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Proposing Some New Ecliptics in New Testament Studies Enabled by Digital Humanities-Based Methods

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Abstract:

“Fragmentation” is a well-worn watchword in contemporary biblical studies. But is endless fragmentation across the traditional domains of epistemology, methodology and hermeneutics the inevitable future for the postmodern exercise of biblical scholarship? In our view, multiple factors mitigate against such a future, but two command our attention here. First, digital humanities itself, through its principled use of corpora, databases and computer-based methods, seems to be remarkably capable of producing findings with high levels of face validity (interpretive agreement) across multiple hermeneutical perspectives and communities. Second, and perhaps more subversively, there is a substantial body of practitioners that, per Kearney, actively question postmodernity’s

impress as the final port of call for philosophy. For these practitioners deconstruction has become both indispensable — by delegitimizing hegemonies — but, in its own way, metanarrative by stultifying all other iterative, dialectical and critical processes that have historically motivated scholarship. Sensing this impasse, Kearney (1987, pp. 43-45) proposes a reimagining that is not only critical but that also embraces *ποίησις*, the possibility of optimistic, creative work. Such a stance within digital humanities would affirm that poietic events emerge not only through frictions and fragmentation (e.g. Kinder and McPherson 2014, pp. xiii-xviii) but also through commonalities and convergence. Our approach here will be to demonstrate such a reimagining, rather than to argue for it, using two worked examples in the Greek New Testament (GNT). Those examples – digital humanities-enabled papyrology and digital humanities-enabled statistical linguistics – demonstrate ways in which the data of the text itself can be used to interrogate our perspectives and suggest that our perspectives must remain ever open to such inquiries. We conclude with a call for digital humanities to further leverage its notable strengths to cast new light on old problems not only in biblical studies, but across the spectrum of the humanities.

About the Author:

Dr. James A. Libby is CEO and founder of Decision Support Sciences, a marketing science-predicated consultancy and mathematical modeling firm whose software and databases have been used by Fortune 500 countries in over forty countries worldwide. Libby earned his Ph.D. in New Testament Studies from McMaster Divinity College in 2015. His academic research focuses on leveraging the assets of digital humanities, including, but not limited to, computational linguistics, systemic functional linguistics, modern (non-positivistic) experimental design theory, and the development of knowledge discovery platforms (software, algorithms and databases) to address challenging problems in the humanities in general and biblical studies in particular.

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1. Introduction: Plumbing the Problem—The Fractures within the Épistémè of Contemporary NT Studies¹

As the new millennium dawned, David Lowe clearly stated what many New Testament (NT) researchers had already concluded: that the divides in NT research had widened into a crisis. There was, according to Lowe (2000, p. 693), “the spreading feeling that critical study of the New Testament was of limited utility.” The assessment of Bockmuehl (2006, p. 30-39) was even more trenchant: Ours is a discipline in “disarray”, “fractured and aimless”. Among an extensive list of maladies enumerated by Bockmuehl, agreed methods and criteria have disappeared, scholars work with an “increasingly restricted field of reference and linguistic competence” and, most tellingly, NT scholarship no longer has a clearly identifiable field of study. According to Watson (1997, p. 26), moreover, methodological pluralism and ever-narrowing specialization have resulted in an on-going process of fragmentation. Aichele, Miscall and Walsh (2009, p. 383) concur and conclude that contemporary NT studies is a landscape of “entrenched camps” and “embattled groups...who speak to one another...only in sniping, intellectually unengaged footnotes.” What *does* one do with an academic discipline, asks Robert W. Jenson, which has almost done away with its own object of study?²

To those operating outside the guild, the “camp” metaphor of Aichele, et al. (2009) may seem to overstate the case. For many working NT scholars, however, such a description actually *understates* the philosophical and methodological dissonance that they regularly experience as they comb through the literature of their own discipline. Moreover, were we to end our description here, we would be left with the impression that virtually all NT scholars stand unified in the conviction that this level of fragmentation actually *needs* fixing. The crux of the matter is that NT scholars, consistent with the contemporary ingress of postmodern critique in all the

humanities, widely disagree as to whether such fragmentation is evidence of an underlying *problem* or evidence of the hard fought *solution* to the problem. One could, for instance, cull opinions only from the former group, which includes recognized lights in the NT firmament such as Fowl (1997; 1998), Green (2000, pp. 23–43; 2010; 2011), Jeanrond (1988; 1991; 1993), Thiselton (1992; 1995; 2006) and Thiselton and Marko (1998). While this cadre of scholars are by no means cut from the same hermeneutical cloth, they are united at least in the conviction that unbounded and untethered plurality leads only to hermeneutical vacuity. For an equally disparate number of scholars within NT studies, however, such as Tracy (1987), Adam (2000; 2006), Aichele, Miscall and Walsh (2009) and Moore and Sherwood (2010, p. 90; 2011), fragmentation, pastiche, methodological dissonance and scholarly hermitage are not the problem but the long-awaited *deliverance* from the *real* problem—the manifold metanarratives that NT scholars have served far too long.

2. Proposing Digital Humanities as a Voice Speaking into the Fractures of Contemporary NT Studies

Given this backdrop, is endless fragmentation the future of biblical studies? In our view, two factors mitigate against such a future. First, certain tools within the broad expanse of perspectives and methods that comprise the digital humanities³—specifically its databases, annotated corpora and computer-based methods—seem to be consistently capable of yielding findings that enjoy high levels of face validity (interpretive agreement) across multiple hermeneutical perspectives and communities. This is especially the case for problems within the domain of the computational humanities—problems where the nature of the data allows for the repeated testing of alternative hypotheses regarding unknowns such as the initial form, author(s) or contexts of texts and corpora. These kinds of problems, serendipitously, allow for *coherentist* designs. In stark contradistinction to classical empirical designs, coherentist designs a) are anti-positivistic in that they allow the priors from any perspective to define the presuppositional grounding of the system to be tested; b) allow for a broad and more creative set of hypotheses to be *abductively* tested per the seminal work of C.S. Peirce;⁴ and c) encourage researchers to test alternative hypotheses and methods as part of a reentrant cycle of verification per Harman's

Inference to the Best Explanation (IBE).⁵ That is, coherentist designs encourage a framework in which their diverse priors are tested with an equally diverse set of methods to see if the system demonstrates *pragmatic* adequacy.⁶ In sum, coherentist designs test the priors behind any given candidate's critical framework for coherence, rather than tautologically presupposing them. In this sense such designs wholly reject the hegemony of Positivism, especially in its Logical formulations, but can nonetheless leverage its methods, or indeed the methods of any other critical framework capable of being submitted to coherentist inquiry. In our experience, the greater creativity and diversity allowed in coherentist designs substantially increases interpretive agreement even among quite disparate hermeneutical communities.

Second, and more fundamentally, we concur with Richard Kearney's call to question postmodernity's impress as the final port of call for philosophy. Accordingly, Kearney proposes a reimagining that is critical but that also embraces *ποίησις*, the possibility of optimistic, creative work (Kearney 1987, p. 43-45). Despite Kearney's charge, we cannot in a single article presume to comprehensively address (poiemically or otherwise) the larger, discipline-wide issue of fragmentation within New Testament studies. Nor do we concur that all such fragmentation actually needs "solving," given that some of it exists as the necessary by-product of inadequate priors and methods that are, in fact, quite deserving of deconstruction! We do propose, however, something far more modest: two worked examples that support Kearney's thesis that optimistic creative work (specifically, creative, abductivist, IBE-predicated digital humanities work) is indeed possible and that a coherentist framework provides one fruitful avenue toward that end.⁷ Accordingly, in the next section we present two worked examples in this regard: digital humanities-informed papyrology and digital humanities-enabled statistical linguistics.

3. Two Worked Examples: Digital Humanities as a Still Relevant Poiemic Voice

A. Example 1: Using Digital Humanities to Aid in the Identification of Heavily Damaged Papyri

1. The Problem.

Finding better ways to unambiguously identify heavily damaged papyri has long been a *desideratum* of papyrology. In the discipline of New Testament scholarship, to no one's surprise, the epicenter of scholarly interest falls upon the Greek literary papyri dated to the first centuries of the Christian era.⁸ The problem with papyri this ancient, of course, is that much of it is fragmentary or otherwise heavily damaged. Second, contemporary *de facto* approaches not only frequently fail to unambiguously identify their quarry; they fail to provide criteria capable of arbitrating between competing identifications. In terms of a case study, scarcely any single papyri better exemplifies both of these challenges than does the diminutive Qumran fragment known as 7Q5—a fragment with no less than ten competing published identifications. Might a digital humanities-predicated approach be capable of not only arbitrating between these proposals but also of finding novel identifications? To achieve these kinds of outcomes, we will first briefly review the contested identifications of 7Q5, then propose and execute a digital humanities-predicated approach; finally, that approach will be compared to contemporary, published identifications.

Figure 1. 7Q5 from Baillet's *Editio Princeps* (left) and from Estrada-Herrero et. al (right).⁹

In 1972 the late Catalan papyrologist José O’Callaghan startled the scholarly community by announcing that four of the nineteen¹⁰ Greek fragments discovered in cave seven at Qumran “certainly” originated from the New Testament and that five others were likely from the New Testament as well.¹¹ Most audaciously, however, O’Callaghan (1972b, pp. 4-10) identified the fifth fragment (7Q5) with Mark 6:52-53. The latter claim produced an almost perfect disputational storm—and it wasn’t hard to see why. As Wallace (1994a, p. 2) notes, accepting 7Q5 as Markan would have (1) made 7Q5 the earliest New Testament MS by some 50-100 years, (2) dated Mark to the 40s (given that 7Q5’s “Zierstil” text was no later than 50 CE), (3) silenced advocates of Matthean priority and (4) required scholars to seriously consider a far earlier timetable for the formation of the New Testament canon.¹² While the flurry of excitement concerning 7Q5 is long past (peaking in the mid-1990’s due to C.P. Thiede’s loyal patronage of O’Callaghan’s initial claims),¹³ 7Q5’s contested readings make it an excellent test case for any approach that seeks to better (more creatively and poiemically) arbitrate between claimed identifications. Accordingly, Table 1 summarizes the major published identifications of 7Q5 along with a metadescription of the orthographic, stichometric and text critical factors associated with each identification.

Prior Identifications of 7Q5 ¹⁴				
Proposed Identification	Researcher and Date	Characteristics of the Identification by Class of Criteria		
		Orthographic	Mis-alignment	Text Critical
		Difficult or Contested Reading	Stichometry Score ¹⁵ (Smaller is Better)	Omission (O), Change (C) or Addition (A) (The “Tweaks” Required to Make the Reading “Work”) ¹⁶
Mark 6:52-53	O’Callaghan (1972b)	N after ΤΩ (line2), the Τ (line 3) is interpreted as a Δ	23.947	O: ΕΠΙ ΤΗΝ ΓΗΝ ¹⁷
1 Enoch 15:9d-10	Spottorno (1999, p. 76)	K before HC (line 5)	14.025	O: ΤΑ before ΠΝΕΥΜΑΤΑ (line 3) ¹⁸

Matthew 1:2-3	Parker (1972, pp. 467-469) ¹⁹	ΚΩ rather than ΤΩ (line 2)	6.423	None
2 Kings 5:13-14 (in the Hebrew Bible)=2 Sam 5:13-14	Roberts (1972, p. 446)	ΤΙΥ rather than ΤΩ (line 2) and ΗΜ rather than ΗC (line 5) ²⁰	12.436	None
Ex. 36:10-11	Garnet (1973, pp. 8-9)	ΚΟ after ΤΩ (line 2) and Ε before ΝΗ (line 4)	16.578	Ο: CYN ²¹
2 Sam 4:12-5:1	University of Edinburgh (Per Scibona (2001, p. 153))	ΗΛ rather than ΗC (line 5)	7.390	None
Zech 7:3c-5	Spottorno (1992, p. 542; 1999, p. 72)	ΓΩ rather than ΤΩ (line 2) and Ν after ΤΩ (line 2)	40.022	A: THC ΓNC (after ΙΕΡΕΙC (line 3)) ²² C: ΤΑΙC to ΤΩ (line 5) ²³
Luke 3:19-21 ²⁴	Aland (1974, p. 375)	Requires ΗΝ in line five	10.988	None
Gen 46:20 ²⁵	Muro (2010, no pages)	None	36.668	None
Ezekiel 23:36ff	Wallace (1994c, p. 177) ²⁶	No Η (line 5)	58.72	None

Table 1: Prior Identifications of 7Q5

Even a cursory review of Table 1 underscores not only that scholars disagree on the identity of 7Q5, but that, whatever else may be said for it, the real-world practice of textual identification evidences—how shall we say it—a remarkable plasticity in its orthographic, stichometric and text critical assumptions! These kinds of major disagreements motivated the undertaking of a multidisciplinary review of the current practice of fragmentary textual identification. While that review goes beyond our immediate scope and will be published elsewhere (Libby, forthcoming-a), three summary findings are relevant for our current purposes. First, positively, papyrological researchers clearly *do* attempt to justify their readings orthographically, stichometrically and text-critically. Second, and less positively, criteria from these three accepted domains of

papyrological identification were quite often inconsistently applied, and sometime seemingly rescinded at will. Third, the arbitration criteria necessary to develop *goodness of fit* (relative scoring) *across identifications* are in general left wholly undefined. These latter two deficits reveal that the current, *de facto* method of papyrological identification does little to mitigate the two primary causes of systemic error endemic to any identification task²⁷—error due to the failure to find actual matches (false negatives) and error due to the failure to reject false candidates (false positives).

2. *The Proposal: A Digital Humanities-Based Approach to Reduce Systemic Sources of Error in Identifying Fragmentary Literary Papyri*

The two primary limitations summarized above gave rise to a reworked *phase one* protocol for fragmentary textual identification. That protocol was comprised of four components: (1) the development of an initial digital database of 205 texts drawn from the period and literature of late second temple Judaism and early Christianity, (2) the development of search software specifically designed to overcome the limitations of the *de facto* protocol, (3) the development of a redesigned summative component-based algorithm to score textual readings orthographically and (4) the development of a redesigned approach to accurately measure alignment (stichometry). Because the latter three components were subsequently embedded into the search software as algorithms, we can simplify the explanation of the four points above by describing the *database* and *software* built for this effort.

The Database: We decided to build a specialized database for fragmentary textual identification for four reasons. First, many extant databases have not yet incorporated recently discovered pseudepigrapha and papyri. Second, of the databases that *do* attempt currency in this regard, many do not include critical variants of the NT, LXX or apocrypha—texts critical to identifying papyri in our period of interest: late 2nd temple Judaism and early Christianity. Third, almost all current databases are solely web (cloud) resident, an architecture that slows maximal search speed by one or even two magnitudes of order. The resulting database development effort yielded revision 1.0 of what we term the Integrated Jewish Christian Corpus (IJCC), a corpus of 205 Greek texts of the Hellenistic period embracing the LXX, Apocrypha, Greek recensions of

Jewish pseudepigrapha and the New Testament.²⁸ Fourth, as can be readily inferred from this description (prioritizing the development of the IJCC to first include critical variants of biblical late second temple Judaism Greek texts), revision 1.0 of the IJCC was purpose-built to include those Greek texts that would have been of the most interest to the Qumran community.

The Software: Largely to address the failure to reject false candidates (false positives), the research team²⁹ designed and coded a textual identification software tool, somewhat whimsically named METIS (Manuscript and Epigraphal Textual Identification System).³⁰ While a description of the complete feature set of METIS is beyond our current scope (Libby Forthcoming-c), the major features of METIS are that it a) allows unlimited search term depth, b) includes both combinatoric- and permutation-based searching,³¹ c) takes into account textual characteristics such as spacing, line skipping between terms, etc., d) allows searching via wildcards or Boolean (logic-based) searching, e) includes features to make complex searching more convenient, f) implements a more accurate approach to calculating alignment by taking into account textual phenomena such as varying character widths, etc., g) produces “best fit” reconstructions of the text, h) implements a component-based approach to orthographic readings allowing each match or “hit” to be scored based on its summed correspondence to the contested letters in the fragment, i) eliminates matches that do not meet researcher determined alignment and orthographic criteria and j) includes a variety of automation and output options. In terms of performance, it should be noted that METIS has been cross validated by successfully identifying known papyri in a similar state of fragmentation as 7Q5, from the same location and written in a similar hand (7Q1).³² For purposes of this study, however, the most important capabilities of METIS relate to the two algorithms that test the fit or “goodness” of proposed identifications stichometrically and orthographically.

The stichometry algorithm finds the best aligned matches by (1) using a purpose-designed font, (2) taking into account that not all letters have the same width or kerning, (3) taking into account textual phenomena such as such as *stigma teleia*, *hypostigma*, *stigma mese*, double dots, Aristarchian editorial symbola and the like³³ and (4) exhaustively testing line lengths that result in the highest fit of the identified text to the fragment which is then expressed as a coefficient of variation (CoV) score. Three measures of calculating CoV alignment and eight methods (filters) to reduce the results have been developed and built into the METIS software.

The simplest of these (the so called FP-SMP Coefficient of Variation) expresses the misalignment per line divided by the average line length, calculated using a font proxy that emulates the width characteristics of 7Q5's text.³⁴ (Hence a FP-SMP CoV of 10 would mean that the misalignment in the candidate is ten percent of the average line length.)

The orthography algorithm leverages the simple principle that the goodness of the reading as a whole should be viewed as the sum of the goodness of its individual contested letters. Criteria derived from OCR (optical character recognition) principles yields a score that ranges from 0 to 1.0 for each contested letter. In terms of 7Q5 (which has six contested letters) the orthography score therefore ranges from -6.0 to 6.0.³⁵ Lastly, to aid in orthography, a font emulating the orthography of 7Q5 was developed.

3. *The Findings*

With these three digital humanities assets in place (the database, software and purpose-designed font), we executed over 300 different exploratory searches—searches that involved trying different combinations of letter, spacing and displacement combinations. From these searches we then built and executed a “production set” of the 26 highest likelihood readings for 7Q5. While the production set established a helpful analytical baseline, to be sure, it yielded—as one would expect—contradictory orthographies for the same identification. To better address this problem, we developed a summative orthography-weighting schema by integrating the best published orthographic arguments informed by OCR principles.³⁶ This hybrid weighting schema in combination with the so-called “generic” search criteria (TΩ–KλI–NH–H) yielded a total of 3,353 candidate matches for 7Q5 from the LXX, Pseudepigrapha and the New Testament. Of these, 2,545 were acceptably aligned. (They displayed either CB-based or SPC FP-based CoV's less than 20 and a spacing alignment cutoff (SAC) value less than or equal to 10.³⁷) These candidates were then sorted by the highest orthographic score as the first sort key followed by the stichometry score as the second sort key. The top fifteen of these 2,545 candidates are summarized in Table 2.

Highest Scoring Stichometric and Orthographic Candidate Matches for 7Q5 ³⁸										
Match	Line Width	Stichometry: (Cutoff ≤ 10, Any CoV ≤ 20)			Orthography: Character Likelihood					
		Coeff. of Variation		Rank Order	Total Score	Post TΩ	Pre KλI	Pre NH	Pre H	Post H
		CB	FP-SPC							
2 Esdras 15:19	49	5.137	5.967	268	4.5	λ	Τ	Ω	Ο	Ε
Isaiah 17:3	51	6.908	10.273	758	4.5	N	λ	I	Θ	C
2 Esdras 15:19	45	14.552	10.493	587	4.5	λ	Τ	Ω	Θ	Ε
2 Esdras 15:19	42	8.333	9.031	729	4	K	λ	Ω	Θ	Ε
1 Enoch 5:9	56	14.201	17.471	245	4	N	H	H	Θ	C
Deuteronomy 4:1	48	4.1667	4.177	1635	3	N	Ε	H	Θ	C
Deuteronomy 4:1	45	8.824	7.997	1652	3	N	Ε	H	Θ	C
2 Kings 12:19	59	9.375	8.316	144	3	λ	C	Ω	Δ	C
Deuteronomy 4:1	50	10	10.104	472	3	N	Ε	H	Θ	C
Ezekiel 39:18	59	5.966	5.385	508	2.5	λ	C	Ω	Δ	C
Genesis 36:5	63	8.777	7.628	712	2.5	Ε	C	H	Θ	Ε
Baruch 3:4	50	10	9.711	431	2.5	ρ	λ	Ω	Θ	C
Jeremiah 9:17	29	10.227	10.387	822	2.5	C	λ	Ω	ρ	λ
Ezekiel 38:22	54	9.317	11.070	1370	2.5	K	C	Θ	Θ	C
Deuteronomy 1:25	39	10.169	12.881	1032	2.5	N	C	I	Θ	C

Table 2: Candidate Matches for 7Q5.

Four findings from Table 2 are noteworthy:

- 1) Five texts (2 Esdras 15:19ff, Isaiah 17:3, 1 Enoch 5:9, 2 Kings 12:19 and Deuteronomy 4:1) constitute the top nine candidates. *Note: to avoid confusing the source of the match we have retained the original source names as given. For clarity, 2 Esdras=Esdras B=Nehemiah.*
- 2) Six of the top ten candidates are either from 2 Esdras 15:19ff and Deuteronomy 4:1.
- 3) Three of the top four candidates are from 2 Esdras, with the top two of these candidates scoring 4.5 out of a possible 6.0. For these top two 2 Esdras candidates, the lowest-scoring letter of each candidate is the Τ before the KλI of line three. Intriguingly, if a

rationale could be built to view this fragmentary letter as a T, only a modest adaption to the orthography weighting table³⁹ would constitute an almost perfect orthographic match to 7Q5. Compelled by this possibility, we compared this fragmentary letter to the more certain T of line two, and two similarities become apparent: a) The vertical stroke of this potential T is actually curvilinear, opening to the right, sharing virtually the same shape as the commonly accepted T in line two and b) a small ink trace is observable to the right of the top of the letter. This could be the remnants of the cap stroke of a T.

- 4) Finally, a compelling possibility concerning two of the 2 Esdras candidates was observed. If the two spaces before the ΚΑΙ in line three are actually not spaces at all but two completely missing letters (a possibility not to be ignored since the vertical stroke of the K that follows the spaces is almost completely effaced), then the curvilinear stroke at the left margin of line three would be a λ—a letter that scores perfectly in that location. In this case, both of the top two 2 Esdras candidates would then receive a perfect summed orthographic score of 6.0.⁴⁰ A visualization of this hypothesis is displayed in Figure 2.

Figure 2: Visualization of Hypothesis.

When the top nine⁴¹ published LXX, pseudepigraphal or New Testament matches from Table 1 are compared to the findings from Table 2, the result is Table 3:

Previously Published Identifications Compared Against the Top IJCC/METIS Findings												
Match	Line Width	Stichometry (SAC <= 10, Any CoV <= 20)			Orthography: Character Likelihood							Requires Changing Accepted Letters
		Coeff. of Var.		Rank Order	Total	Post TΩ	Pre KΑΙ	Post KΑΙ	Pre NH	Pre H	Post H	
		CB	FP-SL									
2 Esdras 15:19	49	5.137	5.967	268	4.5	Λ	Τ	Τ	Ω	Ο	Ε	None
Isaiah 17:3	51	6.908	10.274	758	4.5	Ν	Λ	Τ	Ι	Θ	С	None
2 Esdras 15:19	45	14.552	10.493	587	4.5	Λ	Τ	Τ	Ω	Θ	Ε	None
2 Esdras 15:19	42	8.333	9.031	729	4	Κ	Λ	Τ	Ω	Θ	Ε	None
1 Enoch 5:9	56	14.201	17.471	245	4	Ν	Η	Τ	Η	Θ	С	None
Deuteronomy 4:1	48	4.1667	4.177	1635	3	Ν	Ε	Π	Η	Θ	С	None
Deuteronomy 4:1	45	8.824	7.997	1652	3	Ν	Ε	Π	Η	Θ	С	None
2 Kings 12:19	59	9.375	8.316	144	3	Λ	С	Π	Ω	Δ	С	Nome
Deuteronomy 4:1	50	10	10.104	472	3	Ν	Ε	Π	Η	Θ	С	None
Mark 6:52 ⁴²	25	19.737	23.933	208	2.5	Ν	Η	Δ	Η	Θ	С	Τ for Δ
1 Enoch 15:9d-10	26	15.190	14.011	132	-0.5	Ο	Ι	Τ	Ν	Κ	С	Τ for Π
Matthew 1:2-3	29	6.977	6.409	NA	-0.5	Β	Ν	Τ	Ν	Τ	С	Κ for Τ
2 Sam 5:13-14	21	4.762	12.458	NA	-1.0	Ι	С	Τ	Ν	Λ	Μ	ΙΥ for Ω
Ex. 36:10-11	21	16.406	16.561	NA	-3.0	Κ	Ω	С	Ε	Ι	С	Ο:СΥΝ
2 Sam 4:12-5:1	41	7.317	7.380	NA	-1.5	Ν	Ν	Τ	Ν	Λ	Λ	Λ for С
Zech 7:3b-5	29	32.386	40.011	NA	2.0	Ν	С	Π	Ν	С	Ε	Γ for Τ
Luke 3:19-21	35	11.429	10.977	NA	0.5	Ν	Ν	Τ	Ν	Θ	Ν	Ν for С
Gen 46:20	56	54.790	52.175	NA	3.5	Λ	Η	Τ	Ν	С	С	Ν ⁴³

Table 3: Comparing Previous Identifications to IJCC/METIS Findings.

The data from Table 3 unambiguously demonstrate that 2 Esdras 15:19, Isaiah 17:3, 1 Enoch 5:9, 2 Kings 12:19 and Deut. 4:1 all outperform previously published identifications stichometrically and orthographically.

Given this data can we therefore conclude that 7Q5 is *definitively* from 2 Esdras = Nehemiah? Given our prior discussion, three logical possibilities exist regarding 7Q5:

- a. If the stichometry cuts-offs used have not excluded any candidates, the line lengths are allowed to be greater than 30 (which is very possible given that 7Q5 is a miniscule text) and the fragment is biblical in origin, 7Q5 is most likely a fragment from a miniature scroll of 2 Esdras.
- b. If 7Q5's line length is shorter (e.g. between 20 and 30 letters although nothing demands such), the fragment matches no extant biblical or pseudepigraphal text. This raises the possibility that 7Q5 may be from a nonsectarian literary work.⁴⁴
- c. In either of the above two scenarios, 7Q5 may be an itacistic variant of a biblical, pseudepigraphal or nonsectarian text.

4. *Conclusions and Next Steps Regarding Worked Example 1*

Regardless of the final identification of 7Q5, at least two broader findings are clear. First, the worked exercise has uncovered serious inadequacies in the *de facto* method of identifying fragmentary texts. Second, the new databases, algorithms and software tools enabled by the digital humanities have yielded new identifications that are superior stichometrically and orthographically compared to the *de facto* approach currently being used. Next steps include enhancing both the breadth of the IJCC database⁴⁵ and the features of the METIS software (primarily improvements to the stichometric and orthographic algorithms) to further reduce false negatives and false positives respectively.

5. *The Surprise: Or “Abductive Serendipity Happens”*

A decidedly unplanned sequence of events occurred after the final draft of this article had been accepted for publication, when the author sought copyright permission from the Israeli Antiquities Authority for one of the high resolution images of 7Q5 (Figure 1, left). In a stroke of serendipity, the very helpful personnel at the Israeli Antiquity Authority⁴⁶ made me aware that new, multispectral imagery of 7Q5 had recently been completed. Upon inspection, that imagery did, indeed, reveal details of 7Q5 that have never before been apparent and that are indeed significant for the identification of 7Q5. These details will be published shortly.⁴⁷ Two

implications from that imagery are relevant for our current thesis and can be communicated here. First, the imagery has significantly strengthened the accuracy of the orthographic weightings used in this work (see the Table found in footnote 39). Specifically, it has confirmed that the highest weighted possibilities for the letter after the $\tau\omega$ in line two include a iota (pronounced yo-ta) and, in particular, the iota adscript. Quite importantly, if the letter following the $\tau\omega$ in line two is indeed a iota (either as a following letter in one word, a following letter in another word, or as an adscript), this would eliminate many prior identifications, but would *strengthen* the identification of 2 Es. 5:19ff asserted in this study. This follows because the $\tau\omega$ in line two in 2 Es. 5:19, is, in fact, the masculine singular dative form of the Greek article. In its adscripted form, of course, it would appear as a iota following the omega. Moreover, historically, iota adscripts were common in the Roman era papyri and continued their presence into the third century. The second point speaks directly to our thesis statement, in which we argued that digital humanities-based research moves forward in an *abductive* cycle. Sometimes, to be sure, that new data emerges by assiduous digging and sometimes by serendipity, but in either case, the availability of new information abductively eliminates (or make less probable) certain hypotheses while strengthening others. It is elegant indeed, in our view, that unplanned serendipity has likely aided us in abductively down-selecting some identifications in the course of a paper whose thesis statement stolidly asserted the validity of the abductive process itself!

B. Example 2: Using Digital Humanities to Aid in Identifying the Authorship of the Texts (Books) of the Greek New Testament.

In a second worked example, digital humanities-predicated methods will be used to address the often tendentious authorship debates in the Greek New Testament. As before, we will explore the depth of the problem, propose elements of a digital humanities-predicated solution, produce a worked example and then develop some preliminary conclusions.

1) *The Problem:* The Authorship Debates in the Greek New Testament

Stated briefly, four broad movements summarize the historic trajectory of the authorship debates in the Greek New Testament. *First*, setting aside occasional challenges to the traditional authorship assignments from the likes of Erasmus (1663)⁴⁸ and Chubb (1731),⁴⁹ the first arguments that yielded substantial shifts in the scholarly consensus concerning the authorship of the texts of the NT occurred courtesy of J.E.C. Schmidt (1804), F. Schleiermacher (1807) and J.G. Eichhorn (1812).⁵⁰ These scholars first questioned 1 Timothy and eventually deemed the other Pastoral Epistles to be pseudepigraphal as well. *Second*, by the end of the 19th century, Holtzmann's (1872) more moderate arguments (compared to those of F.C. Baur (1845)) had come to be generally accepted. Specifically, Baur's rejection of 1 Thessalonians, Philippians and Philemon was itself eventually rejected, while Baur's conclusions regarding the pseudepigraphy or anonymity of 2 Thessalonians, Ephesians and Colossians was retained. Except for minority opinions, this consensus of seven authentic Pauline texts in the NT is little changed today. *Third*, whereas the original 19th century arguments contested these texts on stylistic grounds, many of those early assumptions and methods (e.g. *hapax legomena* linked to authorship, and "marker"-based research) have been either challenged or overturned by the end of the 20th century.⁵¹ *Fourth*, a tsunami of new categories of quantitative methods has emerged since the mid-1980's. One of these families, extractive or eigen-systems-based multivariate analysis, has discovered that stylistic variation associated with genre most often *exceeds* stylistic variation due to authorship. Specifically, research performed by Burrows (1987, p. 64), Binongo and Smith (1999, p. 784), Forsyth, Holmes and Tse (1999, p. 383), Juola and Baayen (2005, p. 63) and others⁵² demonstrated that in studies in which unsupervised multivariate analysis were executed upon *mixed genre corpora*, the first extracted component (which accounts for the most variation) separated *genres before it separated authors*.

These four movements have two compelling implications for NT scholarship. First, if the stylistic variation due to genre *in the GNT* is also found to be greater than the stylistic variation due to authorship, then, quite ironically, earlier NT stylistic studies that claimed to be demonstrating *plural authorship* were likely demonstrating *plural genres* instead. The rationale for this surprising conclusion is not difficult to fathom. If the total variation is multifactorial (is due to a number of components such genre, authorship, cultural contexts, etc.), one must necessarily disentangle the different components from one another in order to accurately

disambiguate the variation due to any single component. Second, if one simply assumes *de facto* that the preponderance of variation is due to a given component (e.g. authorship) and that component turns out to be a minor component of the total variation, the likelihood that the total, entangled (combined) variation actually is predominantly due to the hypothesized minor component is equal to the ratio of that minor component compared to the total variation.⁵³ That is, it becomes markedly less likely. Our goal, then, *cannot* be to simplistically measure the total stylistic variation and assume it is authorial. Our goal, rather, is to disentangle the total stylistic variation into its components and see whether the authorship or genre “fraction” is greater.

Accordingly, our approach embraces two sequential steps. In step one, bivariate association will quantify whether genre variation constitutes a substantial proportion of the total stylistic variation in the GNT. If this succeeds, a second step is indicated in which various forms of multivariate analysis will be used to disentangle genre stylistic variation from authorship variation. Once that is achieved, the normed variation of both components (genre and authorship) will be measured and compared. Importantly, especially if the “disentangled” genre proves to be *the* major normed component of stylistic variation, such a result would a) interrogate all prior studies that have not controlled for generic stylistic variation or removed it as a covariate and b) strongly infer that such studies have likely confounded authorship variation with generic stylistic variation.

2) *The Proposal: A Digital Humanities-Based Approach to Measure the Relative Component Contributions of Genre and Authorship Toward the Total Observed Stylistic Variation in the GNT*

In order to determine whether authorship or genre constitutes the larger component of stylistic variation in the NT requires that we develop (as one would expect) a representative set of authorship and genre theories.

Developing the Authorship Theories: Three primary historic views of authorship exist in New Testament studies: the traditional enumeration of thirteen authors of the GNT, the mainstream critical view of seventeen authors and Baur's rather radical assessment of twenty-one authors. We have added other minor perspectives to yield six authorship theories that will be tested in this study.

	Original Baur (21 Authors)⁵⁴	Reduced Baur (19 Authors)	Modern Critical (18 Authors)	Modern Critical (17 Authors)	Modern Critical (15 Authors)	Trad. (9 Authors)
Matt.	Matt. Writer	Matt. Writer	Matt. Writer	Matt. Writer	Matt. Writer	Matthew
Mark	Mark	Mark	Mark	Mark	Mark	Mark
Luke	Lukan Writer	Lukan Writer	Lukan Writer	Lukan Writer	Lukan Writer	Luke
John	2nd Cent. Jn.	2nd Cent. Jn.	John, Redactors ⁵⁵	John, Redactors	John, Redactors	John
Acts	Lukan Writer	Lukan Writer	Lukan Writer	Lukan Writer	Lukan Writer	Luke
Rom.	Paul	Paul	Paul	Paul	Paul	Paul
1 Cor.	Paul	Paul	Paul	Paul	Paul	Paul
2 Cor	Paul	Paul	Paul	Paul	Paul	Paul
Gal.	Paul	Paul	Paul	Paul	Paul	Paul
Eph.	Eph. Writer ⁵⁶	Eph. Writer	Eph. Writer	Eph. Writer	Eph. Writer	Paul
Phil.	Phil Writer ⁵⁷	Paul	Paul	Paul	Paul	Paul
Col.	Col. Writer ⁵⁸	Col. Writer	Col. Writer	Col. Writer	Paul ⁵⁹	Paul
1 Thess.	1 Th. Writer ⁶⁰	1 Th. Writer	Paul	Paul	Paul	Paul
2 Th.	2 Th. Writer ⁶¹	2 Th. Writer	2 Thess. Writer	2 Thess. Writer	2 Thess. Writer	Paul
1 Tim.	1 Tim. Writer ⁶²	Pastoralist Paul ⁶³	1 Tim. Writer	Pastoralist Paul	Pastoralist Paul ⁶⁴	Paul
2 Tim.	2 Tim. Writer	Testamental Paul	2 Tim. Writer	Testament Paul	Pastoralist Paul	Paul
Titus	Titus Writer	Pastoralist Paul	Titus Writer	Pastoralist Paul	Pastoralist Paul	Paul
Philmn.	Philmn. Writer ⁶⁵	Philmn. Writer	Paul	Paul	Paul	Paul
Heb.	Heb. Writer	Heb. Writer	Heb. Writer	Heb. Writer	Heb. Writer	Unknown
James	James Writer	James Writer	James Writer	James Writer	James Writer	James
1 Peter	1 Peter Writer	1 Peter Writer	1 Peter Writer	1 Peter Writer	1 Peter Writer	Peter
2 Peter	2 Peter Writer	2 Peter Writer	2 Peter Writer	2 Peter Writer	2 Peter Writer	Peter
1 John	Jn. School	Jn. School	John, Redactors?	John, Redactors?	John, Others? ⁶⁶	John
2 John	Jn. School	Jn. School	John the Elder	John the Elder	John the Elder	John
3 John	Jn. School	Jn. School	John the Elder	John the Elder	John the Elder	John
Jude	Jude Writer	Jude Writer	Jude Writer	Jude Writer	Jude Writer	Jude
Rev.	1 st Cent. Jn.	1 st Cent. Jn.	Asia Minor Jn.	Asia Minor Jn.	Asia Minor Jn.	John

Table 4. Authorship Theories by Texts of the New Testament Developing the Genre Theories:

Similar to the above exercise, genre theories are simply combinations of the NT texts grouped by genre rather than authorship categories. These categories were developed by consulting genre criticism, rhetorical criticism and literary criticism. We propose that four genre theories be tested following a Type/Audience/Recipient (Number) typology. These four theories can be inspected in Table 5 below:⁶⁷

GNT Books by Genre (Following a Type / Audience / Number Typology)				
Closest Genre Category	Genre (13)	Genre (12)	Genre (10)	Genre (8)
Gospel: <i>sui generis</i> . Closest to Greco-Roman biography with traditional material (pronouncement stories, miracles)	Matt, Mark, Luke	Matt, Mark, Luke	Matt, Mark, Luke	Matt, Mark, Luke, John
Gospel: <i>sui generis</i> . Closest to Greco-Roman biography with traditional material and elements of φιλοσόφημα	John	John	John	<i>N/A</i>
History/Historiography (with embedded form critical elements such as miracles)	Acts	Acts	Acts	Acts
Epistle Corporate: Didactic/Diatribic	Romans, 1-2 Cor, Gal, Phil	Romans, 1-2 Cor, Gal, Phil	Romans, 1-2 Cor, Gal, Phil, Heb	Romans, 1-2 Cor, Gal, Phil, Heb
Epistle Corporate: Didactic/Paraenesis	Eph, Col	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
Epistle Corporate: General	1-2 Thess, 1-2 Peter, ⁶⁸ Jude	Eph, Col, 1-2 Thess, 1-2 Peter, Jude	Eph, Col, 1-2 Thess, 1-2 Peter, Jude	Eph, Col, 1-2 Thess, 1-2 Peter, Jude
Epistle Corporate: Hortatory (Sermon?)	Hebrews	Hebrews	<i>N/A</i>	<i>N/A</i>
Epistle Corporate: Jewish Paraenesis ⁶⁹ (Ethical Paraenesis?)	James	James	James	James
Letter ⁷⁰ Individual: Paraenesis or <i>Mandata Principis</i>	1 Tim, Titus	1 Tim, Titus	1-2 Tim, Titus	1-2 Tim, Titus, Philm
Letter Individual: Elements of <i>Mandata Principis</i> /Personal Appeal	Philemon	Philemon	Philemon	<i>N/A</i>
Letter Individual: Testament with Elements of Paraenesis	2 Tim.	2 Tim.	<i>N/A</i>	<i>N/A</i>

Letter Individual: Appeal/Elements of φιλοσόφημα	1-3 John	1-3 John	1-3 John	1-3 John
Apocalyptic: Jewish	Revelation	Revelation	Revelation	Revelation

Table 5: Texts by Genre

Given the authorship and genre theories just described, genre and authorship can be made to compete head-to-head, so to speak, using modern univariate, bivariate and multivariate methods. Accordingly, in the remainder of this study we will present data that tests the authorship theories against the genre theories using a variety of bivariate and multivariate methods. After each exhibit we will interpret the data and draw conclusions.

3) *The Findings*

*Exploration One: Is Genre or Authorship More Associated with the Language of the GNT: Bivariate Analysis?*⁷¹

Figure 3: Comparing the Association Between the Genre and Authorship Theories with Different GNT Language Measures (Cramér's V Used as the Measure of Association)

The columns in Figure 3 represent the magnitude of the association between the various authorship and genre theories and different measures of language in the GNT. Three interpretive preliminaries are necessary to allow the correct interpretation of Figure 3. *First*, in the research design used for this study, ten distinct “language measures” (linguistically defined categories of language) were analyzed: lemmas, words, major semantic domains, minor semantic domains, three different traditional grammatical annotations, clauses annotated with the Systemic Functional annotation⁷² and two types of clause complexes (clause chains). (Note that in Figure 3 we display only the first four language measures since the other five remaining measures displayed essentially the same data profile.) *Second*, all ten authorship and genre theories are represented as the individual bars within each group of bars. *Third*, the error bounds above each bar represent the 95% confidence level as determined by a procedure called bootstrapping.

Once these necessary preliminaries are understood, the interpretation of the data is quite straightforward. The data demonstrates that *regardless of the language measure explored, genre (the final four bars) are clearly more highly associated with the language of the GNT than authorship*. It should be noted that this finding holds regardless of (1) the measure of association used,⁷³ (2) the binning used (combining low-frequency forms together into a final category) or (3) the frequency partitions explored. The most probable explanation for the higher association that of genre with the language measures of the GNT is also the simplest; that generic stylistic variation exceeds authorial stylistic variation. To test that assumption, however, requires that more formal multivariate mathematical models be built to disentangle stylistic variation due to authorship from stylistic variation due to genre. This we pursue next.

Exploration Two: Is Genre or Authorship More Associated with the Language of the GNT?

Nonparametric Multivariate Analysis

	Genre 13	Genre 12	Genre 10	Genre 8	Row Totals
Baur Original (21)	0/9	0/9	0/9	4/9	4/36
Baur Reduced (19)	0/9	0/9	0/9	4/9	4/36
Modern Critical (18)	0/9	0/9	0/9	4/9	4/36
Modern Critical (17)	0/9	0/9	0/9	4/9	4/36
Modern Critical (15)	0/9	0/9	0/9	4/9	4/36
Traditional Authorship (9)	0/9	0/9	0/9	0/9	4/36
Column Totals	0/54	0/54	0/54	20/54	20/216

Table 6: HLLA Models in Which Authorship Accounted for a Larger Component of Variance⁷⁴ than Genre: Unbinned Data

One of the primary benefits of multivariate analysis is that it can disentangle sources of stylistic variation in texts by analyzing variation in terms of *main effects* and *interaction effects*. One common tool used to decompose the categorical (frequency-based) data into its main effects and

their interactions is Hierarchical Log-Linear Analysis (HLLA).⁷⁵ Specifically, HLLA enables the two-way interaction effect of authorship by language to be studied while controlling for the effect of genre. This two-way interaction effect can therefore be termed *authorship controlled for genre* or (A|G). In like manner, HLLA enables the study of the two-way interaction effect of genre and language controlled for authorship (G|A). *Thus, by disentangling authorship from genre the normed magnitude that each contributes to the total variance can be measured.*

In Table 6, each of the ten language measures was cross tabulated against each combination of genre and authorship, yielding 216 separate HLLA models.⁷⁶ At the most summary level, Table 6 demonstrates that for 196 of 216 HLLA models (e.g. six authorship theories by four genre theories by nine language measures) the normed value of G|A (genre) was greater than the normed value of authorship (A|G).⁷⁷ To date, over 25,000 such multivariate models (via different fractions, bins, and different combinations of subcorpora within the GNT) have been executed. Overall, genre explains more variance—and often far more variance—in the GNT than does authorship.

Exploration Three: Is Genre or Authorship More Coherent in the GNT (Does It Display Less Spread)? Nonparametric Multivariate Analysis (Correspondence Analysis)

Figure 4: Spread of Authorship and Genre

In this last experiment we used another form of multivariate analysis, this time an extractive (eigen-systems-based) multivariate technique, Correspondence Analysis (CA). We have already seen that research in other literary disciplines most often demonstrated that the first extracted component was genre and the second extracted component was authorship. When this technique was run on the GNT, intriguingly, no clear authorship component was found *at all* in the first five to six extracted components—all the components seemed to be generic in nature. That is, genre seemed to “swamp” the authorship signal.

To assist in finding that authorship “signal,” a very simple measure of multidimensional diffuseness, Euclidean Distance Spread (EDS), was chosen to better understand the relationship between genre and authorship. Stated briefly, EDS tests how well the various theories (whether they be authorship or genre theories) matched the actual locations of the texts developed empirically by the CA analyses. Interpretively, theories with a lower spread (EDS) are more coherent; they fit the empirically derived locations of the texts with less error. Accordingly, EDS was executed upon a wide number of CA runs with a representative run being presented here.

Three findings emerged: (1) All theories of genre displayed less spread than all theories of authorship, (2) two new, empirically derived genre theories (13E and 12E) outperformed all other genre theories in terms of fit to the CA data and (3) for the longer linguistic units (clauses or clause complexes), while the various genre theories still outperformed the authorship theories, the difference between the theories became negligible. In conclusion, as measured by EDS, the stylistic variation in the GNT is, again, seen to be disproportionately generic rather than authorial in character.

4) *Conclusions Regarding Worked Example 2*

These findings deserve careful clarification as to what is truly novel in this research, and what these findings mean in terms of the current consensus in NT studies.

To fully understand what is truly novel in this second case study, perhaps it is best to clarify what we have *not* discovered. First, we have not been the first to discover that stylistic variation in mixed genre corpora is disproportionately generic rather than authorial. That finding is indeed a well-recognized phenomenon—at least outside of New Testament Studies.⁷⁸ In that sense, the data in section 3.B.3 is merely confirmatory of earlier findings outside the corpus of the NT. Second, this work is not the first extractive or “disentangling” research performed on texts of the NT. The NT has, in fact, been subjected to Multiple Discriminant Analysis (MDA), principal components analysis (PCA), factor analysis (FA) and correspondence analysis (CA) by almost a dozen scholars beginning with Neumann.⁷⁹ What can be said with clarity, however, is that, from a design perspective, this is the first NT study that 1) has attempted to explicitly separate genre from authorship using the largest set of linguistically-derived measures to date

(>50,000 separate measures), 2) the first to assay such large results within and across functional linguistic categories (the syntagmatic structures, paradigmatic systems, multiple strata and multiple metafunctions of the GNT) and 3) the first to disentangle the effect of genre using non-parametric multivariate analysis (HLLA) in concert with other non-parametric analyses (e.g. non-parametric bivariate inference and correspondence analysis).

Enabled by the design just discussed, the overall findings that emerge from this work are quite clear and, to a certain extent, disruptive to the still dominant mid-20th century historical-critical view of authorship in New Testament studies. The data demonstrate that whether by bivariate association, multivariate HLLA analytics or EDS-fitted correspondence analysis, genre is decidedly the larger component of variation across language measures in the GNT. This calls into deep question the historic consensus of New Testament studies—studies that have overwhelmingly assumed that stylistic variation is disproportionately authorial in character. While the predominance of genre over authorship is no surprise to disciplines outside of NT studies, it is disruptive to NT studies precisely because the argument from style has assumed that stylistic variation demonstrates authorship variation and not genre variation. This mistaken assumption, moreover, necessarily carries with it another implication: namely, that prior studies that have neither controlled for generic stylistic variation nor removed it as a covariate have likely thoroughly confounded authorship variation with generic variation. Lastly, and even more disruptively, because the preponderance of stylistic variation in the GNT is generic, *prior studies that have multiplied authors to explain large swings in stylistic variation between texts were very likely demonstrating plural genres, contexts or registers instead.*

4. Overall Conclusions from the Two Worked Examples Enabled by the Digital Humanities

These two case studies demonstrate, at least in an initial way, that digital humanities can offer the NT scholar a Kearney-esque optimism that creative work is still possible in NT studies. Accordingly, against certain strains of NT scholarship that leave us only to our own perspectives, we call upon digital humanities to continue to use its strengths—both its frictions and its convergences—to cast new light on old problems not only in NT studies but across the spectrum

of the humanities. Yet this call is not an unbounded one. Such a call must resist the totalizing tendencies that deny all possibility of coherence on the one hand (unbounded postmodernism) while also resisting hegemonic circularities (via the various insidious brands of positivisms that seem to always attach themselves to critical empirical methods)⁸⁰ on the other. As even these two brief worked examples demonstrate, digital humanities research, when carefully executed and manacled by the experimental rigors of non-positivistic experimental designs, can contribute new insights that operate within and across interpretive communities. In so doing, tools such as abduction and IBE can be seen to be *poietic activities*, activities which interoperate with the interpreter to interrogate both the phenomena under study as well as the interpreters themselves.

Notes

¹ Parts of this introduction and parts of the data in Section 3-B were included in the author's dissertation (Libby 2015).

² See Jensen's endorsement to Bockmuel's edited work (2006). Adam (2006, p. 19) paints the same picture of biblical theology, asking, "Can these bones live?"

³ By speaking of the digital humanities in this way, I wish to avoid two mistaken notions. First, I do not wish to leave the impression that "digital humanities" is a coherent and singular field. It is better described as an emergent cornucopia of practices, methods and perspectives—one that has about it an emergent, creative ethos. It is, according to Alvarado, a social category and not an ontological one (Alvarado 2012, p. 50). Second, notwithstanding the above, neither do I wish to fail to connect to the quantitative history of DH, which most trace to the 1940's, and the humanities computing work of Busa. (Hockey 2004, p. 4).

⁴ See especially Peirce (1867, p. 261-287; 1878, p. 470-482; 1901, p. 75-114).

⁵ See Harman (1965).

⁶ One way pragmatic adequacy can be assayed in digital-humanities-informed NT studies is to take special note of when candidate explanations both verifiably (reproducibly) and significantly (more probabilistically) explain the textual data than do other candidate explanations.

⁷ Although abduction and IBE are both historically and epistemologically distinct from Whitehead and Russel's positivism on the one hand and Aristotle's essentialism on the other, the surprising ease with which abduction and IBE are sometimes confounded with these prior systematics suggests that further clarification is indicated. Stated briefly, all abductive exercises, including the two case studies detailed here, stand in marked contradistinction to positivism in that they a) deny the object subject distance that claims that data can somehow "speak for itself" without an interpreter, b) affirm that presuppositions, privilege and power necessarily effect the interpreters conclusions, c) deny that logic and inference are

adequate alone to arrive at the most adequate explanation of the phenomena and d) affirm that multiple, diverse interpretive frameworks can (and do!) lead to liberating insights. On the other hand, abduction and IBE demonstrate their independence from essentialist, hyper-ordinating priors in that they test rather than uncritically accept the adequacy of *a priori* epistemological hierarchies as well as their hypotheses and methods.

⁸ Literary papyri are papyri written in a more careful *literary* hand—as opposed to the day-to-day *documentary* texts that typically chronicle commercial transactions, receipts, and the like (Metzger 1968, p. 8-16; Porter 2013, p. 79-82).

⁹ Left image courtesy of the Israeli Antiquities Authority. Available at: <http://www.deadseascrolls.org.il/explore-the-archive/image/B-284859>. [Accessed May 27th, 2015]. Right image is from Estrada, D. and White Jr. (1978, p. 85). It is also reproduced at Wikipedia. Available at: <https://en.wikipedia.org/wiki/7Q5#/media/File:7Q5.jpg>. [Accessed May 27th, 2015]. The images were selected to show the original condition of the fragment and the papyrus fibers, respectively. The contrast and brightness of both images have been digitally enhanced to permit the fragment's letters to stand out in greater relief.

¹⁰ A photograph of all the 7Q fragments can be inspected in the initial edition of the cave seven fragments in Baillet, Milik and de Vaux (1962, p. 19). See also Martini (1972, p. 15).

¹¹ O'Callaghan's initial work (1972g), published in *Biblica*, was made more accessible by republishing the findings in English (as translated by William L. Holladay) that same year in *JBL* (O'Callaghan 1972b). See also his other claims regarding 7Q4 in O'Callaghan (1972a) and concerning 7Q4, 7Q5, 7Q6, and 7Q8 in O'Callaghan (1972f).

¹² Setting aside recent unpublished claims made by Scott Carroll from a funerary mask of unknown provenance, should this be a symbol? $\P^{52}$ is currently considered by most as the earliest NT papyri (circa 125 AD). It should be noted that Wallace's review presented at the ETS regional conference (1994a) is different than his WTJ review of the same title (1994c).

¹³ Thiede's vigorous defense of the a New Testament origin for 7Q5 included his monograph (1992) and his *Biblica* article (1984). Against Wallace's vigorous deconstruction of his arguments, Thiede responded with his *WTJ* article "7Q5—Facts or Fiction?" (1995). See also Estrada, D. M. (1972 p. 109-117), who supported O'Callaghan's views by providing paleographic justification regarding O'Callaghan's method.

¹⁴ We have not included here identifications beyond the LXX, the Pseudepigrapha and the NT such as Colin J. Hemer's identification of 7Q5 (1974, p. 155) with Thucydides War I.41.2. Hemer's candidate, however, requires line five to read **NE** rather than **NH**. It thus constitutes a match only if we admit itacisms. Wallace (1994c, p. 177) moreover, has found sixteen other matches including Exodus 23:36 in a search of the *Thesaurus Linguae Graecae*; the largest database of Greek works of antiquity.

¹⁵ A stichometry score is a score of alignment developed by the approach described in this study. Lower scores represent better alignments.

¹⁶ The all too common opinion of Spottorno (1999, p. 70) that it is "acceptable to introduce into the reconstructions...a variant reading, even if it is not supported by any of the extant witnesses" is to be vigorously opposed and with incredulity. The praxis of creating a variant to make the stichometry fit is wholly retrogressive; it *creates* false positives rather than seeking to eliminate them.

¹⁷ As in O'Callaghan (1972b, p. 10).

¹⁸ See Spottorno (1999, p. 76).

¹⁹ As in Focant (1985, p. 451).

²⁰ As in Scibona (2001, p. 158).

²¹ In contrast to the LXX, Garnet omits the $\sigma\upsilon\nu$ before $\tau\eta\ \beta\acute{\upsilon}\sigma\sigma\omega$. Cf. with Scibona (2001, p. 152).

²² Cf. Kraus (1999, p. 251).

²³ Compare to the Göttingen LXX in Ziegler (1984).

²⁴ Slaby (1992, p. 83-88), as demonstrated by our work, is correct in denying to Aland his claim that his identification is the only one possible in the NT.

²⁵ Ernest Muro, perhaps best known for his work with 7Q4, ran the following command line search via BibleWorks in 1999: (*h kai t*).2(*nnh*). He found nine hits of which the “best by far” was Genesis 46:20. Muro, to our knowledge, never published these candidates except on his website since he judged even the best of them “not a suitable identification for 7Q5.” Available at:

<http://www.bsreview.org/blog/2004/03/page/3>. (Muro 2010) [Accessed: February 2nd, 2010].

Two candidates were developed using the search $\tau\omega\text{---}\kappa\alpha\iota\tau\text{---}\text{nnh}\text{---}\text{hc}$, which incorporates Muro’s search. The best-aligned candidate was used for the data in Table 1.

²⁶ Wallace concedes that his Ibycus-developed “hits” in the *Thesaurae Linguae Graecae* are likely not as impressive as O’Callaghan’s but presents them to show how easy it is to find identifications using the newer computer-based methods. (Wallace 1994c)

²⁷ In my own experience of executing predictive models in commercial settings, false negatives are reduced by improving the *record depth* of the database (adding more possible candidates), and false positives are reduced by improving the *field depth and accuracy* (improving the predictors) within the database.

²⁸ The texts are drawn from four primary sources: 1) the CCAT-UPenn database of Robert Kraft (the LXX and the Apocrypha); 2) the Online Critical Pseudepigrapha, an electronic database effort directed by Miller, Penner and Scott; 3) texts of the GNT including the NA27, Westcott-Hort, the Byzantine majority text, and an eclectic Byzantine text, courtesy of Maurice Robinson; and 4) the IJCC which, quite importantly, includes major critical variants of texts where available. It should be noted that Revision 1.0 makes up for that deficit in terms of the NT by including the four NT texts listed above.

²⁹ The algorithms and interface of METIS were designed by the author and programmed in the C++ by Mark Knafl. The project was underwritten by WorldView Resources, a US not-for-profit corporation founded by the author.

³⁰ METIS is the primordial Greek goddess of wisdom and thought.

³¹ Permutation-based searching reconstructs the order of multiple fragments.

³² Among other test cases, METIS has identified 7Q1, a papyrus found in the same cave at Qumran as the best aligned candidate among 33 hits in the IJCC database. This agrees with the identification in the *editio princeps* (Baillet, Milik and de Vaux 1962, p. 142-143). The identification developed by METIS is as follows:

Text: Exodus 28:5. Line length: 20 characters (average). Alignment score: 1.25.

ΡΑΤΕΥΕΙΝΜΟΙΚΑΙΑΥΤΟΙΛΗ
ΜΨΟΝΤΑΙΤΟΧΡΥCΙΟΝΚΑΙΤ
ΗΝΥΛΚΙΝΘΟΝΚΑΙΤΗΝΠΟΡΦ
ΥΡΑΝΚΑΙΤΟΚΟΚΚΙΝΟΝΚΑΙΤ

³³ These symbols can be explored on Nick Nicholas’ website. Available at:

<http://www.tlg.uci.edu/~opoudjis/unicode/punctuation.html>. [Accessed: 26 September 2009].

³⁴ FP-SMP-CoV stands for Font Proxy-based, Space Mean Percent Coefficient of Variation. The algorithm that defines it and other parametrics in METIS are as follows:

Assume search terms $ST_1, ST_2, \dots, ST_N$

Assume horizontal alignment adjustments $HAA_1, HAA_2, \dots, HAA_N$

Let $s[i, j]$ be the substring starting at and including i until, but not including, j

Let $|s[i, j]|$ be the length of a substring starting at and including i until, but not including, j

Let the inter-term distance, the distance between the start of adjacent terms, be

$$ID_CB_x = (ST_x - HAA_x) - (ST_{x-1} - HAA_{x-1}) \text{ in characters}$$

$$ID_FP_x = |s[ST_{x-1} - HAA_{x-1}, ST_x - HAA_x]| \text{ in pixels}$$

Let the average inter-term distance be

$$AID_CB = (\sum_1^{N-1} ID_CB_x) / (N - 1)$$

$$AID_FP = (\sum_1^{N-1} ID_FP_x) / (N - 1)$$

Let the coefficient of variation, the percent of the average inter-term distance that the terms are misaligned, be

If Mode == Previous Line

$$COV_CB = ((\sum_2^{N-1} |ID_CB_x - ID_CB_{x-1}|) / (N - 2)) / AID_CB * 100$$

$$COV_FP = ((\sum_2^{N-1} |ID_FP_x - ID_FP_{x-1}|) / (N - 2)) / AID_FP * 100$$

If Mode == Mean

$$COV_CB = ((\sum_1^{N-1} |ID_CB_x - ALL_CB|) / (N - 2)) / AID_CB * 100$$

$$COV_FP = ((\sum_1^{N-1} |ID_FP_x - ALL_FP|) / (N - 2)) / AID_FP * 100$$

Assume indices of the first character of the lines of a reconstruction $B_1, B_2, \dots, B_N$

Assume indices of the last character of the lines of a reconstruction $E_1, E_2, \dots, E_N$

Let the average line length be

$$ALL_CB = (\sum_1^N |s[B_x, E_x]|) / N$$

Let the reference point, the horizontal starting point of a search term, be

$$RP_CB_x = |s[B_x, ST_x - HAA_x]| \text{ in characters}$$

$$RP_FP_x = |s[B_x, ST_x - HAA_x]| \text{ in pixels}$$

Let the average reference point be

$$ARP_CB = (\sum_1^N RP_CB_x) / N$$

$$ARP_FP = (\sum_1^N RP_FP_x) / N$$

Let the alignment score, the average misalignment as a percent of the average line length, be

$$Alignment_CB = ((\sum_1^N |RP_CB_x - ARP_CB_x|) / N) / ALL_CB * 100$$

$$Alignment_FP = ((\sum_1^N |RP_FP_x - ARP_FP_x|) / N) / ALL_FP * 100$$

³⁵ More detail on the development of the component-based orthographic scoring and how OCR (optical character recognition) makes readings more objective will be forthcoming in (Libby, Forthcoming-a).

³⁶ OCR principles and our meta-analysis yielded the following scoring table:

Component Scores for 7Q5's Letters by Location and Likelihood					
	Description	Location of the	High Likelihood	Moderate Likelihood	Low Likelihood

Letter Location		Contested Letter	Weight = 1.0	Weight = 0.5	Weight = 0.0
1	The letter(s) after the ΤΩ of line two	ΤΩ_	Ιλ, Ιλ, λ, λ, Ι	ΙΔ, Δ, ρλ, ρλ, ρ	Κ, Ν
2	The letter before the spaces(s) of line three (the ΚλΙ)	_ΚλΙ	Η	λ, λ, Δ, Π, C	Τ, Θ, Ε, Ο
3	The letter after the ΚλΙ of line three	ΚλΙ_	Π, Τ		
4	The letter before the ΝΗ of line four	_ΝΗ	Ι, Φ	Ω, Ν	Μ, Η
5	The letter before the Η of line five	_Η	Θ, Ο, Ε	ρ, Φ	Β
6	The letter after the Η of line five	Η_	С, Θ, Ο, Ε		

³⁷ The SAC (spacing alignment cutoff) rejects a candidate if any of its letters deviate greater than a given number of vertical alignment spaces compared to the fragment.

³⁸ These identifications were first presented in a paper read to the Papyrology and Early Christian Backgrounds session at the SBL annual meeting in Atlanta, GA. They are presented here unchanged (Libby 2010).

³⁹ Per the following:

Component Scores for 7Q5's Letters by Location and Likelihood					
Letter Location	Description	Location of the Contested Letter	High Likelihood	Moderate Likelihood	Low Likelihood
			Weight = 1.0	Weight = 0.5	Weight = 0.0
1	The letter(s) after the ΤΩ of line two	ΤΩ_	Ιλ, Ιλ, λ, λ	ΙΔ, Δ, Κλ, Κλ	ρλ, ρλ, ρ, Κ, Ι, Ν
2	The letter before the spaces(s) of line three (the ΚλΙ)	_ΚλΙ	Η	С, λ, Δ	Τ, Θ, Ε, Ο, λ, Π
3	The letter after the ΚλΙ of line three	ΚλΙ_	Π, Τ		
4	The letter before the ΝΗ of line four	_ΝΗ	Ω, Ι, Φ	Η, Ν	Μ
5	The letter before the Η of line five	_Η	Θ, Ο, Φ	ρ	Β
6	The letter after the Η of line five	Η_	С, Θ, Ο, Ε		

⁴⁰ By comparing the characteristics of the fragmentary letter before the ΝΗ of line four with the fully extant omega of line two, all its characteristics (its vertical trace, the serif cap at the top of the trace and even the slight leftward turn of the letter toward its bottom) are completely consistent with a damaged

omega. It is noteworthy that even if the omega is assigned a lower weight than 1.0, these two instances of 2 Esdras would still be tied for the highest orthographic score.

⁴¹ Wallace's Ezekiel 23:36ff identification was omitted because its stichometry misalignment score exceeded 50.

⁴² This instance is the best reconstruction of O'Callaghan's match with Rahlfs's text when unattested omissions are disallowed.

⁴³ Both of these Genesis matches require that the between-letter sequence distance be increased from the default maximum of 65 to 80.

⁴⁴ Nothing in the data, of course, *requires* a Septuagintal, pseudepigraphal or New Testament origin for the text. Moreover, the massive corpus of nonsectarian texts must be assayed to definitively eliminate the possibility. See especially Focant (1985, p. 453) and Wallace (1994c, p. 177).

⁴⁵ Given that this worked example relates only to the NT, one might wonder if the approach just described is as effective outside the Judea Christian corpus. Two comments, it seems to me, are relevant. First, of the ten major features of the automated protocol listed in Section 3.A.2, the component that disproportionately contributes most to misidentification (false positives) is how closely the chosen or architected font emulates the literary or documentary hand in the target papyrus. Given that fact, it is difficult to imagine a scenario in which the ability to emulate a given literary hand would differ between sacred and secular texts of the same era. Second, notwithstanding the above, the IJCC database, by definition, is comprised solely of Judeo-Christian texts. As such, a comparison between the rate of genuine false positives between sacred and secular texts (as well as by genre, era, and the like) would constitute a potentially enlightening test in characterizing the overall performance of the METIS system.

⁴⁶ Special thanks are due to Pnina Shor, head of the Dead Sea Scrolls project at the IAA, and Orit Rosengarten, also of the Dead Sea Scrolls Project, who made me aware of the new imagery and kindly provided access to it.

⁴⁷ As a preview of that work, the new imagery reveals new detail in the fragment's fiber patterns when illuminated by frequencies close to the near ultraviolet and maximizes the relative reflectivity difference between the papyri and the carbon-based inks at Qumran when illuminated by the near infrared frequencies.

⁴⁸ The Danish humanist questioned the authenticity of Ephesians.

⁴⁹ Chubb was the first of the rationalists to point out the anonymity of the gospels.

⁵⁰ J.E.C. Schmidt inaugurated the inquiry and was followed quickly by Schleiermacher who rejected the Pauline authorship of 1 Timothy on the basis of language and the difficulty of placing the text within the chronology of Acts. J.G. Eichhorn was the first to inveigh against Pauline authorship for all three epistles.

⁵¹ See especially the critique of serial univariate methods and procedures by Rudman (1997), Juola, Sofko and Brennan (2006) and Juola (2008) and the disutility of *hand-picked* markers as a test of authorship by Mosteller and Wallace (1963, p. 285).

⁵² Cf. Burrows (1992, p. 92–102). Cf. also Baayen, van Halteren, Neijt et al. (2002, section 3).

⁵³ The otherwise excellent methodological work of Herdan (1960, p. 250), Greenwood (1992; 1993), and Ledger (1995, p. 95) as well as the more methodologically compromised work of the early Radday (1970, p. 73), the modified CUSUM efforts of Barr (2002, p. 5–9), and the deeply flawed work of Morton (1986, p. 1) are all marred by assuming *de facto* that all or most of the total stylistic variation in their analyses is authorial in origin.

⁵⁴ For Baur's evaluation of the nine Paulines he rejected, see Baur (1845, p. 417–499).

⁵⁵ Some scholars (Howard 1952, p. 460) see core source material in John (that has been subsequently redacted) that connect a certain eyewitness John to Jesus.

⁵⁶ Baur (1845, p. 417–418) followed Evanson (1792, p. 312–313) and de Wette (1843, p. 79) in weighing against the authenticity of Ephesians due to its perceived dependence on Colossians.

⁵⁷ Though de Wette (1842, p. 267–268) affirmed Philippians as Pauline beyond any dispute, Baur (1845, p. 458–464) saw in it purported gnostic ideas.

⁵⁸ Kümmel (1975, p. 140) noted that the modern era of critical arguments against Pauline authenticity of Colossians began with Dibelius.

⁵⁹ Kümmel (1975, p. 341–342) supported authenticity based on its style.

⁶⁰ Baur (1845, p. 480–481) rejected 1 Thessalonians because it lacked originality.

⁶¹ Schmidt (1801, p. 380–386) was the first to contest 2 Thessalonians due to perceived differences between the *parousia* of 1 and 2 Thessalonians.

⁶² Schmidt (1804, p. 257–267) doubted both epistles on the basis of aberrant vocabulary, and Schleiermacher (1807, p. 16–19) doubted them because he viewed them as unknown to Polycarp as well as to the apostolic fathers.

⁶³ On the similarity of 1 Timothy and Titus, see Aageson (2008, p. 87).

⁶⁴ Kümmel (1975, p. 385) viewed 1 Timothy as the work of a single pseudepigraphist.

⁶⁵ von Weizsäcker (1892, p. 183–184) is one of the few that rejected this epistle.

⁶⁶ Kümmel (1975, p. 450), however, views 1, 2, and 3 John to be by one hand.

⁶⁷ At first glance one might wonder if the number of single-instance genres within the NT corpus as represented by this table renders the stylistic analysis a little suspect. Two comments might be tendered in response to this concern. First, when one seeks to qualitatively categorize genres within a quite limited but heterogeneous corpus (the NT contains only 27 books), a single instance genre is quite unavoidable. Few would argue, for instance, that the NT contains any more than one clear example of apocalyptic literature (e.g. the Book of Revelation). Second, even if there is only one instance of a given genre (e.g. Revelation) from the standpoint of measurement adequacy, the text of Revelation presents thousands of linguistic instances (lexical, semantic, word group, etc.) for analysis. In this way a single text can be seen as a corpus of linguistic measures. Accordingly, the quite appropriate concern over the multiplication of Type I error caused by a seemingly unitary sample evaporates. Second, from an experimental design stance we concur that it would indeed be advantageous to use multiple instances of similar genre forms if they were available (e.g., The Shepherd of Hermas as an additional apocalyptic text). Unfortunately, many contemporaneous early Christian or late second temple Jewish texts are not as richly semantically and linguistically tagged as is the Greek New Testament and hence were not available for this analysis. That tagging is now in work.

⁶⁸ Achtemeier's observation in Achtemeier, Green and Thompson (2001, p. 528) that 2 Peter has elements of testament is worthy of further investigation. If so, it would be grouped with 2 Timothy.

⁶⁹ Given its address, "to the twelve tribes," and its tenor, a Jewish audience seems to be in view.

⁷⁰ Deissmann (1927, p. 228–230) viewed the essential difference between the epistle and letter to be that the epistle is public and for posterity and the letter is private and personal. Because discerning authorial intent is always problematic, I have simplified the definition to *number*: audience plurality vs. singularity.

⁷¹ The data in Figures 4 and 5 and Table 6 were previously included in the author's dissertation.

⁷² Courtesy of OpenText.org.

⁷³ Goodman and Kruskal's tau was also used, as was the uncertainty coefficient (UC) from the mathematics of Information Theory.

⁷⁴ Per our definition of strength in the text, in all 20 models where authorship was stronger than genre, both terms were removed in the same step.

⁷⁵ For an accessible introduction to HLLA see Knoke and Burke (1980, p. 11-41).

⁷⁶ All forms of language in the GNT were allowed to contribute (instead of subsets produced by partitions or bins).

⁷⁷ Interpretively, for each cell in Table 6, nine models were built, one for each language measure, with the number representing the total HLLA models where authorship (A|G) was “stronger” than genre (G|A) per the definition just given. Hence, the “4/9” at the intersection of Genre 8 and Modern Critical 18 means that for four of the nine tested language measures authorship (A|G) was stronger than genre (G|A).

⁷⁸ Indeed, the notion that stylistic variation is a composite entity capable of being separated by multivariate analysis was central to Carroll’s seminal study on the analysis of prose (1960), Blacklith’s analysis of Latin Elegiac verse (1963), Moerks’s description of style (1973), Brainerd’s distinction between novel and Romance (1973), Ule’s clustering of Elizabethan texts (1974), Boreland and Galloway’s attempt at author discrimination (1980), Faigley and Meyer’s classification of text types (1983), Biber’s study of macroscopic text variation (1985) and Ledger’s proposal to use multivariate statistical analysis for stylometry (1985).

⁷⁹ Such work, however, has usually focused on authorship issues alone without first controlling for that fraction of the total variation that is due to genre or other socio-contextual factors. Researchers that have pioneered this work have included, notably, Neumann (1990); Ledger (1995); Mealand (1995; 1997; 1999; 2011); Putniņš, Signoriello, Jain et al. (2006); and Erwin and Oakes (2012).

⁸⁰ The persistent specter of Logical Positivism, in particular, warrants special concern. For its trajectory, see its inspiration by Comte’s manifesto (1830), its birth in the Berlin and Vienna circles, its peak under Wittgenstein (1999, p. Proposition 4.003) and Whitehead and Russell (1910, pp. vii–viii), its merger with Otto Neurath’s physicalism (1931, p. 618–623) and Carnap’s reduction of philosophy to science (1984, p. 506), its mathematical unraveling under Gödel (1931, p. 180–186, 196–198) and its philosophical inadequacy as discursively demonstrated by Kuhn (1962, p. 147), Popper (2014, p. 342-376) and Quine (1980, p. 37-39).

Bibliography

- Aageson, J. W., 2008. *Paul, the Pastoral Epistles, and the Early Church*. Peabody, MA: Hendrickson.
- Achtemeier, P. J., J. B. Green and M. M. Thompson, 2001. *Introducing the New Testament: Its Literature and Theology*. Grand Rapids: Eerdmans.
- Adam, A. K. M., 2000. *Handbook of Postmodern Biblical Interpretation*. St. Louis: Chalice.
- , 2006. *Faithful Interpretation: Reading the Bible in a Postmodern World*. Minneapolis: Fortress.
- Aichele, G., P. D. Miscall and R. Walsh, 2009. An Elephant in the Room: Historical-Critical and Postmodern Interpretations of the Bible. *Journal of Biblical Literature* 128(2), pp. 383–404.
- Aland, K., 1974. Neue neutestamentliche Papyri III. *New Testament Studies* 20(4), pp. 357–376.
- Alvarado, R., 2012. The Digital Humanities Situation. In: M. K. Gold, ed. 2012. *Debates in the Digital Humanities*. Minneapolis: Univ of Minnesota Press. pp. 50-55.
- Baayen, R. H., H. van Halteren, A. Neijt, et al., 2002. An Experiment in Authorship Attribution. In: *6th JADT*. Saint-Malo, France, 13-15 March 2002. Paris: JADT.
- Baillet, M., J. T. Milik and R. de Vaux, 1962. *Les "petites grottes" de Qumrân: exploration de la falaise, les grottes 2Q, 3Q, 5Q, 6Q, 7Q à 10Q, le rouleau de cuivre*. Oxford: Clarendon Press.
- Barr, G. K., 2002. The Impact of Scalometry on New Testament Letters. *The Expository Times* 114(1), pp. 3–9.

- Baur, F. C., 1845. *Paulus, der Apostel Jesu Christi: Sein Leben und Wirken, seine Briefe und seine Lehre*. Stuttgart: Becher & Müller.
- Binongo, J. N. G. and M. W. A. Smith, 1999. A Bridge between Statistics and Literature: The Graphs of Oscar Wilde's Literary Genres. *Journal of Applied Statistics* 26(7), pp. 781–787.
- Bockmuehl, M., 2006. *Seeing the Word: Refocusing New Testament Study*. Grand Rapids: Baker Academic.
- Burrows, J. F., 1987. Word-Patterns and Story-Shapes: The Statistical Analysis of Narrative Style. *Literary & Linguistic Computing* 2(2), pp. 61–70.
- , 1992. Not Unless You Ask Nicely: The Interpretative Nexus between Analysis and Information. *Literary & Linguistic Computing* 7(2), pp. 91–109.
- Carnap, R., 1984. On the Character of Philosophic Problems. *Philosophy of Science* 51(1), pp. 5–19.
- Chubb, T., 1731. *A Discourse Concerning Reason, with Regard to Religion and Divine Revelation*. London: T. Cox.
- Comte, A., 1830. *Cours de philosophie positive*. Bachelier: Paris.
- de Wette, W. M. L., 1842. *Lehrbuch der historisch-kritischen Einleitung in die Bibel alten und neuen Testaments*. 4th ed. Berlin: Reimer.
- de Wette, W. M. L., 1843. *Kurze Erklärung der Briefe an die Colosser, an Philemon, an die Ephesier und Philipper*. Leipzig: Weidmann.

- Deissmann, G. A., 1927. *Light from the Ancient East: The New Testament Illustrated by Recently Discovered Texts of the Graeco-Roman World*. Translated from German by L. R. M. Strachan. London: Hodder & Stoughton.
- Eichhorn, J. G., 1812. *Einleitung in das Neue Testament*. Leipzig: Weidmann.
- Erasmus, D., 1663. *Annotationes, of, Aanteekeningen op 't Nieuwe Testament*. Amsterdam: Voor Ian Rievwertsz.
- Erwin, H. and Oakes, M., 2012. Correspondence Analysis of the New Testament. Workshop on Language Resources and Evaluation for Religious Texts. Paper presented at the Language Resources and Evaluation for Religious Texts, Istanbul, Turkey.
- Estrada, D. and W. White Jr., 1978. *The First New Testament*. Nashville: Thomas Nelson.
- Estrada, D. M., 1972. On the Latest Identification of New Testament Documents. *Westminster Theological Journal* 34(2), pp. 109–117.
- Evanson, E., 1792. *The Dissonance of the Four Generally Received Evangelists*. Ipswich: George Jermym.
- Focant, C., 1985. Un fragment du second évangile à Qumrân: 7Q5 = Mc 6,52-53? *Revue Théologique de Louvain* 16(4), pp. 447–454.
- Forsyth, R. S., D. I. Holmes and E. K. Tse, 1999. Cicero, Sigonio, and Burrows: Investigating the Authenticity of the Consolatio. *Literary and Linguistic Computing* 14(3), pp. 375–400.
- Garnet, P., 1973. O'Callaghan's Fragments: Our Earliest New Testament Texts? *Evangelical Quarterly* 45(1), pp. 6-12.

- Gödel, K., 1931. Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme. *Monatshefte für Mathematik und Physik* 38(1), pp. 173–198.
- Green, J. B., 2000. Scripture and Theology: Uniting the Two So Long Divided. In: Green, J. B. and M. Turner, eds. 2000. *Between Two Horizons: Spanning New Testament Studies and Systematic Theology*. Grand Rapids: Eerdmans. pp. 23-43.
- , 2011. *Practicing Theological Interpretation: Engaging Biblical Texts for Faith and Formation*. Grand Rapids: Baker Academic.
- Green, J. B. ed., 2010. *Hearing the New Testament: Strategies for Interpretation*. 2nd ed. Grand Rapids: Eerdmans.
- Greenwood, H. H., 1992. St Paul Revisited: A Computational Result. *Literary and Linguistic Computing* 7(1), pp. 43–47.
- Greenwood, H. H., 1993. Saint Paul Revisited: Word Clusters in Multidimensional Space. *Literary and Linguistic Computing* 8(4), pp. 211–219.
- Harman, G. H., 1965. The Inference to the Best Explanation. *The Philosophical Review* 74(1), pp. 88-95.
- Hemer, C. J., 1974. Note on 7Q5. *Zeitschrift für die Neutestamentliche Wissenschaft und die Kunde der Älteren Kirche* 65(1-2), pp. 155–157.
- Herdan, G., 1960. *Type-Token Mathematics. A Textbook of Mathematical Linguistics*. Hague: Mouton.

- Hockey, S., 2004. The History of Humanities Computing. In: S. Schreibman, R. G. Siemens and J. Unsworth, eds. 2004. *A Companion to Digital Humanities*. Malden, MA.: Blackwell Publishing. pp. 3-19.
- Holtzmann, H. J., 1872. *Kritik der Epheser-und Kolosserbriefe: auf Grund einer Analyse ihres Verwandtschaftsverhältnisses*. Leipzig: Wilhelm Engelmann.
- Howard, W. F., 1952. The Gospel According to John. In: G. A. Buttrick, ed. 1952. *The Interpreter's Bible*. Vol. 8. Nashville: Abingdon.
- Jeanrond, W. G., 1988. *Text and Interpretation as Categories of Theological Thinking*. New York: Crossroad.
- , 1991. *Theological Hermeneutics: Development and Significance*. New York: Crossroad.
- , 1993. Theology in the Context of Pluralism and Postmodernity: David Tracy's Theological Method. In: D. Jasper, ed. 1993. *Postmodernism, Literature and the Future of Theology*. Houndmills: Macmillan. pp. 143–163.
- Juola, P., 2008. Author Attribution. *Foundations and Trends in Information Retrieval* 1(3), pp. 233–334.
- Juola, P. and R. H. Baayen, 2005. A Controlled-Corpus Experiment in Authorship Identification by Cross-Entropy. *Literary and Linguistic Computing* 20(supplement), pp. 59–67.
- Juola, P., J. Sofko and P. Brennan, 2006. A Prototype for Authorship Attribution Studies. *Literary and Linguistic Computing* 21(2), pp. 169–178.
- Kearney, R., 1987. Ethics and the Postmodern Imagination. *Thought: Fordham University Quarterly* 62, pp. 39–58.

- Kinder, M. and T. McPherson, 2014. Preface: Origins, Agents, and Alternative Archaeologies. In: M. Kinder and T. McPherson, eds. 2014. *Transmedia Frictions the Digital, the Arts, and the Humanities*. Berkeley: University of California Press. pp. xiii-xviii.
- Knoke, D. and P. J. Burke, 1980. *Log-Linear Models*. Vol. 07-020. Newbury Park: Sage.
- Kraus, T. J., 1999. 7Q5: Status quaestionis und grundlegende Anmerkungen zur Relativierung der Diskussion um das Papyrusfragment. *Revue de Qumrân*, 19(74), pp. 239-258.
- Kuhn, T. S., 1962. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Kümmel, W. G., 1975. *Introduction to the New Testament*. Translated from German by H. C. Kee. Nashville, TN: Abingdon.
- Ledger, G. R., 1995. An Exploration of Differences in the Pauline Epistles Using Multivariate Statistical Analysis. *Literary and Linguistic Computing* 10(2), pp. 85–97.
- Libby, J. A., 2010. A Reworked Omnibus Protocol for Identifying Fragmentary Papyri Using 7Q5 as a Test Case. In: *SBL Annual Conference*. Atlanta, GA., November 21st, 2010.
- , 2015. *Disentangling Authorship and Genre in the Greek New Testament: History, Method and Praxis*. Ph.D. dissertation. McMaster Divinity College, Hamilton, ON., Canada.
- , Forthcoming-a. Novel Identifications for the 7Q5 Papyrus Enabled by a Reworked Omnibus Protocol for Identifying Fragmentary Papyri.
- , Forthcoming-c. A Protocol and Software to Meaningfully Reduce False Negatives and False Positive in the Identification of Fragmentary Texts of Antiquity.

- Lowe, M., 2000. The Critical and the Skeptical Methods in New Testament Research. *Gregorianum* 81(4), pp. 692–721.
- Martini, C. M. C., 1972. Notes on the Papyri of Qumrān Cave 7. *Journal of Biblical Literature* 91(2), pp. 15–20.
- Mealand, D. L., 1995. The Extent of the Pauline Corpus: A Multivariate Approach. *Journal for the Study of the New Testament* 18(59), pp. 61–92.
- , 1997. Measuring Genre Differences in Mark with Correspondence Analysis. *Literary & Linguistic Computing* 12(4), pp. 227–245.
- , 1999. Style, Genre, and Authorship in Acts, the Septuagint, and Hellenistic Historians. *Literary & Linguistic Computing* 14(4), pp. 479–505.
- , 2011. Is There Stylometric Evidence for Q? *New Testament Studies* 57(4), pp. 483–507.
- Metzger, B. M., 1968. *The Text of the New Testament; Its Transmission, Corruption, and Restoration*. New York: Oxford University Press.
- Moore, S. D. and Y. Sherwood, 2010. Biblical Studies ‘After’ Theory: Onwards Towards the Past. Part 2, The Secret Vices of the Biblical God. *Biblical Interpretation* 18(2), pp. 87–113.
- , 2011. *The Invention of the Biblical Scholar: a Critical Manifesto*. Minneapolis: Fortress Press.
- Morton, A. Q., 1986. Once. A Test of Authorship Based on Words Which are Not Repeated in the Sample. *Literary and Linguistic Computing* 1(1), pp. 1–8.

Mosteller, F. and D. L. Wallace, 1963. Inference in an Authorship Problem. *Journal of the American Statistical Association* 58(302), pp. 275–309.

Muro, E. 2010. Bible Software and Papyrology. Retrieved February 2nd, 2010, from <http://www.bsreview.org/blog/?m=200403&&paged=3>

Neumann, K. J., 1990. *The Authenticity of the Pauline Epistles in the Light of Stylostatistical Analysis*. Atlanta, GA: Scholars.

Neurath, O., 1931. Physicalism: The Philosophy of the Viennese Circle. *The Monist* 41(4), pp. 618–623.

O’Callaghan, J., 1972a. ¿1 Tim 3:16 : 4:1.3 en 7Q4? *Biblica* 53(3), pp. 362–367.

-----, 1972b. New Testament Papyri in Qumrān Cave 7. *Journal of Biblical Literature* 91(2), pp. 1–14.

-----, 1972f. Notas sobre 7Q tomadas en el Rockefeller Museum de Jerusalén. *Biblica* 53(4), pp. 517–533.

-----, 1972g. ¿Papiros neotestamentarios en la cueva 7 de Qumrān? *Biblica* 53, pp. 91–100.

Parker, P., 1972. Enthält das Papyrusfragment 5 aus der Höhle 7 von Qumran einen Markustext? *Erbe und Auftrag* 48, pp. 467–469.

Peirce, C. S., 1867. On the Natural Classification of Arguments. *Proceedings of the American Academy of Arts and Sciences* 7, pp. 261–287.

-----, 1878. Deduction, Induction, and Hypothesis. *Popular Science Monthly* 13, pp. 470–482.

- , 1901. On the Logic of Drawing History from Ancient Documents, Especially from Testimonies. In: T. P. E. Project, ed. 1901. *The Essential Peirce: Selected Philosophical Writings, (1893–1913)*. Vol. 2. Bloomington: Indiana University Press. pp. 75–114.
- Popper, K. R., 2014. *Conjectures and Refutations: The Growth of Scientific Knowledge*. London; New York: Taylor & Francis.
- Porter, S. E., 2013. *How We Got the New Testament: Text, Transmission, Translation*. Grand Rapids: Baker.
- Putniņš, T., Signoriello, D. J., Jain, S., et al., 2006. Advanced Text Authorship Detection Methods and Their Application to Biblical Texts. In: Bender, A., ed. 2006. *Complex Systems*. Bellingham, WA: Society of Photo Optical. pp. J1–J13.
- Quine, W. V. O., 1980. Two Dogmas of Empiricism. In: W. V. O. Quine, ed. 1980. *From a Logical Point of View: Nine Logico-Philosophical Essays*. Cambridge, MA: Harvard University Press. pp. 20–46.
- Radday, Y. T., 1970. Isaiah and the Computer: a Preliminary Report. *Computers & the Humanities* 5(2), pp. 65–73.
- Roberts, C. H., 1972. On Some Presumed Papyrus Fragments of the New Testament from Qumran. *The Journal of Theological Studies* 23(2), pp. 446–447.
- Rudman, J., 1997. The State of Authorship Attribution Studies: Some Problems and Solutions. *Computers and the Humanities* 31(4), pp. 351–365.
- Schleiermacher, F. D. E., 1807. *Ueber den sogenannten ersten Brief des Paulos an den Timotheos: Ein kritisches Sendschreiben an J. C. Gass, Consistorialassessor und Feldprediger zu Stettin*. Berlin: Realschulbuchh.

- Schmidt, J. E. C., 1801. Vermutungen über die beiden Briefe an die Thessalonicher. *Bibliothek für Kritik und Exegese des Neuen Testaments und älteste Christengeschichte*, 2(3), pp. 380–386.
- , 1804. *Historisch-kritische Einleitung ins Neue Testament*. Giessen: Tasché und Müller.
- Scibona, R., 2001. 7Q5 e il ‘calcolo delle probabilità’ nella sua identificazione. *Bibbia e Oriente* 43(3), pp. 133–181.
- Slaby, W. A., 1992. Computer-unterstützte Fragment-Identifizierung. In: Mayer, B. and J. H. Charlesworth, eds. 1992. *Christen und Christliches in Qumran?* Regensburg: Pustet. pp. 83–88.
- Spottorno, M. V., 1992. Una nueva posible identificación de 7Q5. *Sefarad* 52(2), pp. 541–543.
- , 1999. Can Methodological Limits Be Set in the Debate on the Identification of 7Q5? *Dead Sea Discoveries* 6(1), pp. 66–77.
- Thiede, C. P., 1984. 7Q: eine rückkehr zu den neutestamentlichen Papyrusfragmenten in der siebten Höhle von Qumran. *Biblica* 65(4), pp. 538–559.
- , 1992. *The Earliest Gospel Manuscript?: the Qumran Papyrus 7Q5 and Its Significance for New Testament Studies*. Exeter: Paternoster.
- , 1995. 7Q5—Facts or Fiction. *Westminster Theological Journal* 57(2), pp. 471–474.
- Thiselton, A. C., 1992. *New Horizons in Hermeneutics*. Grand Rapids: Zondervan.

- , 1995. *Interpreting God and the Postmodern Self: On Meaning, Manipulation, and Promise*. Grand Rapids: Eerdmans.
- , 2006. *Thiselton on Hermeneutics: The Collected Works and New Essays of Anthony Thiselton*. Grand Rapids: Eerdmans.
- Thiselton, A. C. and U. Marko, 1998. Thirty Years of Hermeneutics: Retrospect and Prospect. In: Krašovec, J., ed. 1998. *Interpretation of the Bible: The International Symposium in Slovenia*. Sheffield: Sheffield Academic. pp. 1559–1574.
- Tracy, D., 1987. *Plurality and Ambiguity: Hermeneutics, Religion, Hope*. San Francisco: Harper & Row.
- von Weizsäcker, K. H., 1892. *Das apostilische Zeitalter der christlichen Kirche*. Freiburg: Mohr.
- Wallace, D. B., 1994a. 7Q5: The Earliest NT Papyrus? In: *Evangelical Theological Society Southwestern Regional Meeting*. John Brown University, Siloam Springs, AR, 4 March 1994. www.Bible.org: Biblical Studies Press.
- , 1994c. 7Q5: The Earliest NT Papyrus? *Westminster Theological Journal* 56(1), pp. 173–180.
- Watson, F., 1997. *Text and Truth: Redefining Biblical Theology*. Grand Rapids: Eerdmans.
- Whitehead, A. N. and B. Russell, 1910. *Principia Mathematica*. Vol. I. London: Cambridge University Press.
- Wittgenstein, L., 1999. *Tractatus Logico-Philosophicus*. Translated from German by C. K. Ogden. Mineola, NY: Dover.

Ziegler, J. ed., 1984. *Zechariah*. Göttingen: Vandenhoeck & Ruprecht.