
Published: 8 January 2025

Citation: Pracht, Erich Benjamin, and Thomas McCauley. 2025. Style and Influence: Computing Hebrews and the Early Christian Stylistic Fingerprint. *Religions* 16: 55. https://doi.org/10.3390/rel16010055

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

1.1. Perspectives on the Style of Hebrews

In scholarship on the New Testament book of Hebrews, style has been analyzed from two key perspectives, both of which are also commonplace in other literary fields. One perspective is that of literary artistry. In German literary theory in the mid-twentieth century, style was seen as an artistic quality that is judged through aesthetic experience. In this tradition, the unit of analysis is typically an entire text or corpus as opposed to individual features that comprise the text (e.g., Kayser 1948; Staiger 1955; Spitzer 1961). In a similar vein, Erich Grässer's claim that the author of Hebrews is "ein Meister des Stils" typifies an evaluation shared by many scholars that the book is written in elevated Greek (Grässer 1990, p. 28). Many scholars take an emic perspective to the style of Hebrews and investigate features of the text through stylistic and rhetorical categories discussed by ancient literary theorists. Craig Koester, for example, investigates the author's style in terms of his use of rhetorical devices, imagery, rich vocabulary, and rhythm (Koester 2001, pp. 92–97). Similarly, Harold Attridge notes that Hebrews "displays many of the characteristics of Hellenistic rhetorical embellishment" and that "Hebrews is ornamented with an abundance of rhetorical figures" (Attridge 1989, p. 20). Approaches to the style of Hebrews from the perspective of literary artistry, then, are often tied to aesthetic judgements on the author's stylistic elegance and to rhetorical criticism, both of which have been associated with assessments of the author's communicative intentions (e.g., Holmes 2018; Croy 1998; Guthrie 1994).

The second common approach to style is that it is a window through which a reader can perceive aspects of the individuality of an author. Literary theorists in Europe in the early twentieth century argued that style even reflects the emotions of a person writing a text (e.g., Bally 1921; Stutterheim 1947). In New Testament criticism, a similar link between style and emotion is often made, for instance, in studies of Paul's letter to the Galatians, which has been seen as a reflection of the apostle's anger (see Barclay 1987). The style-as-window perspective is particularly common in forensic studies of authorship attribution, where the operative premise is that an author always leaves traces of his stylistic fingerprint when writing a text. Although in modern times such forensic studies are largely the domain of computational stylometry, in the early reception-history of Hebrews the author's style was investigated with a view to the book's authorship. Particularly in the West, the Pauline authorship of Hebrews was debated far more vigorously than it was in the East, which prompted early scholars such as Clement of Alexandria, Tertullian, and Origen to assess how well the style of Hebrews matches the styles of the Pauline letters. Although in modern scholarship there is a consensus that Paul is not the author of Hebrews, scholars continue to engage stylistic comparisons between both authors. Ceslas Spicq, in a thorough investigation of the book's vocabulary, compares Hebrews to the Pauline corpus in terms of shared terms and expressions, from which he produces lists of features of Paul's style found in Hebrews and lists of Pauline features that are absent (Spicq 1952, pp. 155–60). Similarly, Paul Ellingsworth compiles an extensive inventory of terminologies in Hebrews and Paul and compares the raw frequencies at which various words occur in each corpus (Ellingsworth 1993, p. 9). To the extent that the style-as-window perspective is applied to Hebrews, then, it is often tied to the long-standing enigma of the book's authorship and to stylistic comparisons with Paul.

1.2. Style and the Quest for Influences in Hebrews

In light of recent advances in digital infrastructures, we intend to push the discussion of the style of Hebrews forward by performing a large-scale statistical analysis of Hebrews and a collection of reference texts from the ancient world (Section 2). Instead of approaching style from the perspective of literary artistry or as a sample of a unique authorial fingerprint, the application of this stylometric analysis is to *influence*. The author of Hebrews, like any other author, participates in a literary network and borrows from his predecessors, which influences to some extent the way he writes (Section 2). Outside of stylometry, this operative premise has motivated countless investigations of the traditions that exercised influence upon the author. The history-of-religions school, for instance, took as its point of departure that religious and cultural concepts that circulated in antiquity were modified to Christian forms in the New Testament (see Koester 2001, pp. 59–63). In recent decades, scholarship on Hebrews continually investigates issues of literary influence and intertextuality. Recent work includes studies on the anonymous author's employment of Greco-Roman moral–philosophical themes (e.g., Gray 2003; Schenck 2007; Trotter 2023), the author's use of Jewish-eschatological (e.g., Mackie 2007; Mason 2008) and cultic (e.g., Gäbel 2006) concepts, and the structure and purpose of Hebrews as a synagogue sermon (e.g., Gelardini 2007). In this study, we investigate the relationship between two topics that have long been prominent in scholarship on Hebrews—*style* and *influence*—the conjunction of which can lead to fresh insights on the place of the book in its literary environment.

The major contributions of this study are:

1. To advance the discussion of the style of Hebrews beyond the common perspectives of style-as-art and style-as-window by making an application to influence.
2. To develop a statistical method that enables us to quantify and trace literary influences.

3. To identify specific stylistic features in Hebrews that reflect the author's participation in his literary network.

In New Testament studies, stylometric analysis with a view to influence is typically limited to the Synoptic Gospels (e.g., Robert Hayek et al. 2023). By contrast, our ambition is to trace influence on a far larger scale by investigating how a single target text relates to an extensive collection of reference corpora in terms of style. Due to the experimental nature of this study, attention to method is critical: while we contend that a statistical analysis can effectively accomplish our research ambitions, it should be acknowledged that hard data can never capture all aspects of a concept as abstract as influence. A statistical approach, however, can uncover points of contact between Hebrews and other texts that are impossible—or, at least, highly impractical—to discover through traditional close readings. Our statistical method enables readers to see ancient texts from a bird's eye view and thereby provides an occasion to interpret a well-known text with a fresh perspective.

Hebrews serves as an ideal test case for tracing influence because scholars explore multiple types of traditions with which the author is in contact. Regarding the date of Hebrews, we accept the traditional view that 1 Clement references the book in 96 CE in a letter to the church in Rome,[1] meaning Hebrews is a late-first-century product.[2] Regardless, however, of how one dates Hebrews, scholars accept that Hebrews was composed by a second or third generation Christian. As a result, many scholars expend considerable effort in situating Hebrews in its early Christian milieu and consider the importance of theological, thematic, and other types of similarities between Hebrews and texts such as the Pauline letters,[3] 1 Peter,[4] or the Gospel of John.[5] Since Hebrews is saturated with quotations and allusions to the Septuagint, a great deal of scholarly energy goes into analyzing how the author reshapes biblical material as he crafts his text.[6] Additionally, as indicated above, scholars investigate how the author reframes philosophical, religious, and cultural ideas in the wider Mediterranean world. The author of Hebrews draws from many overlapping traditions and cultural currents and thereby participates in a complex network of texts, practices, and worldviews that comprise his literary and social world. In this paper, we demonstrate that such influences can be detected at the level of subtle stylistic patterns, meaning the author's participation in his literary network determines to some extent the way he writes.

Our stylistic units of analysis are two-word sequences, known in corpus linguistics as two-word N-Grams. We focus on two-word N-Grams because this type of feature represents a small yet significant step forward from one of the most common ways scholars in the qualitative tradition investigate influence, namely, word choice. For example, in the history of interpretation, many scholars thought the author of Hebrews was influenced by Philo's works, a position Spicq famously advances based on shared vocabulary between both authors (Spicq 1952, p. 91).[7] As another example, scholars investigate influence on topics such as Christology and thereby identify traditions—such as allegorical traditions in Alexandria (Grindheim 2023, pp. 11–14) or Greco-Roman conceptions of lordship (Porter and Dyer 2023, pp. 3–7) and beneficence (McCruden 2008)—that provide a bank of terms from which the author of Hebrews draws to describe Jesus. By focusing on two-word sequences, we advance scholarship on Hebrews by showing that this text bears evidence of influence beneath the surface. In other words, the author leaves a hidden stylistic trail, which once uncovered can lead us to discern in new ways how his literary network impacted the shape of his text.

2. Theory

2.1. Influence

For our operative definition of influence, we draw from Matthew L. Jockers, who was trained as a scholar of English literature but who has since become a leading figure in corpus linguistics. Speaking with respect to 19th-century British, American, and Irish novels, Jockers says:

> In terms of literary history and literary *influence*, our corpus is a type of network. Whether consciously influenced by a predecessor or not, every book is in some sense a descendent of, or "connected to", those before it. Its relationship may be familial, that is, a new book by the same author, or it may be parodic, as in *Shamela*, a book meant to be a direct response to some other book. Or the relationship may be indirect and subtler, as when an author unconsciously "borrows" elements from the book(s) of some predecessor(s), or simply pulls from the same pool of stylistic and thematic materials (Jockers 2013, p. 162).

In a literary network, habits of style can be transferred from one text to another. Even as the author of Hebrews strives to create a text of his own, his ability to be innovative is to some degree "tempered and influenced by the past and the present" and is at times "trumped by some herd instinct" (Jockers 2013, pp. 156–57). Drawing from the linguistic resources available to him, the author of Hebrews composes a text that comprises a unique complex of stylistic features. By tracing how similar Hebrews is in terms of these features to other corpora, we can gauge various lines of influence by charting which ancient texts are closest to Hebrews, and in which ways.

Indeed, stylistic habits may signal that a certain text can be classified in a certain category with other texts (see Jockers 2013, pp. 63–104; Hermann et al. 2015, p. 46). To give an intentionally obvious example, the preposition διά ("through") combined with the noun πίστις ("faith") is a two-word combination that is particularly distinctive to Paul's letters and of subsequent texts in the Pauline tradition. This is not to say that every Greek text that contains this two-word combination is to be categorized as a "Pauline" text. The sequence of διά and πίστις occurs, for example, three times in the writings of Josephus. Conversely, the absence of this feature does not necessarily imply that the Pauline tradition exercised no influence. For example, the book of Acts, which narrates the missionary travels of Paul, contains no occurrences of this two-word sequence. Nevertheless, since the combination διά and πίστις tends to cluster together in the letters of Paul and in texts composed in his wake, it can be viewed as a distinctive feature of Pauline literature. Put simply, a text wherein the sequence of διά and πίστις recurs is likely influenced by Pauline tradition, at least in terms of the occurrence of this stylistic feature.

Influences come from multiple locations within a literary network. The book of Acts, for example, contains a mix of Paulinisms and Septuagintalisms, elements of the styles of Luke's predecessors reinscribed in a new setting. To give a concrete modern example of multiple stylistic influences, we cite Stephen King, one of the most prolific American novelists in recent decades. In giving advice to aspiring writers, King indicates that one's style is likely to reflect the styles of a range of predecessors, especially those which are important to a given author:

> You may find yourself adopting a style you find particularly exciting, and there's nothing wrong with that. When I read Ray Bradbury as a kid, I wrote like Ray Bradbury—everything green and wonderous and seen through a lens smeared with the grease of nostalgia. When I read James M. Cain, everything I wrote came out clipped and stripped and hard-boiled. When I read Lovecraft, my prose became luxurious and Byzantine. I wrote stories in my teenage years where

> all these styles merged, creating a kind of hilarious stew. This sort of stylistic blending is a necessary part of developing one's own style, but it doesn't occur in a vacuum (King 2000, p. 147).

2.2. Reference Corpora

To trace stylistic influence, we utilize 24 reference corpora, which in computational linguistics are contextual materials that allow the analyst to make meaningful claims, in a statistical sense, about a given target corpus, which in this study is Hebrews. A collection of reference corpora is not designed to be comprehensive, but rather functions to provide a "generalized snapshot" of various styles in written materials relevant to the target text (Hardy 2004, pp. 411–12). In selecting reference corpora, we do not insist that these are the only texts that constitute the author's literary network. Rather, we mean to assemble a collection of contemporary corpora that represent the various genres as well as cultural and religious backgrounds relevant to the study of Hebrews:[8]

Paul	LXX-Wisdom Literature
Colossiansand Ephesians	LXX-Maccabean Literature
Pastoral Epistles	Josephus
Catholic Epistles	Philo
Gospel of Matthew	Plutarch
Gospel of Mark	Arrian
Luke-Acts	Appian
Gospel of John	Cassius Longinus
1 Clement	Dio Chrysostom
LXX-Pentateuch	Dionysius of Halicarnassus
LXX-Deuteronomistic History	Aelius Aristides
LXX-Psalms	Epictetus

In New Testament times, early Christian text production was central to the preservation of literary memory (Becker 2017) and to communal self-definition (Kraftchick 2008), yet texts also exist within and reflect oral culture and social realities (Robertson 2016). As a result, we do not necessarily presume that the author of Hebrews had access to or knowledge of the reference corpora listed above (although in certain cases, namely the Septuagint, it is obvious that he did). Theoretically, there are several factors that could influence style other than direct literary dependence. In this connection, J. Berenike Hermann and colleagues note that "even in the absence of conscious intentions, causal relationships may be hypothesized" (Hermann et al. 2015, p. 46). Accordingly, in early Christian texts, common religious affiliation is an example of a factor that can cause style, which we suspect is the case for texts that reproduce the sequence διά πίστις. Genre, gender, topic, and social purpose are among other influential factors that can cause style and need not involve literary dependence upon another text (Jockers 2013, pp. 63–104). As a result, we do not limit ourselves to corpora that pre-date our target text, since doing so is not always necessary to gain insights into stylistic influences.[9]

To illustrate our point, we provide a concrete example. In our target and reference corpora, the N-Gram τίς γάρ is particularly prominent in 1 Clement, Hebrews, Paul, and Epictetus. On the one hand, this result could be seen as evidence that the author of Hebrews knew Paul's letters and recycled one of the apostle's stylistic habits. In support of this claim, one would adduce as evidence 1 Clement, who as a reader of Paul's letters also recycles the same stylistic feature. However, the fact that τίς γάρ is a recurring feature in Epictetus shows empirically that this feature is not an exclusively Pauline habit. Epictetus' teachings

were transcribed by his pupil Arrian in the second century, which rules out a direct literary relationship with Hebrews. The prominence of τίς γάρ in these four corpora may indicate that the feature is a signifier of philosophically oriented texts written in a conversational style, such as Epictetus' *Discourses* or Paul's letter to the Romans, which makes it difficult to argue that the author of Hebrews was exclusively influenced by his literary predecessor. In this case, similarities in genre or modes of social discourse may be influential factors that cause style.

3. Method

3.1. Objectives

In this section, we outline our statistical method for tracing lines of influence. At the outset, we have two objectives that we seek to accomplish: (1) to control for the differences in length of our corpora and (2) to uncover specific stylistic features in Hebrews that reflect influence from its literary network. In stylometry, distance and weighing measurements are among the most common data analysis techniques. To justify our use of a new technique, we examine the most common distance and weighing methods and explain why they cannot accomplish our two objectives. In Section 3.5, we describe our method.

3.2. Vectors

Before we consider distance measurements, we briefly introduce vectors, which are critical to understanding the first two methods presented below (Euclidean distance and cosine similarity). In stylometry, analysts consider multiple stylistic features at the same time. We observe, for instance, the rate of occurrence of 40 N-Grams throughout Hebrews and our 24 reference corpora (Section 3.5.2). It is often convenient to organize these data points into a vector, a data structure which presents data points in an ordered list. In the present study, the rate of occurrence of our 40 N-Grams would produce a vector with 40 different data points.

We illustrate how vectors work with a simple hypothetical example. Suppose we have two texts, *Text A* and *Text B*, and we record the number of occurrences of two Greek words, θεός ("God") and κύριος ("Lord"). Suppose further that *Text A* has exactly 1 occurrence of "God" and 2 occurrences of "Lord". We could represent this information in an equation, $\textit{Text A} = (1,\ 2)$. Similarly, if $\textit{Text B} = (5,\ 10)$, we understand that to mean *Text B* contains exactly 5 occurrences of the word "God" and 10 occurrences of the word "Lord".

3.3. Assessing Euclidean Distance

Euclidean distance is one of the common distance measurements used in data science and is an attractive metric because it is straightforward and intuitive. It is given by the formula

$$d = \sqrt{\sum (x_i - y_i)^2}$$

Euclidean distance measures the length of the straight line between two vectors in multi-dimensional space. In stylometry, analysts assume that documents separated by a short distance are more stylistically similar than documents separated by a long one. Indeed, Matthew Jockers effectively deploys this technique in his stylometric analysis of English-language novels and draws inferences about literary influences based on ranked lists of stylistic similarity (Jockers 2013, pp. 63–104). In this study, however, we face a problem not encountered by Jockers, namely the considerable differences in the lengths of our text corpora. Euclidean distance produces a distance measurement based on the frequencies of words and thereby risks making corpora appear dissimilar based on length as opposed to the rates at which stylistic features occur.

To illustrate this point with our earlier example, suppose *Text B* is five times longer than *Text A*. Under this scenario, the words "God" and "Lord" appear at the same rate and the differences in their frequencies can be explained entirely by the length of the text. In this case, the stylometric data ought to suggest that these texts have the same style, even though they have a Euclidean distance of about 8.944. Therefore, we see that Euclidean distance is, in this case, a poor measure of style.

To elaborate on this point with real data from our reference corpora, we perform a Euclidean distance measurement of Hebrews and our 24 reference corpora based on the frequencies of the tokens θεός ("God") and κύριος ("Lord"). The results are listed below, with the corpora ranked in order of their similarity to Hebrews.

In our opinion, there are reasons to be suspicious of the results produced by the Euclidean distance metric, as listed in Table 1. Many of the smaller New Testament corpora, particularly the ones that are similar in length to Hebrews, tend to cluster towards the top of the list. Furthermore, Septuagint texts tend to fall toward the bottom, while Josephus and Philo are the most distant from Hebrews. If these results were used to gauge influence, we would conclude that the Septuagint and two key Hellenistic Jewish authors are of comparatively little relevance to the author of Hebrews. On the contrary, it appears that, in this case, the low rankings result from the fact that these corpora are considerably longer than Hebrews, meaning the authors have more opportunities to deploy the divine titles God and Lord. In short, as it pertains to the corpora used in this study, Euclidean distance says more about disparities in length than it does about differences in style.

Table 1. Euclidean distance.

Rank	Corpus	d	Rank	Corpus	d
1	Mark	20.1	13	Epictetus	193.5
2	Past Ep	20.88	14	Luke-Acts	292.66
3	Ael Arist	25.55	15	Dio Chr	376.43
4	Arrian	26.83	16	Paul	397.64
5	Col and Eph	30.53	17	LXX-Wis	411.64
6	John	39.22	18	LXX-DH	481.18
7	Cass Long	61.84	19	Dion Hal	522.12
8	1 Clement	63.41	20	LXX-Pent	655.31
9	LXX-Macc	65.8	21	LXX-Ps	838.98
10	Matthew	66.22	22	Plutarch	1836.04
11	Cath Ep	68.54	23	Josephus	1845.16
12	Appian	76.32	24	Philo	1909.01

3.4. Assessing Cosine Similarity

Another widely used data analysis technique is cosine similarity, which determines the angle between two frequency vectors in multi-dimensional space. The angle between two vectors can be used as a measurement of their stylistic similarity because a small angle indicates that two vectors have nearly the same proportion. When two vectors are proportional, as in our earlier hypothetical example of *Text A* and *Text B*, their angle is 0°. Frequency vectors with very different proportions will have a larger angle between them, with a maximum possible angle of 90°. It is given by the formula

$$Cos(\theta) = \frac{A \cdot B}{\sqrt{\sum A^2} \cdot \sqrt{\sum B^2}}$$

Cosine similarity is a score between 0 and 1 that divides the dot product of the vectors by the product of their lengths. The angle between the vectors can be found by taking the arccosine of this value, resulting in an angle between 0° and 90°.

We note that either the angle, θ, or the cosine of that angle, can be recorded as a measure of similarity, and analysts vary in their preference of similarity metric. We chose to record the angle because the cosine function is non-linear, meaning it has the effect of compressing some intervals of angles into a smaller range of cosine values. For example, the set of angle measures from 0° to 30° are compressed into the range of cosine values from 0.866 to 1. For this reason, a cosine similarity score may give the impression of a high level of agreement, when in fact the angle between the vectors is large.

Cosine similarity is a measure of proportionality and thereby enables effective stylistic comparisons between texts of different lengths. Practically speaking, corpora that are considerably longer than Hebrews will not appear stylistically dissimilar simply based on size. To illustrate this concretely, in the previous section, the Pentateuch and Josephus appeared stylistically dissimilar from Hebrews under Euclidean distance, but with cosine similarity they are highly similar to Hebrews (Heb and LXX-Pent: 3.7°; Heb and Jos: 12.0°), since all three corpora deploy the terms θεός and κύριος at similar proportions relative to their lengths.

Although cosine similarity is a powerful tool for its ability to neutralize data, it nevertheless fails to meet one of our stated objectives, namely, to uncover specific stylistic features in Hebrews that reflect influence from its literary network.[10] Cosine similarity is designed to compute stylistic similarity between corpora based on multiple features. For example, in the chart below, we compute cosine similarity in 24 reference corpora based on 153 two-word N-Grams, chosen because they appear three times or more in Hebrews (Section 3.5.2). The results are listed with the corpora ranked in order of their similarity to Hebrews.

The chart Table 2. above provides a fairly accurate measurement of stylistic similarity between Hebrews and our reference corpora based on 153 features. In this exercise, the three most stylistically similar corpora to Hebrews are 1 Clement, Paul, and Luke-Acts. Regarding influence, this suggests that the author of Hebrews shares certain patterns of writing with some of his contemporary co-religionists. Outside of this general finding, cosine similarity lacks specificity: the method fails to show *why* 1 Clement, Paul, and Luke-Acts are close to Hebrews and *why*, for example, the Pastoral Epistles have the lowest rank. By contrast, in developing our method, our ambition is to discover specific ways in which the style of Hebrews reflects influences from the author's literary network.

Table 2. Cosine similarity.

Rank	Corpus	θ	Rank	Corpus	θ
1	1 Clement	29.0°	13	LXX-Ps	43.7°
2	Paul	32.0°	14	Philo	43.9°
3	Luke-Acts	37.1 °	15	Epictetus	44.1°
4	LXX-Macc	39.4°	16	Col and Eph	44.1°
5	Dion Hal	40.4°	17	Mark	44.2°
6	Josephus	40.8°	18	Plutarch	44.5°
7	Appian	41.0°	19	John	45.0°
8	Matthew	41.4°	20	Cass Long	45.0°

Table 2. *Cont.*

Rank	Corpus	θ	Rank	Corpus	θ
9	Cath Ep	41.4°	21	Dio Chr	45.6°
10	Ael Arist	41.8°	22	LXX-Wis	46.8°
11	Arrian	42.6°	23	LXX-DH	47.0°
12	LXX-Pent	43.2°	24	Past Ep	47.2°

3.5. Assessing TF-IDF

In addition to the common distance measurements discussed above, we also consider term frequency–inverse document frequency (TF-IDF), a widely used statistical method in corpus linguistics. TF-IDF is a technique used to weigh the importance of terms in a document relative to a collection of documents. In other words, TF-IDF provides a quantitative measure of which words are particularly special to a given document relative to a wider corpus. Accordingly, TF-IDF is the product of two different measures:

$$TF - IDF = \frac{Occurrences\ of\ a\ term\ in\ the\ document}{Total\ number\ of\ terms\ in\ the\ document} \times \log \frac{Total\ number\ of\ documents\ in\ the\ corpus}{Number\ of\ documents\ that\ contain\ the\ term}$$

The first measure, term frequency, is a fraction that represents the proportion of the whole document made up of the given term. The second measure, inverse document frequency, is a measure of how much information is provided by the presence of that term in a document among a corpus of several documents. The logarithm acts as a scaling function. Since $\log(1) = 0$, it ensures that for any term which appears in all documents $IDF = 0$, indicating that the presence of that term provides no information towards distinguishing the documents in the corpus.

TF-IDF can be a powerful tool in identifying the key terms of a given document. For example, it is well-known that the author of Hebrews discusses the role of priests under what he considers to be the Old Covenant. According to TF-IDF, the word ἱερεύς (“priest”) sets Hebrews apart from all 24 reference corpora, including the Septuagint. Regarding influence, one could say that as the author of Hebrews draws from biblical materials to make an argument, he thematizes a key biblical concept far more than even the Septuagint does. However, since TF-IDF gives greater weight to terms that set documents apart from others, it is not an effective tool in tracing subtler lines of influence. Although two-word N-Grams rarely distinguish one document from another, it is possible to determine where in a corpus such sequences cluster together, and in this way we can trace literary influence in terms of stylistic habits that cannot be detected using conventional stylometric methods.

3.6. Tracing Stylistic Influence

3.6.1. The Importance of Outliers

In developing a method for tracing influence, we operate with a simple premise: if a given stylistic feature occurs in Hebrews at a rate that is unusually high in comparison to the general tendencies of our reference corpora, and if the same feature occurs in other reference corpora also at an unusually high rate, this may be evidence of influence, if there are good qualitative reasons to suspect it. In other words, we search for ways in which Hebrews and other reference corpora are outliers. In statistics, outliers are data points that lie at an abnormal or extreme distance away from the other values in a dataset, which indicates that the outlier departs from the behavior of the distribution. By finding outliers, it is possible to quantify which corpora contain unusually frequent occurrences of a given feature and therefore depart from the typical usage in Greco-Roman literature. For example, the N-Gram εἰ γάρ occurs at a high rate in Hebrews and Paul, to the point that

both corpora are statistical outliers. Since εἰ γάρ is a stylistic feature that otherwise occurs relatively infrequently in a large collection of ancient Greek texts, this high rate indicates that Hebrews and Paul both depart from the typical usage of this N-Gram, suggesting this writing habit has been recycled from Paul's letters to the book of Hebrews, probably because of the author's connection with the Pauline tradition.

In our opinion, finding outliers is the most reliable way to trace stylistic influence, since outliers mark deviations from the frequency rates at which N-Grams typically occur in ancient Greek texts. To be sure, outlier corpora are not the only ones where a text's style was influenced by its literary network. Outliers, however, are the most statistically secure basis upon which to use quantitative data to investigate influence. Since data are a descriptive tool, it remains the task of the analyst to consider what intermediate realities may be responsible for a given statistical result. In the case of style and influence, such qualitative reasoning should be performed on solid ground, which we contend is provided by outliers. Finally, it should be acknowledged that since influence is an abstract concept and intermediate realities are difficult to reconstruct, some of our results may generate questions but no solutions.

3.6.2. Procedural Steps

In this section, we outline the four steps of our method, the first of which is to *collect data*. Using a collection of digitized Greek texts in lemmatized form, curated by the research group "Computing Antiquity" at Aarhus University, we upload the files to AntConc, a free corpus linguistics software. We use AntConc to collect data on the frequencies at which each N-Gram that occurs in Hebrews three times or more also occurs in each of our reference corpora. We focus on N-Grams that occur in Hebrews three times or more, the total number of which is 153, to maximize the chances of discovering features that make this text an outlier. Additionally, since there was much variation in the manuscript tradition, focusing on N-Grams with a minimum frequency of three mitigates, but does not overcome, the limitation that we compute the New Testament only with the 28th Nestle-Aland *Novum Testamentum Graece*. Since our target text is Hebrews, we have collected data specifically with an eye toward recurring stylistic features in that text. In other words, this study is "tilted" towards a single target text (see Engberg-Pedersen 2020) and our method is designed to shed light specifically on the place of Hebrews in its literary network.

The second step is to *find outliers*. After converting the raw frequencies for each N-Gram to occurrences per 1000 tokens, we test for outliers by computing the interquartile range (IQR) of the rates of occurrence for each feature, following the procedure suggested by Michael Sullivan (2017, pp. 157–60). The IQR is determined by subtracting the first quartile from the third and is thereby represented by the following equation: $Interquartile\ Range = Quartile_3 - Quartile_1$. With knowledge of the IQR for each N-Gram, we build "fences" around our dataset by determining outlier boundaries. The lower and upper boundaries are determined by the following formulas:

$$Lower\ boundary = Q_1 - (1.5 \times IQR)$$

$$Upper\ boundary = Q_3 + (1.5 \times IQR)$$

If an N-Gram occurs in a corpus at a rate that is above the upper boundary,[11] then we consider that corpus to be an outlier. For example, for the N-Gram γάρ λέγω, the upper outlier boundary is 0.229 occurrences per 1000 tokens. This feature occurs in Hebrews and 1 Clement at the rates of 0.602 and 0.307, respectively, with the result that these corpora are statistical outliers in terms of the high rates at which γάρ λέγω occurs. Here it should be emphasized that outliers are determined only in comparison to our 24 reference corpora, not in comparison to some absolute standard and certainly not to every Greek text ever written.

The third step is to *calculate standard scores* (z-scores). To facilitate comparison of outliers among the 40 N-Grams, we require a statistic that can measure how much an observation differs from the typical value of the distribution. Simply measuring the difference between the observation and the mean of the dataset will not achieve this because this metric does not consider that each distribution has a different typical level of variation. For example, we may consider the two N-Grams, γάρ ὁ and διά ὁ, as they appear in Hebrews. Both N-Grams appear at the rate of roughly 3.81 per 1000 tokens and their distributions have similar typical values, with a mean of 1.60 for γάρ ὁ and a mean of 1.59 for διά ὁ. Nevertheless, the two N-Grams have very different levels of variation. The standard deviation of γάρ ὁ is 2.30, while the standard deviation of διά ὁ is 1.16. For this reason, Hebrews stands out as a more extreme outlier for διά ὁ, as the N-Gram occurs in Hebrews at a rate that is almost two standard deviations above the mean. In contrast, γάρ ὁ occurs in Hebrews at a rate which is not even one standard deviation above the mean.

A better statistic for comparison is the z-score, which measures how far an observation lies from the mean value, expressed in terms of the standard deviation of the distribution. For example, an observation with a z-score of $z = 3$ lies three standard deviations above the mean. The z-score of an observation is calculated by the formula

$$z = \frac{observation - mean}{standard\ deviation}$$

The z-score captures the difference between the N-Grams γάρ ὁ and διά ὁ and their rate of occurrence in Hebrews. Considered among all the reference corpora, the rate of occurrence of γάρ ὁ in Hebrews has a z-score of $z = 0.96$. In contrast, the rate of occurrence of διά ὁ in Hebrews has a z-score of $z = 1.91$. The z-score statistic illustrates that Hebrews is a much more extreme outlier in terms of the N-Gram διά ὁ than the N-Gram γάρ ὁ.

When calculating the z-scores of outliers, we have chosen to remove the outliers from the dataset before calculating the mean and standard deviation. By identifying certain observations as outliers, we suspect they do not follow the trend of the rest of the distribution. In fact, their classification as outliers suggests that an explanation of their extreme value cannot come from the general behavior of the distribution. Consequently, we need to describe the characteristics of the distribution, like the mean and standard deviation, without those outliers to measure accurately their departure from the rest of the distribution. Once we remove the outliers and calculate the mean and standard deviation from the remaining dataset, we calculate the z-score for each outlier using the formula described above. The z-score, then, serves as a measure of how much each outlier departs from the general behavior of the distribution.

The fourth step is to *list all outliers*. In Section 4.1, we display from our original collection of 153 N-Grams that occur in Hebrews three times or more (see above) a selection of 40 N-Grams that we argue are particularly suggestive of influence. To be sure, we have found N-Grams other than the ones listed in the charts below that occur at comparatively high rates in Hebrews. Accordingly, we have excluded two types of N-Grams:

1. N-Grams that result from direct quotations of biblical texts: For example, Hebrews and the Psalms are outliers in terms of the high frequencies at which σήμερον ἐάν, μή σκληρύνω, and τάξις Μελχισέδεκ occur, undoubtedly because these sequences occur in passages the author quotes often and discusses at length. Although direct quotations are certainly a matter of influence, this type of intertextuality is already discussed repeatedly in the commentaries and is hardly the sort of subtle influence that requires digital methods to detect.
2. N-Grams that contain a substantive noun and the article: Since in Koine Greek the article is often required as a matter of grammar, we leave it out of our master chart

when it occurs with a substantive noun. Although in certain cases this decision results in the exclusion of theologically significant expressions that recur in the New Testament, such as ὁ ἐπαγγελία ("the promise") or πνεῦμα ὁ ("Spirit of"),[12] in most cases we remove unnecessary "noise" that we judge is neither reflective of influence nor stylistic peculiarity.

4. Results

4.1. Master Chart

Using the method described above, the results of our statistical analysis are listed below in Table 3.

Table 3. Master chart.

N-Gram	Outlier *z*-Scores
διά ὁ	Col/Eph: 4.11; 1 Clem: 3.95; Heb: 3.85; Paul: 3.72
διά πᾶς	Col/Eph: 7.25; LXX-Ps: 7.1; Heb: 5.63
γάρ ὁ	Col/Eph: 18.82; Heb: 4.66
εἰ γάρ	Paul: 5.61; Heb: 5.16
γάρ ὅτι	Heb: 10.3; Paul: 6.03; Mark: 4.04
οὐ γάρ	Dio Chr: 4.68; Paul: 4.14; Heb: 3.66
ὅς γάρ	Heb: 8.95; Mark: 4.52; Cath Ep: 3.95
γάρ λέγω	Heb: 9.11; 1 Clem: 4.24
γάρ εἰς	Heb: 12.42; Cass Long: 4.89
πᾶς καί	Col/Eph: 7.86; Mark: 6.46; Heb: 6.0; 1 Clem: 4.59
καί πάλιν	1 Clem: 13.89; Heb: 7.42; John: 3.76; Mark: 3.72
καί περί	Dio Chr: 5.54; Cass Long: 5.19; Heb: 4.85
δόξα καί	1 Clem: 9.25; Cath Ep: 7.33; Heb: 6.62
καί θυσία	Heb: 21.64; Col/Eph: 8.55
καί πνεῦμα	Heb: 14.98; 1 Clem: 4.57
πίστις καί	Past Ep: 25.49; 1 Clem: 8.65; Heb: 7.17; Cath Ep: 5.81
ἐν ὅς	Col/Eph: 17.26; Heb: 6.32; Cath Ep: 4.14
ἐν δεξιός	Col/Eph: 220.79; Heb: 182.97; Arr: 51.45; Cath Ep: 48.03; Paul: 14.73
ἵνα μή	Past Ep: 3.37; Heb: 3.31; Paul: 2.45
μή ποτε	Heb: 13.52; Matt: 8.33; LXX-Ps: 6.25; Past Ep: 6.06; L-A: 4.93
μή τίς	Heb: 11.27; John: 6.84; Col/Eph: 4.11
οὐ κατά	Heb: 22.6; Past Ep: 10.31; Col/Eph: 8.93; Arr: 4.05
ἡμεῖς ὁ	Paul: 6.91; Col/Eph: 6.1; Cath Ep: 5.56; Heb: 4.68; LXX-Ps: 4.18
ὑμεῖς ὡς	Heb: 20.34; Col/Eph: 12.41; Cath Ep: 9.71; 1 Clem: 4.7
αὐτός ὡς	LXX-Wis: 4.78; Heb: 4.74; LXX-Ps: 4.56
εἰσέρχομαι εἰς	Heb: 10.94; L-A: 5.88; Matt: 3.39
οὗτος ποιέω	John: 4.68; Heb: 3.85
λέγω οὗτος	Heb: 12.95; L-A: 8.8; John: 7.93; Matt: 7.88; Epict: 6.8

Table 3. *Cont.*

N-Gram	Outlier *z*-Scores
θεός ζῶ	Heb: 72.87; Past Ep: 51.6; Paul: 14.59
θεός εἷς	Heb: 8.53; Col/Eph: 6.97; Paul: 5.69; Cath Ep: 5.41
λέγω κύριος	Heb: 6.44; Matt: 5.52
καρδία ὑμεῖς	Col/Eph: 28.09; Cath Ep: 8.88; Heb: 8.05
φωνή αὐτός	Heb: 10.21; John: 5.12
υἱός ἐγώ	Heb: 11.01; Mark: 6.26; Matt: 4.69; Cath Ep: 4.52
υἱός ὅς	Heb: 69.31; 1 Clem: 11.32; John: 6.88; LXX-Wis: 5.85
ἐάν ὁ	Heb: 22.69; Cath Ep: 14.55; 1 Clem: 7.98; Mark: 4.15; Paul: 3.81
ἀκούω μή	Heb: 54.76; 1 Clem: 6.47; John: 3.84;
ἱερεύς εἷς	Heb: 1776.09; LXX-Ps: 64.68; Jos: 32.64; LXX-DH: 20.95; App: 9.67; Philo: 5.27
αἰών κατά	Heb: n/a; LXX-Ps: n/a; LXX-DH: n/a
ἐν αἷμα	Heb: n/a; LXX-Wis: n/a; LXX-Ps: n/a; LXX-DH: n/a; LXX-Pent: n/a; Jos: n/a

4.2. Mathematical Observations

Nearly all *z*-scores listed in Table 3 are greater than 4. The significance of this value can be seen by comparison with the normal distribution, where exceedingly few observations (less than 0.01%) fall more than 4 standard deviations from the mean. In most introductory textbooks on statistics that include a chart of *z*-scores and probabilities of the normal distribution, *z*-scores above 3.5 are omitted because there is so little probability beyond that cut-off in the tails. Although the distribution of N-Gram rates among our reference corpora may not be normally distributed, this comparison illustrates how unusual it is to observe data with a *z*-score of 4 or greater. We consider our *z*-scores strong confirmation that the outlier corpora listed above significantly depart from the general trends of our reference corpora in terms of their corresponding N-Grams.

Furthermore, a few N-Grams have surprisingly high *z*-scores, such as υἱός ὅς, ἐάν ὁ, ἀκούω μή, and ἱερεύς εἷς. These large *z*-scores arise because the standard deviations of these N-Grams are very small, indicating that the non-outlier corpora have very few occurrences of these N-Grams. As a result, even a small number of occurrences of these N-Grams in a corpus result in a large z-score. For example, the N-Gram υἱός ὅς occurs in Hebrews only three times, but due to its rarity in our reference corpora, that is enough to generate a *z*-score of $z = 69.31$.

Even more notable are the N-Grams αἰών κατά and ἐν αἷμα, for which we cannot calculate a z-score because the standard deviation is 0, once the outliers are removed. The fact that the standard deviation is 0 indicates that every corpus that is not an outlier has 0 occurrences of these N-Grams. Interestingly, the outliers in these cases, apart from Hebrews, come from the Septuagint or Josephus. We argue that the absence of these N-Grams in our other reference corpora constitutes clear evidence of literary influence.

4.3. Theologically Significant Tokens

In our master chart, some N-Grams contain tokens that are of potential theological significance in Jewish and Christian writings. To elucidate our data further, we run outlier tests using the method of interquartile range on ten such tokens. We find that no corpus is an outlier in terms of the rates at which θεός, κύριος, πνεῦμα, φωνή, or δόξα occurs. This result indicates, for example, that θεός εἷς is not prominent in four New Testament corpora

simply because these texts thematize God more than others. Rather, both components of the N-Gram are equally important, meaning it is the specific two-word sequence that causes four New Testament corpora to be outliers. In other words, θεός and θεός εἰς are distinct stylistic features: θεός occurs throughout all our reference corpora, but θεός εἰς is distinctive only to certain early Christian texts (Heb, Paul, Col/Eph, Cath Ep).

In certain cases, we find that some reference corpora are outliers due to the high rates at which theologically significant tokens occur. The Psalms are an outlier due to the high rate of καρδία, but only Christian texts are outliers in terms of καρδία ὑμεῖς (Col/Eph, Cath Ep, Heb). Similarly, the Pentateuch and Deuteronomistic History are outliers due to the high rate of υἱός, but mostly Christian corpora are outliers in terms of υἱός ἐγώ (Heb, Mark, Matt, Cath Ep) and υἱός ὅς (Heb, 1 Clem, John, LXX-Wis). Hebrews, 1 Clement, and the Maccabean writings are outliers due to the high rate of θυσία, whereas Hebrews and Colossians and Ephesians are outliers due to the high rate of καί θυσία. This result indicates that it is unlikely that καί θυσία recurs in Hebrews simply because sacrifice is a major topic, since the N-Gram is not a recurring feature of 1 Clement and the Maccabean writings, the two other corpora where θυσία occurs at an unusually high rate. Many New Testament corpora (Paul, Col/Eph, Past Ep, Cath Ep, and Heb) are outliers due to the high rate of πίστις. However, as the master chart indicates, Paul and Colossians and Ephesians are not outliers in terms of the specific sequence πίστις καί, whereas 1 Clement is an outlier. This result indicates that a high rate of πίστις does not necessarily lead to a high rate of πίστις καί, since the noun token and the N-Gram are distinct stylistic features.

In two cases, we find that Hebrews alone emerges as an outlier due to the high rates at which theologically significant tokens occur. The first token is αἷμα, whose recurrence in Hebrews may suggest that ἐν αἵμα recurs because the author thematizes the blood of Christ and of sacrificial animals. Nevertheless, since ἐν αἵμα otherwise clusters together in the Septuagint (LXX-Pent, LXX-DH, LXX-Ps, LXX-Wis) and Josephus, the better explanation for its recurrence in Hebrews seems to be influence from Greek-language Jewish texts in the author's literary network. The second token is ἱερεύς, whose high rate in Hebrews could be said to explain the excessively high z-score for ἱερεύς εἰς. On the other hand, it is also significant that the outliers for this N-Gram are primarily Septuagint (LXX-DH, LXX-Ps) and Hellenistic Jewish corpora (Jos, Philo), which suggests that this feature recurs in Hebrews as a function of the author's participation in his literary network.

From this investigation of theologically significant tokens, we obtain a more nuanced understanding of our results. As stylistic features, single noun tokens behave differently than two-word sequences, a notion that makes intuitive sense but which we have tested analytically. Our results suggest that while nouns may occur at a high rate due to theme or topic—for example, corpora that conceptualize faithfulness may have a higher rate of πίστις than corpora that do not—two-word sequences are different units of analysis and may occur due to other factors. In other words, N-Grams are patterns of language use whose frequencies do not necessarily correspond to the rates at which potentially significant nouns occur. Our findings reveal stylistic habits that cluster together in certain corpora, the majority of which form natural groups based on religious orientation. For example, θεός and αἷμα are two common Greek words, but θεός εἰς is largely a "Christian" way of writing, whereas ἐν αἵμα is primarily a "Jewish" one.

5. Discussion (Part 1): Patterns Among the Outliers

5.1. The Prominence of Early Christian Corpora Among the Outliers

Our results show that when Hebrews is an outlier, other early Christian writings tend to be outliers as well. To visualize this result, we display a pie chart, in which we divide our corpora into three categories: early Christian (NT and 1 Clem), Jewish (LXX and Jos/Philo),

and Greco-Roman (all others). Here we emphasize that we deploy these categories strictly for descriptive purposes, despite the fact they are imperfect. These categories are not meant, for example, to imply that Paul is not Jewish or that Josephus is not Greco-Roman. Nevertheless, we claim our categories are neither arbitrary nor unwarranted. There is a substantial qualitative difference between, say, texts centered around the God of Israel and those that are not, or texts that propagate the worldview that Jesus is Lord and those that do not. Using these categories, Figure 1 below computes by percentage how often Christian (74%), Jewish (18%), and Greco-Roman (8%) corpora emerge as outliers along with Hebrews.

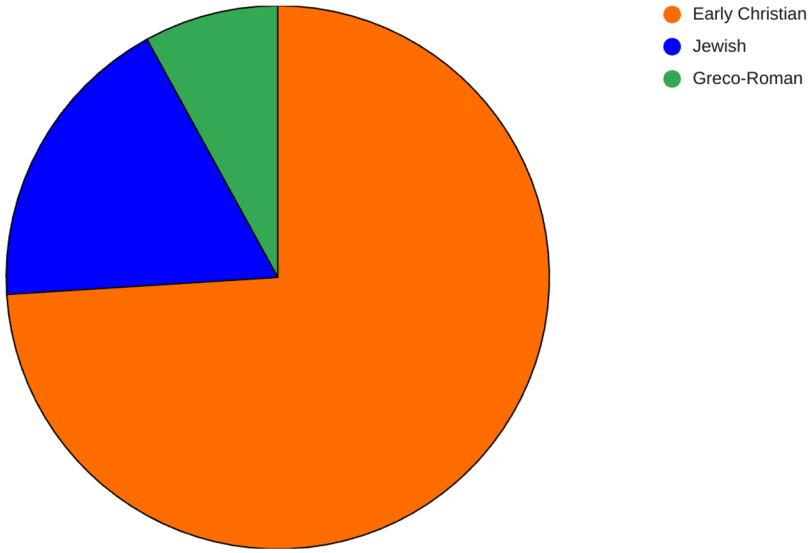

Figure 1. Outliers by category.

To elucidate these results further, we display a bar graph, which shows by percentage in how many N-Grams each reference corpus is an outlier (blue) and the proportion of all outliers comprised by each reference corpus (orange). Paul, for example, is an outlier in 10 out of 40 N-Grams, which corresponds to 25% of the N-Grams from our master chart. Additionally, Paul comprises 10 out of 96 outliers along with Hebrews, which corresponds to 10.41% of the total.

In Figure 2 above, we see, for instance, that Colossians and Ephesians is the reference corpus that most frequently emerges as an outlier, as this letter pair is listed in 32.5% of the N-Grams in our master chart. This result indicates that many of the two-word sequences that recur at a high rate in Hebrews but are otherwise rare in Greek language texts also recur in Colossians and Ephesians. Outliers from the Pauline letter-writing tradition (Paul, Col/Eph, Past Ep) occur in 52.5% of the N-Grams and comprise 29.17% of all outliers along with Hebrews. Outliers from the Gospels (Matt, Mark, L-A, John) occur in 37.5% of the N-Grams and comprise 21.86% of all outliers along with Hebrews. By token count, the literature of emerging Christianity represents approximately 4% of all reference corpora, yet many N-Grams cluster together precisely in these texts. This finding indicates that already in New Testament times certain patterns of writing circulated that were particularly characteristic of emerging Christianity. As a participant in the early Christian literary tradition, the author of Hebrews reflects influence from his literary network by reinscribing stylistic habits shared by his co-religionists.

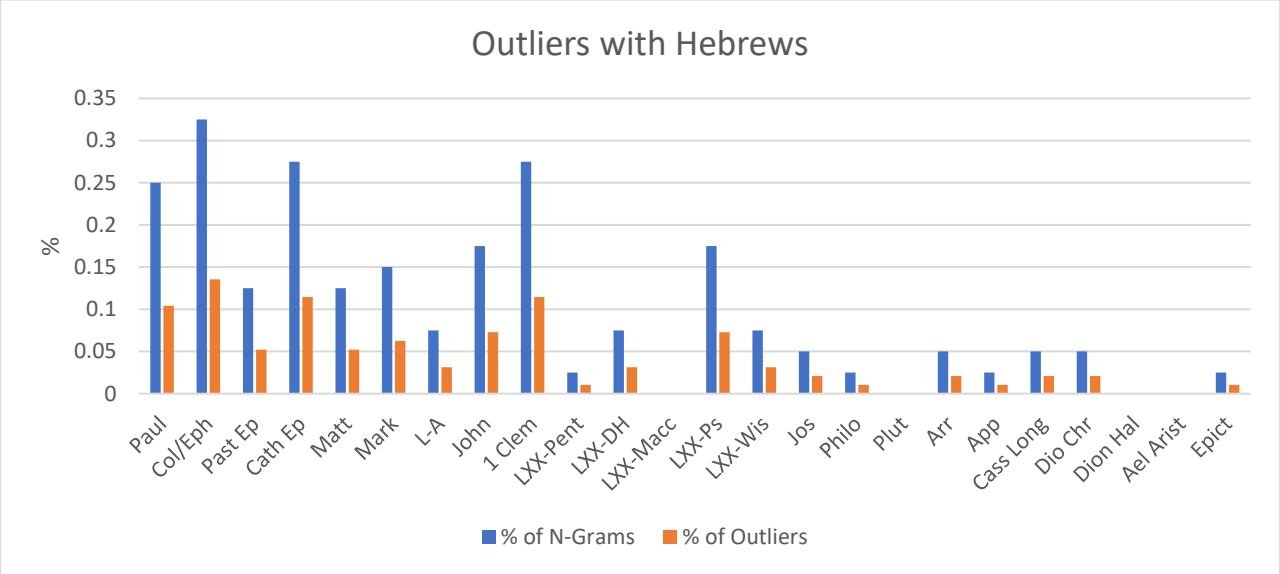

Figure 2. Outlier proportion by corpus.

Our results show that corpora consisting of Jewish texts also influenced the author's style. Outliers from the Septuagint (LXX-Pent, LXX-DH, LXX-Macc, LXX-Ps, LXX-Wis) occur in 20% of the N-Grams and comprise 14.58% of all outliers along with Hebrews. Josephus and Philo, taken as a group, occur in 5% of the N-Grams and comprise 3.12% of the outliers along with Hebrews. For some N-Grams, the only outliers alongside Hebrews are Jewish corpora. However, in most cases, when a Jewish corpus is an outlier alongside Hebrews, a Christian corpus is an outlier as well. Regarding influence, this may suggest that even as writing patterns developed in emerging Christianity, many of these patterns originated in the Greek Bible and were appropriated by multiple authors in New Testament times.

Texts written by non-Christian and non-Jewish authors comprise 8.3% of the outliers along with Hebrews. These reference corpora represent a large sample of ancient Greek literature, so that the relative paucity of N-Grams from our master chart in these texts heightens the significance of their comparatively frequent recurrence in Christian and Jewish corpora. If, for example, the sequence διά πᾶς were merely a signifier of writing in the Greek language, we would not expect this N-Gram to cluster together in three short corpora, namely Hebrews, Colossians and Ephesians, and the Psalms. However, since διά πᾶς is particularly characteristic of these texts, there is good reason to suspect literary influence, especially since the authors of both Hebrews and Colossians and Ephesians knew the Psalms. Ultimately, our Greco-Roman reference corpora function as controlling documents: as samples of ancient Greek literature, they are sufficiently large to render the recurrence of certain N-Grams in Jewish and Christian corpora statistically significant.

To summarize, we find that certain stylistic patterns that are otherwise quite rare in Greek literature recur in Hebrews because the author was particularly influenced by other writers in emerging Christianity. Our quantitative reasoning that leads to this conclusion is as follows: Christian texts stand out as outliers at an unusually high rate. Among our corpora, nine of them, or 37.5%, are early Christian texts. However, as the pie chart above indicates, roughly 74% of our outliers are early Christian texts, a proportion twice as large as their share of the reference corpora. This result provides strong evidence that when an N-Gram from out master chart occurs in a corpus at an unusually high rate, that corpus is likely to be among the literature of emerging Christianity.

5.2. Hypothesis Test

To gain confidence that our results are indicative of influence, we must be able to show that the high rate at which early Christian corpora occur among the outliers is not a function of pure chance. In other words, it is our burden to answer the following question: assuming each corpus is equally likely to be an outlier, what is the probability of achieving by random chance alone the results we have displayed above, which reveal a high concentration of early Christian outliers? To answer this question, we conduct a hypothesis test, which is a statistical procedure that compares two hypotheses, the null hypothesis, designated H_0, and the alternate hypothesis, designated H_a. If the test shows that our data are incompatible with the null hypothesis, we reject it in favor of the alternate hypothesis.

Our null hypothesis is that each corpus is equally likely to be an outlier and our alternate hypothesis is that early Christian corpora are more likely to be outliers. Using mathematical notation and letting p denote the probability that an outlier text belongs to the category of Christian writings, we state our hypotheses as follows:

$$H_0 : p = 37.5\%$$

$$H_a : p > 37.5\%$$

We consider the total number of times early Christian texts are outliers in our master chart. Out of 96 total outliers, 71 are Christian texts (or 74%, as indicated in the pie chart above). To test whether this result is consistent with the null hypothesis, we compare these results with those expected by a binomial distribution. We claim that the binomial distribution is an appropriate model for the null hypothesis because in this test we classify each corpus as either Christian or non-Christian. The binomial setting arises in our test because the following requirements are met (Sullivan 2017, p. 239):

1. Each of the 96 outliers can be considered a "trial", or an experiment with two possible, mutually exclusive outcomes: Christian or non-Christian.
2. Each trial occurs independently, meaning whether one outlier is a Christian text does not affect the probability that another outlier is also a Christian text.
3. Due to our null hypothesis, we assume that each trial has the same probability of returning a Christian corpus ($p = 37.5\%$).

Next, let k be a random variable that represents the total number of Christian texts among a set of 96 outliers. According to the conditions outlined above, k follows a binomial distribution with n = 96 trials and a probability of $p = 37.5\%$ for each outlier to be a Christian text. With this information, we compute a p-value, which is the probability of finding a total number of Christian corpora among our set of 96 outliers as great or greater than the number we observed. Stated mathematically:

$$p = Prob(k \geq 71)$$

We find $Prob(k \geq 71) = 3.38284 \times 10^{-13}$, an infinitesimally small value that, for all practical purposes, is 0. This extremely low p-value represents the probability of finding 71 Christian outliers by random chance alone. As a result, we conclude in favor of the alternate hypothesis, that the true probability that an early Christian corpus would be an outlier is higher than 37.5%. Practically speaking, our result indicates that a circumstance of special interest impacts our data, which enhances our confidence in our claim that certain habits of style were distinctive to early Christian authors. Many of the writing patterns displayed in our master chart are components of an early Christian stylistic fingerprint, which are found in Hebrews due to influence from the author's co-religionists.

6. Discussion (Part 2): Causes of Style

6.1. Introduction

In this section, we consider what factors may have influenced how the author of Hebrews writes. The question we address is what caused the author to deploy the stylistic patterns identified in the master chart? We examine several N-Grams individually, the purpose of which is to showcase representative cases of different causes of style. For each N-Gram, we plot their distributions on histograms. In what follows, we identify three potential causes for style, which we discuss in this order: knowledge of texts, theological affinities, and common modes of discourse.

6.2. Knowledge of Texts

In certain cases, knowledge of texts may determine style. The author of Hebrews operates with a deep knowledge of the Greek Bible and likely had it memorized. Similarly, given the widespread circulation of Paul's letters in early Christianity (Mitchell 2020), it is likely that a second or third generation Christian such as the author of Hebrews would be familiar with their contents. Although the transfer of two-word sequences could be the result of conscious imitation,[13] we suspect unconscious influence is the most likely explanation. The author of Hebrews knew the cadences of the Greek Bible and of Paul's letters and thereby recycles stylistic micro-patterns of his predecessors.

For some N-Grams, we can be confident that certain corpora stand out as particularly influential. For example, in Figure 3 below, the histogram shows that γάρ ὁ occurs in Colossians and Ephesians considerably more than the other corpora. Since among our reference corpora γάρ ὁ is a defining feature particularly of Colossians and Ephesians, we argue that this feature also occurs in Hebrews at a high rate as a direct result of his knowledge of these letters.

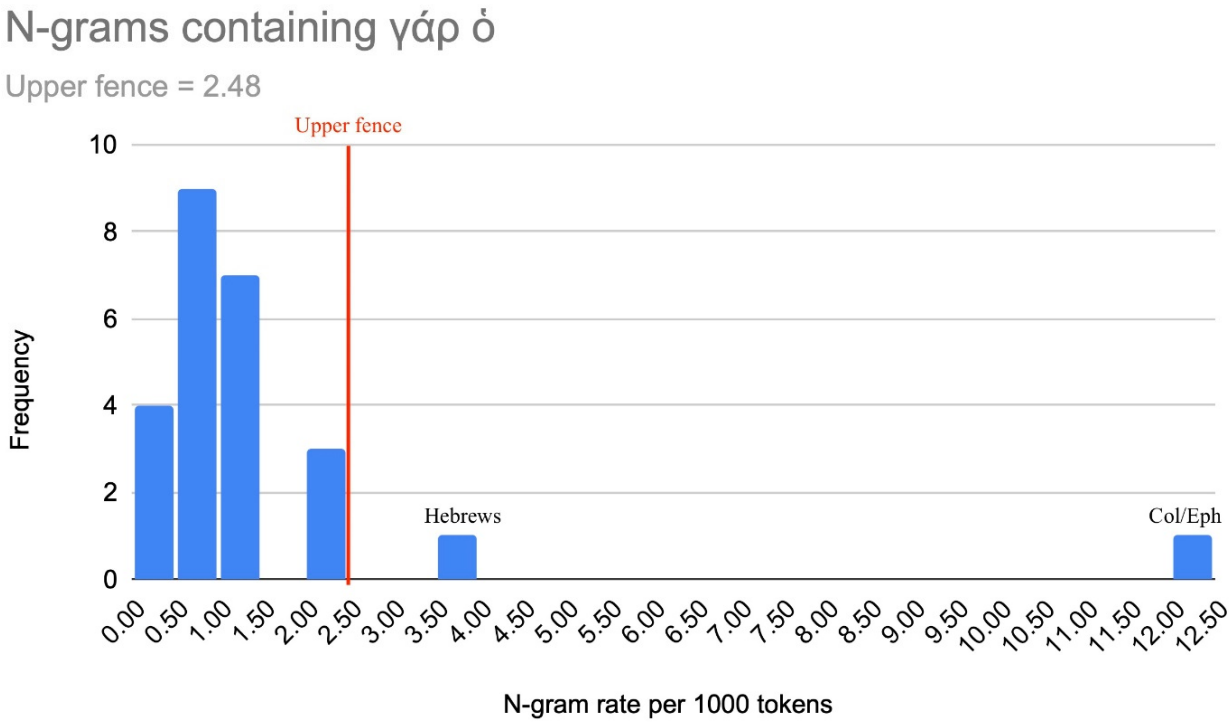

Figure 3. Histogram for γάρ ὁ.

In other cases, we cannot identify a specific corpus that stands out as particularly influential, but we can isolate trends in the data that are suggestive of influence. For example, in Figure 4 below, ἵνα μή occurs at a comparatively high rate in Hebrews, Paul,

and the Pastoral Epistles. Since the authentic Pauline letters are the earliest among these corpora, we find that ἵνα μή is a unique element of Paul's style that has been recycled by subsequent authors who knew his letters. Regarding the author of Hebrews, however, we may only say that he was influenced by the Pauline letter-writing tradition, since the distinction between the "authentic" letters and the Pastorals did not exist in New Testament times and since it is impossible to know whether the author preferred certain Pauline letters over others.

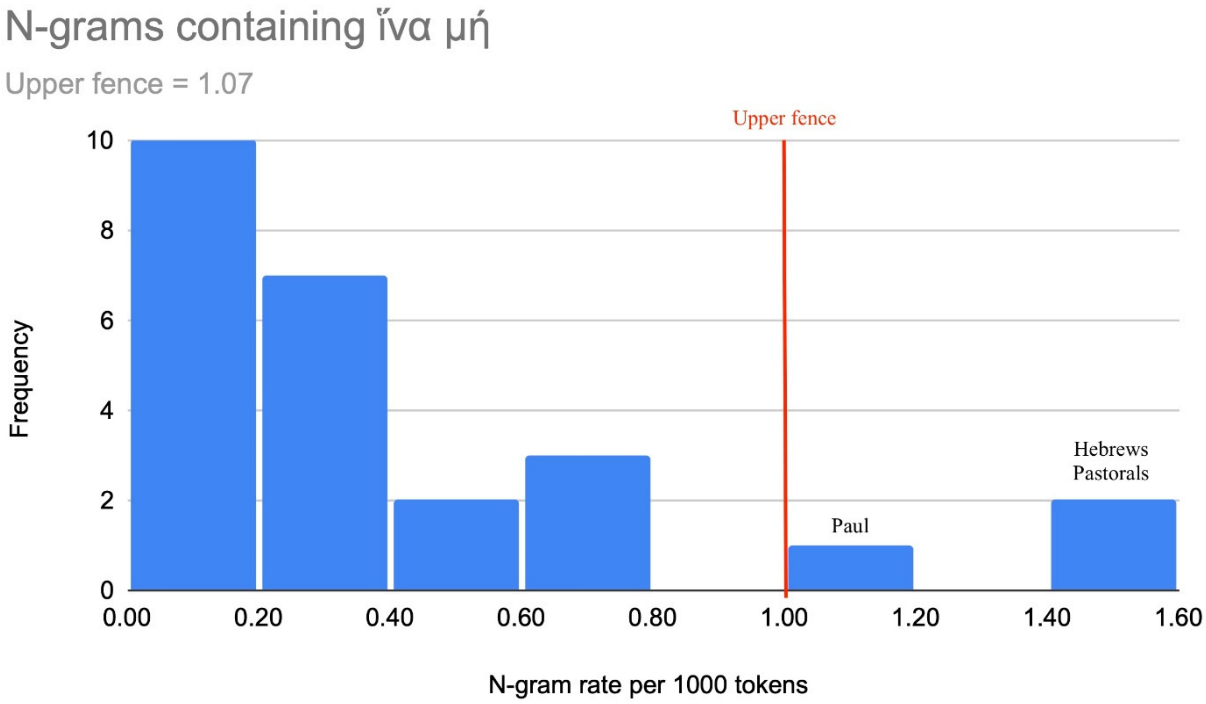

Figure 4. Histogram for ἵνα μή.

In Figure 5 below, γάρ ὅτι is another instance where we trace stylistic influence in terms of general patterns. Once again, since Paul is the earliest of the outliers, we find that γάρ ὅτι is an element of Paul's style employed also by authors writing in his wake. The intertextual relationship here is complex and it is impossible to determine whether the author of Hebrews picked up this stylistic habit from Paul, Mark, or both. However, for the sake of argument, even if the author intentionally borrowed γάρ ὅτι from Mark, Paul's writings would still be influential in an indirect sense, since this stylistic habit appears to have been transferred from Paul to Mark. In any case, the histogram below suggests that the author of Hebrews shares a stylistic habit with the earliest Christian letter-writer and the earliest Christian narrative author, each of whom exercised great influence upon subsequent epistolary and Gospel traditions.

In addition to New Testament texts, some N-Grams occur in Hebrews because of the author's knowledge of biblical texts. For example, in the histogram below, αὐτός ὡς is a stylistic feature that recurs in Hebrews, the Psalms, and the biblical Wisdom Literature, but which is otherwise rare in Greek writings. The sequence αὐτός ὡς neither occurs in Hebrews because the author quotes a favorite passage (the N-Gram recurs throughout both LXX-Ps and LXX-Wis) nor because he thematizes a major biblical concept (the N-Gram consists of two common function words). Rather, the author is deeply familiar with the Psalms and Wisdom Literature and thereby adopts as an element of his style a feature that is distinctive to these corpora.

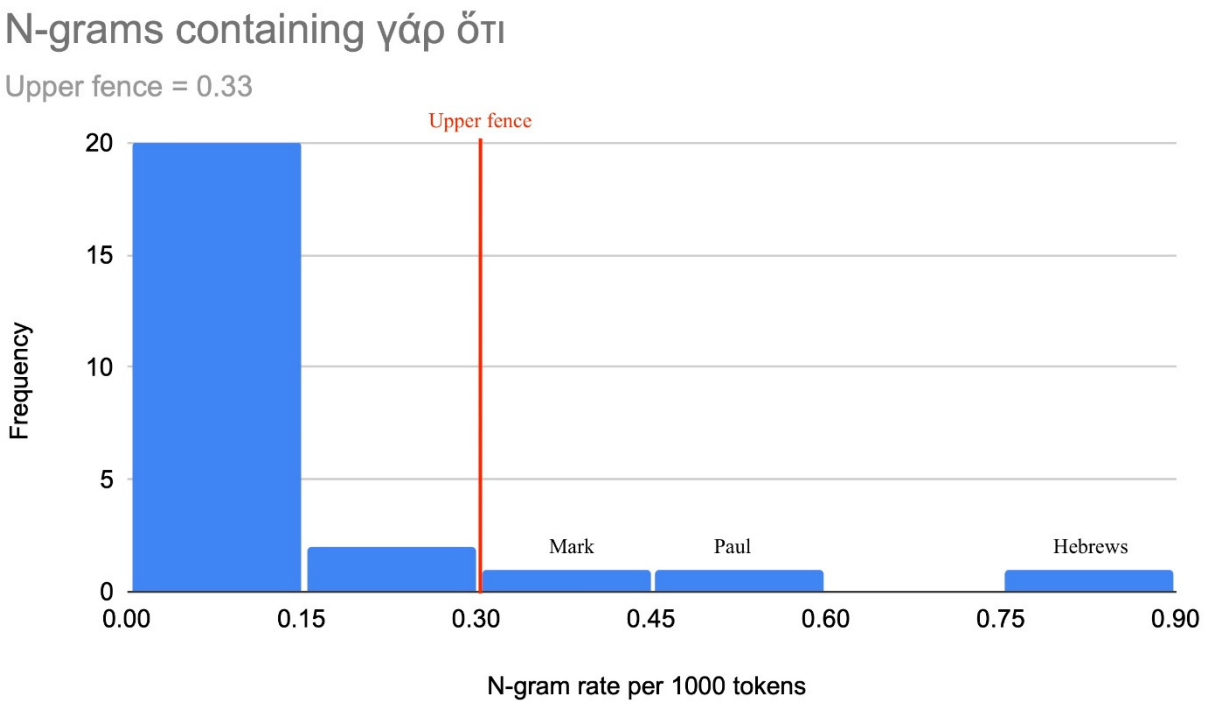

Figure 5. Histogram for γάρ ὅτι.

In addition to New Testament texts, some N-Grams occur in Hebrews because of the author's knowledge of biblical texts. For example, in Figure 6 below, αὐτός ὡς is a stylistic feature that recurs Hebrews, the Psalms, and the biblical Wisdom Literature, but which is otherwise rare in Greek writings. The sequence αὐτός ὡς neither occurs in Hebrews because the author quotes a favorite passage (the N-Gram recurs throughout both LXX-Ps and LXX-Wis) nor because he thematizes a major biblical concept (the N-Gram consists of two common function words). Rather, the author is deeply familiar with the Psalms and Wisdom Literature and thereby adopts as an element of his style a feature that is distinctive to these corpora.

To summarize, we argue that the author of Hebrews shares stylistic habits with his predecessors in part because he knows the contents of key texts in his literary network. Our method enables us to glimpse certain features within certain corpora that the author of Hebrews borrows from his literary ancestors: in certain cases, a single corpus stands out as particularly influential; in other cases, our data reveal general trends (e.g., only texts from the Pauline tradition are outliers) that make possible multiple scenarios. The essential point, however, is that most of the N-Grams in the master chart comprise common function words, which points to knowledge of texts as a major cause of style, since there is nothing distinctively Christian about these patterns. On the surface, for example, one might not suppose that γάρ ὅτι is a New Testament way of writing, yet prior to Hebrews this combination of words clusters together precisely in two of the earliest and most influential New Testament corpora, namely Paul's letters and the Gospel of Mark.

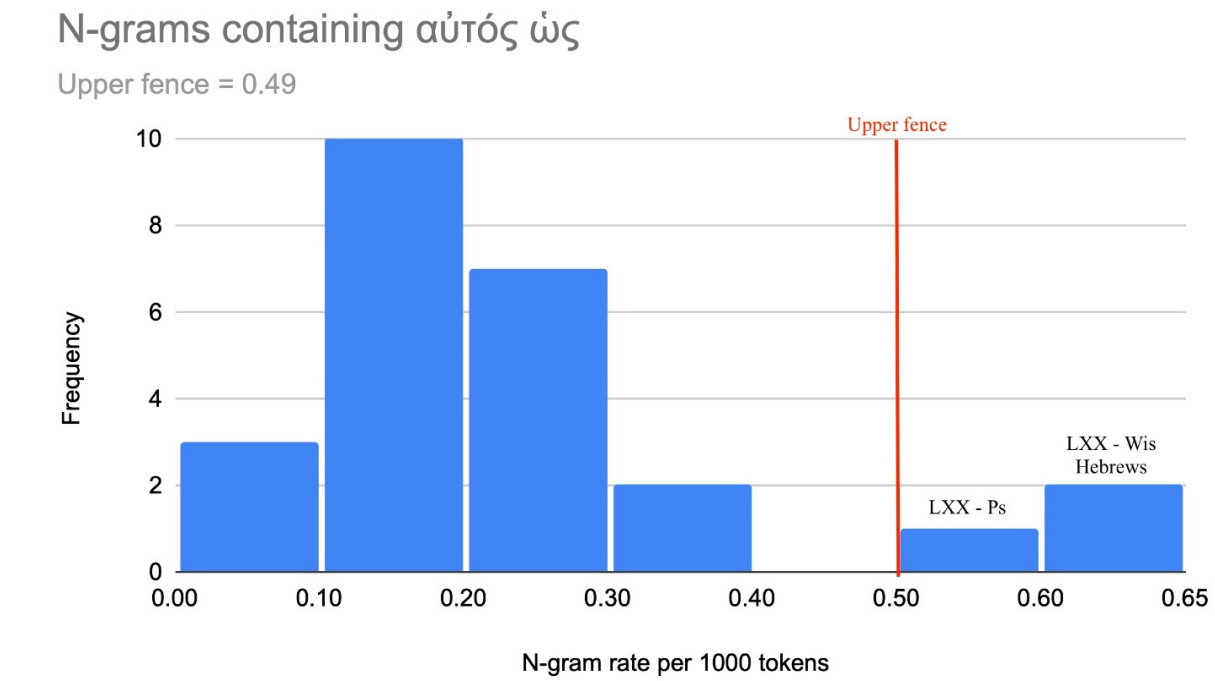

Figure 6. Histogram for αὐτός ὡς.

6.3. Theological Affinities

In other cases, either in connection with or independent of knowledge of texts, shared theology may determine style. In Figure 7 below, we present the distribution of ἐν δεξιός, which showcases the relationship between theology and style. Undoubtedly, ἐν δεξιός recurs in various New Testament texts because of the shared belief that Christ sits at the right hand of God the Father. In this connection, it is no coincidence that Colossians and Ephesians and Hebrews, two corpora that heavily thematize Christ's position in the heavens, are extreme outliers in this distribution.

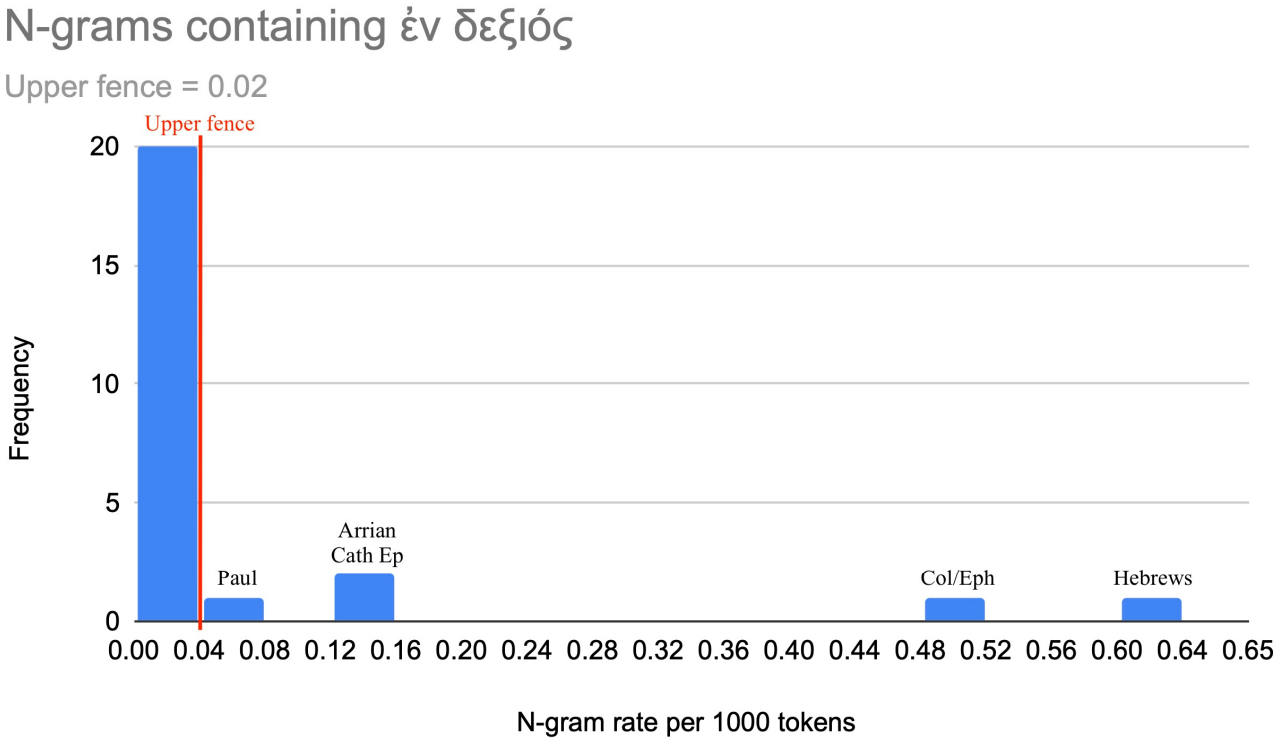

Figure 7. Histogram for ἐν δεξιός.

Theological affinities can also determine style in cases where the N-Gram appears less formulaic. In Figure 8 below, for example, θεός εἰς is a distinctive feature of Hebrews, Colossians and Ephesians, the Catholic Epistles, and Paul. In this case, similar thought-structures among early Christians, where the name of God is linked to some sort of teleological action, results in similarities in style.

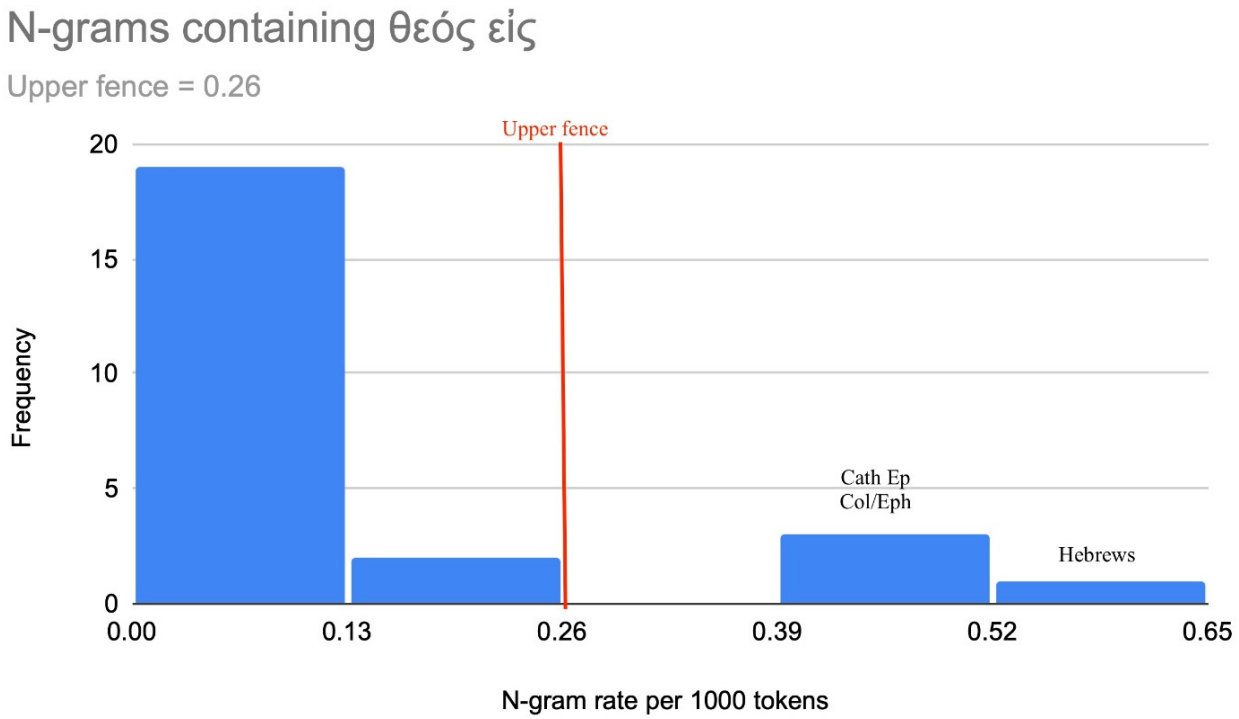

Figure 8. Histogram for θεός εἰς.

6.4. Common Modes of Discourse

In other cases, literary or social modes of discourse in the Greco-Roman world may determine style. Although our units of analysis are small, some of our N-Grams reflect the author's participation in and influence from his wider literary environment. It is significant, for example, that authors such as Cassius Longinus and Dio Chrysostom share with Hebrews high rates of οὐ γάρ, γάρ εἰς, and καί περί, each of which are word sequences that could help one follow a rhetorical argument, whether written or oral. In Figure 9 below, we present the distribution of καί περί as an example. In this case, influence occurs indirectly: the author of Hebrews shares with two rhetoricians a stylistic habit that can structure an argument and clarify a topic ("and concerning"), not necessarily because he knew the texts of these authors,[14] but because he independently deploys a rhetorical protocol also used by other authors in his literary network.

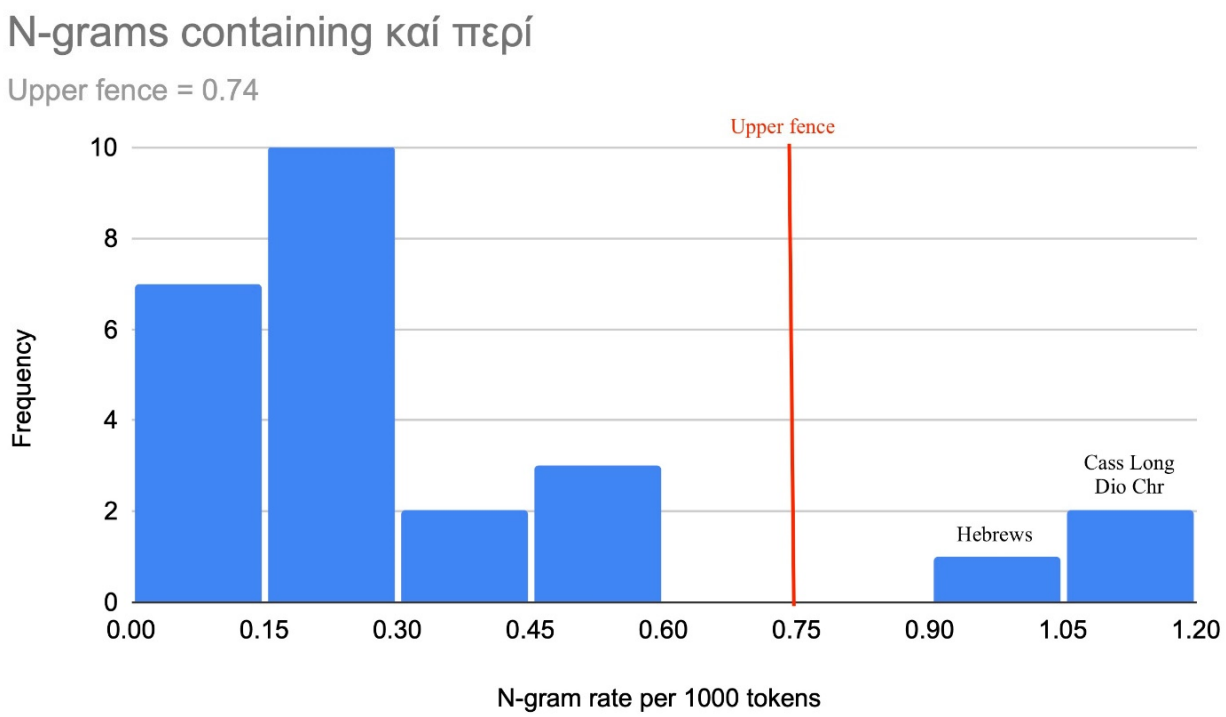

Figure 9. Histogram for καί περί.

6.5. Synthesis

In this section, we have discussed three causes of style that further elucidate the results displayed in our master chart. These three determiners—knowledge of texts, theological affinities, and common modes of discourse—need not be understood as mutually exclusive. Patterns of language use in emerging Christianity are best located near the intersection of written text, spoken word, and shared worldview. For example, regarding the N-Gram ἐν δεξιός, early Christians almost certainly propagated the notion that Christ sits at the right hand of God in various conversational settings even as texts that contain this linguistic pattern also played a major role in recycling this stylistic habit. Even for N-Grams that have no discernable meaning, there may not be a firm boundary between textuality and orality. Although we contend, for example, that ἵνα μή is a Pauline stylistic habit recycled by subsequent authors (Section 6.2), it is possible that as Paul's letters were read and reread in congregational settings, ἵνα μή became part of early Christian spoken vocabulary. Under this scenario, the recurrence of ἵνα μή in Hebrews may very well reflect an unconscious reflex by the author caused by his literary predecessors and the speaking patterns of his co-religionists. Although it is beyond the scope of this study to explore the relationship between textuality and orality further, we note that our data raise an issue that may be suitable for analysis in fields such as the cognitive sciences or linguistic anthropology.

Causes of style are integrally related to a text's classification. It is no accident that outlier corpora along with Hebrews are primarily other early Christian corpora. Even as the author of Hebrews shares stylistic habits that reflect modes of discourse in the wider Mediterranean world (Section 6.4), he is a participant especially in the literary tradition of emerging Christianity. In this way, the book of Hebrews reveals itself as a "Christian" text in terms of the stylistic patterns it has in common with other Christian authors. To be sure, the individual effort and choices of an author are arguably the most important factors that determine style. Nevertheless, the style of Hebrews and of any written text results from a tension between an author's unique contributions and the stylistic and social conventions of others in his literary network.

7. Conclusions

The data presented above show that the book of Hebrews contains stylistic patterns that reflect influence from the author's literary network. We have found that some stylistic features that recur in Hebrews also recur in corpora by contemporary authors. These co-occurrences result from the fact that the author of Hebrews does not write in a vacuum. Rather, the author's interaction with various cultural and literary traditions means he adopts stylistic habits that circulate in the world around him. Borrowing, whether intentional or not, can occur at the level of small word sequences, some of which have discernable meaning, others of which do not. Accordingly, we have found in the case of Hebrews that the author's participation in his literary network reveals itself in stylistic micro-patterns, some of which we have uncovered and analyzed.

Our analysis shows that, when Hebrews is an outlier, other early Christian corpora tend to be outliers as well. In our opinion, this shows that early Christian writings contain linguistic signifiers that categorically distinguish texts produced by participants in proto-orthodox Christ-movements from those that were not. The Pauline tradition is generally prominent among the outliers, which is notable not only because Paul's letters are the earliest extant Christian writings but also because scholarship constantly investigates Paul's influence upon early Christian text production, such as the Deutero-Pauline letters (e.g., Frenschkowski 2001), the Gospels (e.g., Becker et al. 2014), and the book of Acts (Aejmelaeus 1987; Walton 2000; Hays 2012; Becker 2020). Paul and his followers may have created a condition of group imitation, wherein authors who write in his wake recycle his stylistic habits and create new ones. Our data also show that the Gospels, the Catholic Epistles, and 1 Clement are frequently outliers along with Hebrews. We argue that we have uncovered initial evidence that emerging Christianity developed a distinctive grammar, that some features endemic to early Christian literature occur in Hebrews, and that even seemingly meaningless word sequences are important because of the corpora in which they are concentrated.

In terms of method, we have proposed an approach to identifying specific features and corpora that are relevant to literary influence. Traditional stylometric methods could not have accomplished our objectives. Euclidean distance, for instance, is strongly influenced by the length of the documents in question. This characteristic makes it a poor measure of similarity for our reference corpora, which includes short corpora, such as Hebrews and Paul, as well as exponentially longer corpora, such as Plutarch and Josephus. Cosine similarity marked an improvement in this regard, but since that method aggregates information, it cannot identify the effects of a single variable. For example, we found low measures of similarity between Hebrews and the Deuteronomistic History, the Psalms, and the Wisdom writings when considering the aggregate (Section 3.4). However, by investigating each N-Gram individually, we found that these Septuagint corpora share with Hebrews departures from the tendencies of our reference corpora, which is evidence for influence that would be obscured by compressing all variables into a single statistic. TF-IDF, typically applied to single tokens, could be applied to N-Grams, but it is less suitable to measure stylistic similarities. Many N-Grams in our master chart occur at least once in every corpus, meaning the logarithmic function of TF-IDF would pass over many of the features we have identified with our method as reflective of influence.

Finally, we have departed from traditional approaches to the style of Hebrews. Instead of viewing style as a matter of literary artistry or as a reflection of the individuality of an author, we focused on micro-patterns of language use and introduced influence as an application to the stylometric analysis of Hebrews. Accordingly, our analysis marks a first step toward identifying the various elements of an early Christian stylistic fingerprint. To be sure, our claim that the early Christian writings contain a distinctive style requires

further testing and analysis, for it may be that we have only uncovered the tip of the iceberg in terms of writing habits transferred among these texts. We recommend that future stylometric studies contribute further insights to the early Christian stylistic fingerprint, with different target texts, different feature types, and possibly with more sophisticated quantitative methods. We believe that such pursuits would be fruitful not as a replacement of but rather as a complement to previous approaches to Hebrews and style.

Author Contributions: Conceptualization, E.B.P.; methodology, E.B.P. and T.M.; data curation, E.B.P.; writing, E.B.P. and T.M.; review and editing, E.B.P. and T.M. All authors have read and agreed to the published version of the manuscript.

Funding: The research for this article was funded by the Carlsberg Foundation in the Semper Ardens Accelerate-project "Computing Antiquity: Computational Research in Ancient Text Corpora".

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Our data and statistical procedures are freely available at https://github.com/erichpracht, accessed on 4 January 2025.

Acknowledgments: We thank Jacob P.B. Mortensen for managerial support, Márton Kardos for technical support, and Lavinia Cerioni, Christian Thrue Djurslev, and Paul Robertson for detailed comments to previous drafts of this article.

Conflicts of Interest: The authors declare no conflict of interest.

Notes

1 E.g., (Attridge 1989, pp. 6–7; Koester 2001, pp. 21–24); for the minority argument that Hebrews and 1 Clement utilize common traditions, see (Theissen 1969, pp. 34–37). Some scholars argue that 1 Clement could have been written as late as the second century. For discussion, see (Welborn 1984, p. 37; Gregory 2001, p. 149).

2 But see (Johnson 2006), who dates Hebrews prior to the destruction of the temple.

3 Scholars generally agree that Hebrews is in contact with the Pauline tradition, in no small measures based on structural similarities in major theological themes. For a concise discussion of theological affinities between Hebrews and Paul that gives careful attention to key differences, see (Grindheim 2023, pp. 7–10).

4 For discussions of parallels in theology and rhetorical structure, see (Attridge 1989, pp. 30–31; Johnson 2006, p. 30).

5 The classic survey of parallels between Hebrews and John is (Spicq 1952, pp. 109–38).

6 For bibliography, see (Gheorghita 2003, pp. 7–25).

7 Others situate Hebrews in a similar tradition with Philo without presuming direct dependence, see, e.g., (Eisele 2003, pp. 160–240).

8 Although Arrian transcribed the teachings of Epictetus, we consider Arrian and Epictetus as two separate corpora, since their contents originate from two different authors.

9 In NT studies, dating texts is often a highly tenuous enterprise. Therefore, we think the best course is to avoid making one's analysis stand or fall on the issue of dating.

10 Cosine similarity is, however, utilized effectively to accomplish the research objectives of Roy and Robertson (2022).

11 In this study, we only have outliers above the outlier boundary, since the theoretical lower boundaries are all below 0 and since an N-Gram cannot occur a negative amount of times.

12 In the NT, πνεῦμα is often modified by a descriptive genitive.

13 For a translation of ancient school exercises on paraphrasing and elaborating upon pre-existing material, see (Kennedy 2003, pp. 70–72); see (Rothschild 2009), who argues that the author of Hebrews writes in imitation of Paul; for a discussion of imitation in a different context, see (Keeline 2019, pp. 13–72), who discusses the role of Cicero's *Pro Milone* as a model for imitation in the ancient rhetorical classroom.

14 Indeed, as a third-century author, Cassius is one of the latest authors among our reference corpora.

References

Aejmelaeus, Lars. 1987. *Die rezeption der paulusbriefe in der miletrede (Apg 20:18–35)*. Helsinki: Suomalainen Tiedeakatemia.
Attridge, Harold. 1989. *Hebrews: A Commentary on the Epistle to the Hebrews*. Herm and Philadelphia: Fortress.
Bally, Charles. 1921. *Traité de stylistique française*. Heidelberg: C. Winter.

Barclay, John M. G. 1987. Mirror-Reading a Polemical Letter: Galatians as Test Case. *Journal for the Study of the New Testament* 31: 73–93. [CrossRef]
Becker, Eve-Marie. 2017. *The Birth of Christian History: Memory and Time from Mark to Luke-Acts*. New Haven: Yale University Press.
Becker, Eve-Marie. 2020. "Paul and 'Paul'": Paul's Letter to the Philippians in Light of Acts 20:1836. In *Der philipperbrief des paulus: Vorarbeiten zum einem kommentar*. Tübingen: Francke, pp. 21–33.
Becker, Eve-Marie, Engberg-Pedersen Troels, and Müller Mogens, eds. 2014. *Mark and Paul, Comparative Essays Part II: For and Against Pauline Influence on Mark*. Berlin: De Gruyter.
Croy, Clayton N. 1998. *Endurance in Suffering: Hebrews 12:1–13 in Its Rhetorical, Religious, and Philosophical Context*. Cambridge: Cambridge University Press.
Eisele, Wilfried. 2003. *Ein unerschütterliches reich: Die mittleplatonische umformung des parusiegedankens im hebräerbrief*. New York: de Gruyter.
Ellingsworth, Paul. 1993. *The Epistle to the Hebrews*. NIGTC. Grand Rapids: Eerdmans.
Engberg-Pedersen, Troels. 2020. The Past is a Foreign Country: On the Shape and Purposes of Comparison in New Testament Scholarship. In *The New Testament in Comparison: Validity, Method, and Purpose in Comparing Traditions*. Edited by John M. G. Barclay and B. G. White. London: T&T Clark, pp. 41–62.
Frenschkowski, Marco. 2001. Pseudepigraphie und Paulusschule: Gedanken zur Verfasserschaft der Deuteropaulinen, insbesondere der Pastoralbriefe. In *Das ende des paulus: Historische, theologische und literaturgeschichtliche aspekte*. Edited by Friedrich Wilhelm Horn. Berlin: De Gruyter, pp. 239–70.
Gäbel, Georg. 2006. *Die kulttheologie des hebräerbriefes: Eine exegetisch-religiongeschichtliche studie*. Tübingen: Mohr Siebeck.
Gelardini, Gabriella. 2007. *"Verhärtet eure herzen nicht": Der hebräerbrief, eine synagogenhomilie zu tischa be-aw*. Leiden: Brill.
Gheorghita, Radu. 2003. *The Role of the Septuagint in Hebrews: An Investigation of its Influence with Special Consideration to the Use of Hab 2:3–4 in Heb 10:37–38*. Tübingen: Mohr Siebeck.
Grässer, Erich. 1990. *An die hebräer*. Zürich: Benzinger, vol. 3.
Gray, Patrick. 2003. *Godly Fear: The Epistle to the Hebrews and Greco-Roman Critiques of Superstition*. Atlanta: Scholars Press.
Gregory, Andrew. 2001. Disturbing Trajectories: 1 Clement, the Shephard of Hermas, and the Development of Early Christianity. In *Rome in the Bible and the Early Church*. Edited by Peter Oakes. Grand Rapids: Baker, pp. 142–66.
Grindheim, Sigurd. 2023. *The Letter to the Hebrews*. PNTC. Grand Rapids: Baker.
Guthrie, George H. 1994. *The Structure of Hebrews: A Text-Linguistic Analysis*. Leiden: Brill.
Hardy, Donald E. 2004. Collocational Analysis as a Stylistic Discovery Procedure: The Case of Flannery O'Connor's *Eyes*. *Current Trends in Stylistics* 38: 410–27.
Hays, Richard B. 2012. The Paulinism of Acts, Intertextuality Reconsidered. In *Paul and the Heritage of Israel: Paul's Claim Upon Israel's Legacy in Luke and Acts in the Light of the Pauline Letters*. Edited by David P. Moessner, Daniel Marguerat, Mikael C. Parsons and Michael Wolter. London: T&T Clark, pp. 35–48.
Hermann, Berenike J., Karina van Dalen-Oskam, and Christof Schöch. 2015. Revisiting Style, a Key Concept in Literary Studies. *Journal of Literary Theory* 9: 25–52.
Holmes, Christopher T. 2018. *The Function of Sublime Rhetoric in Hebrews: A Study in Hebrews 12:18–29*. Tübingen: Mohr Siebeck.
Jockers, Matthew L. 2013. *Macroanalysis: Digital Methods and Literary History*. Champaign: University of Illinois Press.
Johnson, Luke Timothy. 2006. *Hebrews*. Louisville: Westminster John Knox.
Kayser, Wolfgang. 1948. *Das sprachliche kunstwerk: Eine einführung in die literaturwissenschaft*. Bern: A. Francke.
Keeline, Thomas J. 2019. *The Reception of Cicero in the Early Roman Empire: The Rhetorical Schoolroom and the Creation of a Cultural Legend*. Cambridge: Cambridge University Press.
Kennedy, George A. 2003. *Progymnasmata: Greek Textbooks of Prose Composition*. Atlanta: Scholars Press.
King, Stephen. 2000. *On Writing: A Memoir of the Craft*. New York: Scribner.
Koester, Craig. 2001. *Hebrews. A New Translation with Introduction and Commentary*. New Haven: Yale University Press.
Kraftchick, Steve. 2008. Self-Presentation and Community Construction in Philippians. In *Scripture and Traditions: Essays on Early Judaism and Christianity in Honor of Carl R. Holladay*. Edited by Patrick Gray and Gail R. O'Day. Leiden: Brill, pp. 239–62.
Mackie, Scott D. 2007. *Eschatology and Exhortation in the Epistle to the Hebrews*. Tübingen: Mohr Siebeck.
Mason, Eric. 2008. *"You are a Priest Forever": Second Temple Jewish Messianism and the Priestly Christology of the Epistle to the Hebrews*. Leiden: Brill.
McCruden, Kevin B. 2008. *Solidarity Perfected. Beneficent Christology in the Epistle to the Hebrews*. Berlin: de Gruyter.
Mitchell, Margaret M. 2020. How was the Reception of Paul Shaped in the Early Church. In *The New Cambridge Companion to St. Paul*. Edited by Bruce W. Longnecker. Cambridge: Cambridge University Press, pp. 278–98.
Porter, Stanley, and Bryan R. Dyer. 2023. *Origins of New Testament Christology: An Introduction to the Traditions and Titles Applied to Jesus*. Grand Rapids: Baker.

Robert Hayek, Sophie, Jacques Istas, and Frédérique Michèle Rey. 2023. Unraveling the Synoptic Puzzle: Stylometric Insights into Luke's Potential Use of Matthew. *CEUR Workshop Proceedings 799–813* 3558: 9524.

Robertson, Paul. 2016. *Paul's Letters and Contemporary Greco-Roman Literature: Theorizing a New Taxonomy*. Leiden: Brill.

Rothschild, Clare K. 2009. *Hebrews as Pseudepigraphon*. Tübingen: Mohr Siebeck.

Roy, Ashley, and Paul Robertson. 2022. Applying Cosine Similarity to Paul's Letters: Mathematically Modeling Formal and Stylistic Similarities. In *New Approaches to Textual and Image Analysis in Early Jewish and Christian Studies*. Edited by Garrick V. Allen, Sara Schulthess, Paul Dilley and Peter Phillips. Leiden: Brill, pp. 88–117.

Schenck, Kenneth. 2007. *Cosmology and Eschatology in Hebrews: The Settings of the Sacrifice*. Cambridge: Cambridge University Press.

Spicq, Ceslas. 1952. *L'epître aux hébreux*. Paris: J. Gabalda.

Spitzer, Leo. 1961. *Stilstudien, erster teil: Sprachstile*. München: Max Hueber.

Staiger, Leo. 1955. *Die kunst der interpretation: Studien zur deutschen literaturgeschichte*. Zürich: Deutscher Taschenbuch Verlag.

Stutterheim, Cornelis Ferdinand Petrus. 1947. *Stijler*. Den Haag: Polak and Van Gennep.

Sullivan, Michael D. 2017. *Statistics: Informed Decisions Using Data*. Boston: Pearson.

Theissen, Gerd. 1969. *Untersuchungen zum hebräerbrief*. Gütersloh: Gerd Mohn.

Trotter, Christine. 2023. *Hellenistic Jews and Consolatory Rhetoric: 2 Maccabees, Wisdom of Solomon, 1 Thessalonians, and Hebrews*. Tübingen: Mohr Siebeck.

Walton, Steve. 2000. *Leadership and Lifestyle: The Portrait of Paul in the Miletus Speech and 1 Thessalonians*. Cambridge: Cambridge University Press.

Welborn, Laurence L. 1984. On the Date of First Clement. *Biblical Research* 23: 35–54.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.