

Teile vs. herrsche? Open Access und das Zweitveröffentlichungsrecht

Charlotte Schubert

Zur Zeit rollt eine neue Welle von Rechtsstreitigkeiten auf die Wissenschaftler und Wissenschaftlerinnen zu, die sich zwar vordergründig gegen das Zweitveröffentlichungsrecht richtet, im Grundsatz aber das Prinzip des Open Access, dem sich Digital Classics Online verpflichtet sieht, im Kern treffen könnten und die daher hier aufgegriffen werden soll:

Der Verlag Elsevier und die Fachgesellschaft American Chemical Society klagen gegen die Plattform ResearchGate.¹ ResearchGate wurde 2008 gegründet, hat heute ca. 14 Millionen Nutzer (nach eigenen Angaben), ca. 300 Mitarbeiter und stützt sich auf Investoren wie den Microsoft-Gründer Bill Gates, den Finanzier Peter Thiel sowie die Investmentbank Goldman Sachs. ResearchGate betrachtet sich selbst als soziales Netzwerk und stellt Wissenschaftlern und Forscherinnen auf der Plattform Publikationsmöglichkeiten zu Verfügung, so daß dort – nach Anmeldung - beliebig viele Aufsätze etc. hochgeladen und innerhalb des Netzwerkes geteilt werden können. Elsevier und die American Chemical Society klagen nun gegen ResearchGate und wollen zahlreiche Artikel wegen Verletzung des Copyrights von der Plattform löschen lassen.

Dies ist nicht die erste Aktion der American Chemical Society (ACS): Im September hatte sie bereits eine Klage gegen die Webseite Sci-Hub (eine „Schattenbibliothek“, die Aufsätze zugänglich macht, die sonst hinter einer Paywall liegen) wegen der Verletzung von Copyright vor einem Gericht in Virginia eingereicht, der von dem zuständigen Richter auch stattgegeben wurde. Allerdings hat sich dagegen im Oktober die Computer and Communications Industry Association (CCIA) gewandt. Die CCIA ist eine amerikanische Nonprofit Organisation mit Sitz in Washington, D.C.,² die sich an Antitrust-Verfahren gegen u.a. IBM, AT&T, Microsoft beteiligt hat, heute für „open markets, open systems, open networks, and full, fair, and open competition“ eintritt und die großen amerikanischen Internetkonzerne (Amazon, Google, Facebook) repräsentiert. CCIA hat sich mit einem sog. „amicus curiae brief“ gegen die von der ACS erhobene Forderung gewandt,³ von den Internet Providern und Suchmaschinenbetreibern zu verlangen, den Zugang zu Sci-Hub zu blockieren. Durch die Aktion der CCIA ist die ursprüngliche Anweisung des Gerichts zwar etwas gemildert, aber nicht aufgehoben worden, so daß Sci-Hub Domains bereits jetzt inaktiv geschaltet sind.⁴

1 Elsevier: <https://www.elsevier.com/>; American Chemical Society: <https://www.acs.org/>; ResearchGate: <https://www.researchgate.net/> (2.12.2017).

2 <http://www.ccianet.org/> (2.12.2017).

3 Eine in amerikanischen Gerichtsverfahren übliche Praxis, einen Schriftsatz als »Freundes des Gerichts« einzureichen, in dem Argumente vorgetragen werden, die nach Ansicht der einreichenden Parteien nicht ausreichend berücksichtigt wurden.

4 https://www.theregister.co.uk/2017/11/23/scihubs_become_inactive_following_court_order/.

Diese Auseinandersetzung ist nun keine inneramerikanische, sondern betrifft, da der Sitz von ResearchGate in Berlin ist, auch Deutschland: Der Verband der Wissenschaftsverlage [STM](#) (Science, Technics, Medicine) hat die Kanzlei Caemmerer Lenz beauftragt, das unter Wissenschaftlern und Wissenschaftlerinnen beliebte soziale Netzwerk [ResearchGate](#) anzugehen.⁵

Elsevier und die ACA haben jetzt vor dem Landgericht München eine Klage gegen ResearchGate eingereicht.⁶ Dies könnte darauf hindeuten, daß hier exemplarisch vorgegangen wird, um das freie Teilen im wissenschaftlichen Austausch grundsätzlich unter die Verfügungsgewalt der organisierten Verlage zu stellen.

ResearchGate hat bereits reagiert und 1,7 Millionen Aufsätze bis Anfang November in einen nicht öffentlichen Modus verschoben.⁷

Wie sich diese Aktionen zu den „Sharing principles“ verhalten, den freiwilligen Prinzipien für den offenen Austausch von Fachbeiträgen in wissenschaftlichen Netzwerken, denen sich die STM Fachverlage für Wissenschaft, Technik und Medizin verpflichtet sehen,⁸ ist daraus zu ersehen, daß die STM sich einerseits zu dem wissenschaftlichen Austausch, der Kooperation und der freien Forschung bekennen, dies aber andererseits an die Zugehörigkeit zu einer Forschergruppe und der Beachtung aller kommerziellen Schranken binden! Zu den STM gehören mehr als 120 Verlage in 21 Ländern (u.a. einige der University Presses wie Oxford University Press oder Cambridge University Press, aber auch Elsevier, EBSO, ProQuest u.v.a.m.). Weiterhin haben Verlage den Verbund „Coalition for Responsible Sharing“ gegründet, zu dem Brill, Elsevier, Wiley und Wolters Kluwer gehören, daneben auch die American Chemical Society, jedoch nicht Springer-Nature und Taylor & Francis. Die PR-Agentur Fleishman Hillard ist für den Verbund tätig.

Bildet sich hier eine neue Herrschaftshierarchie aus?

Die hier beschriebenen Aktionen sind ein direkter Angriff auf den deutschen §38 UrhG, der das sog. Zweitveröffentlichungsrecht erlaubt. Das Wiederveröffentlichen wissenschaftlicher Texte nach einer Frist von 12 Monaten durch die Autoren wurde im Juni 2013 vom Deutschen Bundestag beschlossen. Hiernach ist diese Zweitveröffentlichung erlaubt, wenn die Publikation „im Rahmen einer mindestens zur Hälfte mit öffentlichen Mitteln geförderten Forschungstätigkeit entstanden und in einer periodisch mindestens zweimal jährlich erscheinenden Sammlung erschienen“ ist und darf nur in der „akzeptierten Manuskriptversion“ publiziert werden, „soweit dies keinem gewerblichen Zweck dient“ (UrhG §38). Bei ResearchGate sollen ca. 7 Millionen Artikel nicht dieser Regelung entsprechen und sind daher von der Urheberrechtsklage betroffen.⁹ Es wird u.a. angeprangert, daß die 12-Monatsfrist nicht eingehalten werde, aber auch andere Beschränkungen nicht berücksichtigt werden.

Daß hier und auch im Fall von Sci-Hub möglicherweise gegen Gesetze verstoßen worden ist, soll hier keinesfalls bestritten werden. Aber allein die Tatsache, daß Sci-Hub und ResearchGate sich einer derart großen Nachfrage erfreuen, verweist auf ein ernstes Problem: Viele Bibliotheken können sich die teuren Lizenzverträge mit den Großverlagen nicht mehr leisten,

⁵ <https://wisspub.net/2017/09/20/verlage-greifen-berliner-start-up-researchgate-an/> (2.12.2017).

⁶ <https://www.capital.de/wirtschaft-politik/wissenschaftsverlage-gehen-gegen-researchgate-vor> (30.11.2017).

⁷ S. Anm. 3.

⁸ <https://www.stm-assoc.org/> und <https://www.stm-assoc.org/about-stm/about-the-association/> (2.12.2017).

⁹ <http://digitur.de/es-brodelt-der-fall-researchgate/> und <https://irights.info/artikel/zweitveroeffentlichungen-von-forschern-elsevier-und-fachgesellschaft-klagen-gegen-researchgate/28748> (30.11.2017).

Privatleute sowieso nicht und Wissenschaftseinrichtungen sowie Forscher/Forscherinnen in ökonomisch schwächeren Ländern erst recht nicht. Dies bedeutet, daß sehr große Kreise von Wissenschaftlern und Wissenschaftlerinnen zunehmend von der Spitzenforschung, deren Publikationen und deren Erkenntnissen ausgeschlossen werden.

Hier soll gar nicht für das Prinzip „Der Zweck heiligt die Mittel“ argumentiert werden, jedoch sei der Hinweis gestattet, daß es eine lange Tradition des informellen Teilens in der Wissenschaft und unter Wissenschaftlern und Wissenschaftlerinnen gibt und daß Wissenschaft vom freien Austausch lebt.

Ein Mitarbeiter der Plattform Scienceopen,¹⁰ wird damit zitiert, daß es „kein großes Geheimnis“ sei, daß viele Autoren ihre Aufsätze auf den Plattformen hochladen, ohne daß dies von den Bedingungen der jeweiligen Verlagsverträge gedeckt sei. Wenn nun diese Verträge die Wissenschaftler und Wissenschaftlerinnen darin hindern, ihre Ergebnisse zu teilen, dann komme es zu einem „Dark Sharing“.¹¹ Ob dies in Unkenntnis der Rechtslage geschieht oder ob sich aus dem Brauch des informellen Teilens eine neue Schattenwelt entwickelt, scheint mir jedoch noch ganz offen zu sein.

Es ist m.E. dringend nötig, Forscherinnen und Wissenschaftlern aus allen Wissenschaftsbereichen, den Naturwissenschaften ebenso wie den Geistes- und Gesellschaftswissenschaften einen Überblick über die geltende Rechtslage – nationale wie international! – zu geben. Wir brauchen Entscheidungshilfen, um überhaupt erkennen zu können, in welcher rechtlichen Situation wir uns in unserer Beziehung zu Verlagen befinden. Ein gangbarer Weg, auch für bereits publizierte Werke ebenso wie für noch unveröffentlichte Werke könnten Vertragszusätze sein. Hierzu gibt das Policy Paper des iRights.Lab¹² Formulierungshilfen, ebenso sind die FAQ zum Zweitveröffentlichungsrecht der Schwerpunktinitiative “Digitale Information” der Allianz der deutschen Wissenschaftsorganisationen hilfreich.¹³

In jedem Fall gilt: Es ist dringend erforderlich, auf die Situation aufmerksam zu machen, die Probleme zu benennen, und für die Akzeptanz derjenigen Publikationsform zu werben, die einer Kultur des Teilens in einem verlässlichen und international etablierten Rahmen entspricht, nämlich Open Access mit CC-Lizenz und ohne Autorengebühren!

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¹⁰ <https://www.scienceopen.com/> (2.12.2017).

¹¹ <https://irights.info/artikel/streit-um-zweitveroeffentlichungen-verlage-nehmen-researchgate-ins-visier/28728> (30.11.2017).

¹² <https://irights.info/artikel/open-access-policy-paper-zum-zweitveroeffentlichungsrecht-fuer-wissenschaftler-veroeffentlicht/25264> (30.11.2017).

¹³ <http://www.allianzinitiative.de/de/handlungsfelder/rechtliche-rahmenbedingungen/faq-zvr.html> (30.11.2017).

¹⁴ Die Rechte für Inhalt, Texte, Graphiken und Abbildungen liegen, wenn nicht anders vermerkt, bei den Autoren. Alle Inhalte dieses Beitrages unterstehen, soweit nicht anders gekennzeichnet, der Lizenz CC BY 4.0 International.

Beyond Screenshots: Machine-Actionable, Canonical, Semantic Citation of Graphed Data

Christopher William Blackwell

Abstract: In 2016 and 2017, a series of conferences for European philologists was organized around the question, “What digital services, collections or curricula need to be developed so that a field of study can flourish in a digital society?” This paper argues for the need to cite graphs of data with machine-actionable canonical citation, independently of the data organized by a graph. It describes ongoing work to implement a “Canonical Graph Service” into the CITE/CTS framework used by the *Homer Multitext* (HMT). It describes citation of graphs, parts of graphs, and sub-graphs by URN, with some examples of how such URN citations might usefully be resolved. Finally, I discuss the limits of this approach, problems that will not be solved by a Canonical Graph Service. This approach may facilitate the creation of generic tools for documenting syntax across languages, integrating data from diverse projects, and opening new areas of research to scholars outside of quantitative fields.

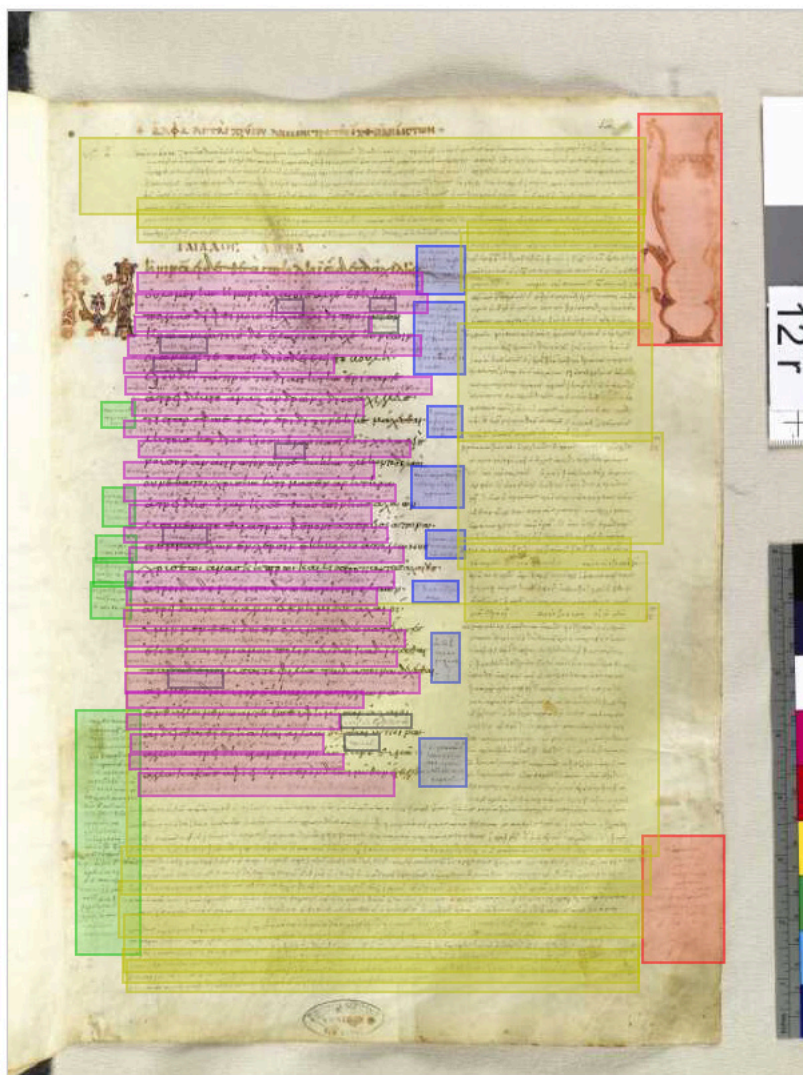


Figure 1: A visualization of texts aligned to a physical object, via the medium of a digital image. An implicit graph.

1. Background: Citation and Quotation of Data and Text

Research with any complex dataset requires many *procedural* approaches, from computational processes like find or diff, to entirely manual and intellectual tasks like reading ancient Greek or disambiguating names. But to publish the results of humanist research, we need an architecture that allows *declarative* scholarship. Once we have found things, or asserted them, we need to be able to name them. Scholars name things with *citation*.¹

Classical scholarship has always relied on *canonical citation* for declarative scholarship. Citations, e.g. “John 3:16” or “*Iliad* 24.1”, identify passages of text across editions and across technologies. For work in the digital realm, the Homer Multitext (hereafter “HMT”) has developed a digital architecture for *machine-actionable canonical citation* that allows us to identify our objects of study with citations that are precise while retaining access to the larger context.²

This architecture is CITE, for “Collections, Indices, Texts, and Extensions”. It is based on two standards for citations in URN format.³ The URN citations defined by CITE allow us to cite scholarly data, and by virtue of being machine-actionable, we can *resolve* URNs to the data which they identify, and thus automate scholarly *quotation*.⁴

With the CITE Architecture, we define “text” as “an ordered hierarchy of citation objects”⁵ can identify passages of text precisely with CTS URNs that capture the semantics of that definition:

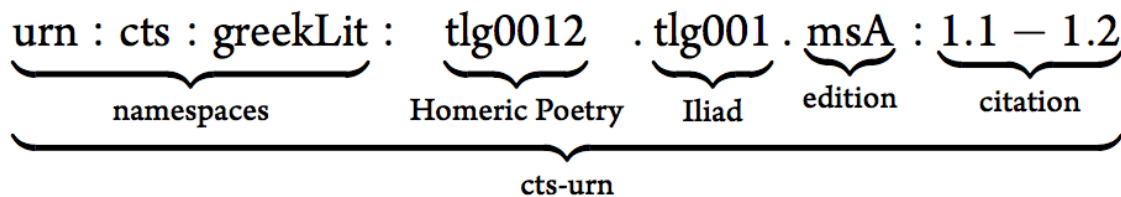


Figure 2: A CTS URN.

1 The information industry has exerted great intellectual effort to extract information and insight in the absence of any citation-practice, e.g. Guha & Gupta (2015). While this effort has led to many sophisticated and powerful heuristics and algorithms in computer science, the industry and Academe make radically different assumption. Guha and Gupta say, “Expecting a large number of different sites to use the same unique identifiers for these millions of entities is unrealistic.” (2) A thousand years of philology, on the other hand, has depended on a large number of different scholars, over centuries, using the same unique identifiers for millions of entities.

2 <http://www.homermultitext.org>

3 <http://cite-architecture.github.io>

4 Robert Sokolowski calls quotation a ‘curious conjunction of begin able to name and to contain’. Sokolowski (1984) 699. V.A. Howard is more succinct: quotation is ‘replication-plus-reference’. Howard (1974) 310. For the HMT we are less interested in the metaphysical aspects of quotation than in the practical ones. Quotation, when accompanied by citation, allows us to bring the reader’s attention to bear on a particular part of a larger whole efficiently and without losing the surrounding context. A work of Biblical exegesis, for example, can quote or merely cite ‘Genesis 1:29’ without having to reproduce the entire Hebrew Bible, or even the Book of Genesis; a reader can resolve that citation to a particular passage about the creation of plants, and can see that passage as a discrete node at the bottom of a narrowing hierarchy: Hebrew Bible, *Genesis*, Chapter 1, Verse 29. We take this for granted as philologists.

5 See Smith & Weaver (2009).

If an object of study is not an “ordered hierarchy of citation objects”, CITE offers CITE URNs. These identify objects in Collections, objects that share a set of properties.

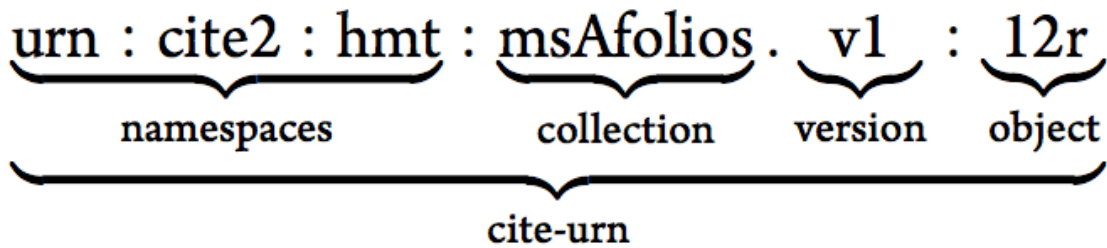


Figure 3: A CITE URN.

The URN above identifies one object (12r) in a collection (msAfolios). This is a collection of *physical objects*, the folio-sides of the Venetus A manuscript. This collection consists of records containing a shared set of properties, in this case metadata about the folios of this manuscript:

Property	Value
URN	urn:cite2:hmt:msAfolios.v1:12r
Sequence	25
Number	12
RV	recto

Table 1: A single object in a CITE Collection.

The fundamental unit of organization here is the *collection*. In this example, msAfolios is a notional collection; it is realized in a specific *version*: .v1. Any change to any of the members of this collection results in a new version.⁶

2. Background: Graphed Data

Humanists work with graphs, often more than they realize. Figure is a visualization of an implicit graph, whose nodes (or “vertices”) are citations to passages of text, citations to regions-of-interest on a digital image, and citations to a physical object, folio 12 *recto* of the manuscript *Marcianus Graecus Z454*, and whose edges are scholarly assertions of relationships (in this case) defined by RDF statements. The HMT refers to graphs like this as “Diplomatic Scholarly Editions” graphs, DSE graphs.

⁶ In the Venetus A codex, some of the folios were added in the 15th century by Cardinal Basileus Bessarion to replace missing, original folios. If our collection added a property, replacement, with a boolean value, we might call that collection v2. urn:cite:hmt:msAfoios.v1:12r and urn:cite:hmt:msAfoios.v2:12r would identify the same object, but a citation to v1 would not resolve to any information about replacement folios.

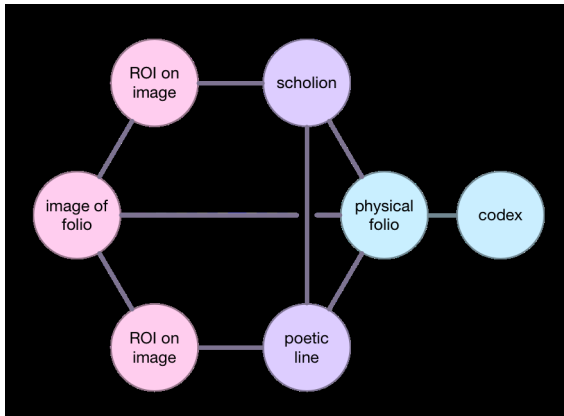


Figure 4: A graph of physical objects, images, and textual content.

In the case of this particular manuscript, which contains a text of the Homeric *Iliad* and commentary text, a specific DSE graph that might be the object of scholarly study relates a commentary text to the text it comments on, and relates both texts to their location on the physical folio, by means of visual evidence. Figure 4 is an abstract view of this scholarly assertion.

It is easy for humanists to fail to consider those commonplace associations—text, commentary, folio—as a *graph*, but other kinds of analysis are more obviously graphs. For philology in the 21st century, some of the most exciting opportunities are afforded by treebanks, explicit graphs capturing syntax or other semantic relationships, essentially documenting a reading of a text.

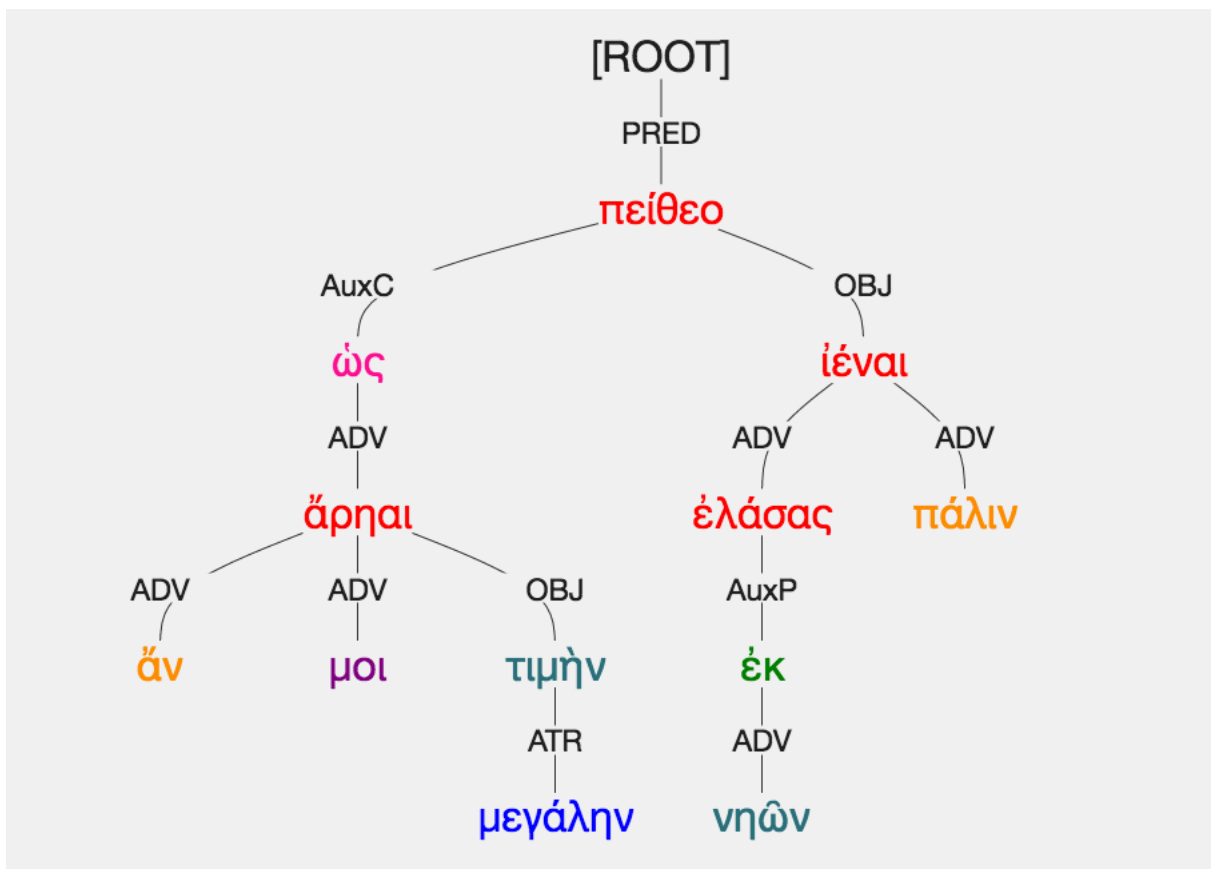


Figure 5: A graph of syntax.

In a syntactic treebank, like Figure 5, the nodes are words (and possibly punctuation), and the edges are defined syntactic relations. The treebank in Figure 5, created with the [Arethusa tool](#)⁷, the word-tokens organized in the graph of syntax are also linked to morphological and lexical data.⁸

The pedagogical value of treebanking has been widely recognized, as have its potential as a tool for linguistic analysis.⁹ But the potential of this kind of explicit graphing of semantic information remains to be fully exploited. For example, in the syntactic treebanks generated as part of the *Open Greek and Latin* project, or in the output of the analytical tools at *eAQUA*¹⁰, individual textual objects are identifiable with generic, canonical citations, which can be resolved to their texts regardless of any particular technology.

The graphs themselves, explicitly drawn in the case of treebanks, or implicit in the case of word-concurrence or other analysis, are *reproducible* using those analytical tools but are not currently identified by concise citations offering similar capabilities to citations available for textual or image data. We cannot *cite* specific sub-graphs or individual nodes or edges as *members of the graph*; we cannot resolve abstract expressions of the graphs to representations of the graph in various formats.

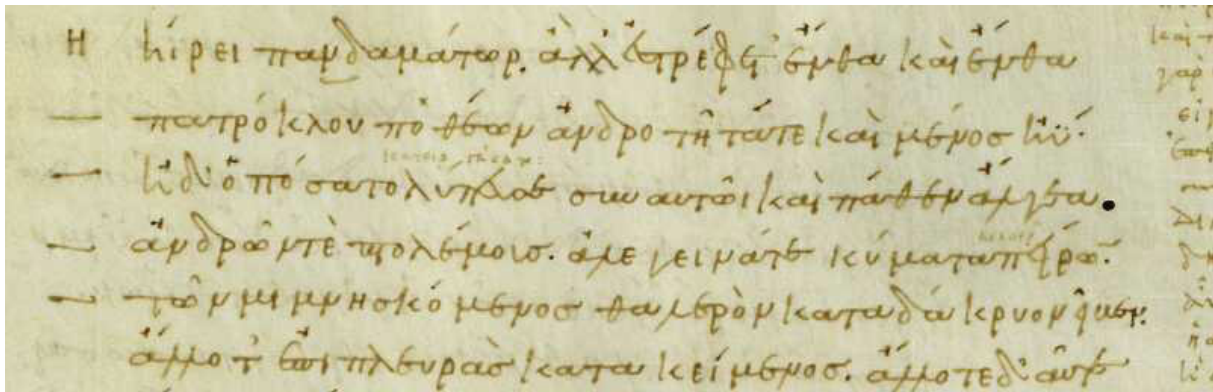


Figure 6: *Iliad* 24.5-24.10 on the Venetus A MS, showing *athetēsis* of four lines.

3. Use Case: Capturing Ancient Argument

The *scholia* on Byzantine manuscripts of the Homeric *Iliad*, the marginal comments, often discuss the editorial status of passages of the poetic text, noting when some ancient scholar of the *Iliad* expressed doubt as to the authenticity of lines of poetry. A single example will serve to illustrate how complex these ancient arguments can be. Folios 310 *verso* and 311 *recto* of *Marcianus Graecus Z822*, the “Venetus A”, contains the opening lines of Book 24 of the *Iliad*. In these lines Achilles is in his tent, sleepless and grieving over his dead friend Patroclus:

⁷ Almas & Beaulieu (2013).

⁸ Preliminary work on CITE Citable Graphs has given attention to programmatic tokenization of texts specifically for syntactic annotation. While it is beyond the scope of this paper, the [GitHub repository for our Citable Graph Extension](#) includes utilities written in [Scala](#) for generated collections of syntactically significant tokens, including data on editorial status, and level of discourse (direct or indirect), from CTS texts. These utilities are written in Scala and represent the first steps in the next stage of development of the CITE architecture.

⁹ See, for example, Mambrini (2013); Mambrini & Passarotti (2016).

¹⁰ [eAQUA](#); Schubert & Heyer (2013); Schubert (2013).

...αὐτὰρ Ἀχιλλεὺς
 κλαῖε φίλου ἐτάρου μεμνημένος, οὐδέ μιν ὕπνος
 ἦρει πανδαμάτωρ, ἀλλ' ἐστρέφετ' ἔνθα καὶ ἔνθα
 — Πατρόκλου ποθέων ἀνδροτιήτα τε καὶ μένος ἦϋ,
 — ἦδ' ὅποσα τολύπευσε σὺν αὐτῷ καὶ πάθεν ἄλγεα
 — ἀνδρῶν τε πτολέμους ἀλεγεινά τε κύματα πείρων:
 — τῶν μιμνησκόμενος θαλερὸν κατὰ δάκρυον εἶβεν,
 ἄλλοτ' ἐπὶ πλευρὰς κατακείμενος, ἄλλοτε δ' αὖτε
 ὕπτιος, ἄλλοτε δὲ πρηγής:
 — *Iliad* 24.3–24.11, Edition of the Venetus A.

...But Achilles
 wept, remembering his beloved companion, nor did sleep,
 the all-mastering, hold him, but he turned this way and that way
 yearning for the manliness and noble strength of Patroclus
 and all the things he had accomplished with him, and all the pains he suffered
 passing through the wars of men and the pain-giving waves
 remembering all these things, he let fall a great tear
 at times lying on his side, at other times again
 on his back, at times on his front.

On the Venetus A Manuscript, the scribe has included *obeloi* to the left of lines 6–9; these indicate *athetēsis*, an editor's decision that the lines are somehow inauthentic (see Figure 6).

A Scholion commenting on this passage explains the *athetēsis* (Scholion 24. A2 [HMT Edition, G. Hedden and M. Velthuisen, trans.]):

Yearning for Patroclus [From this phrase] until [the line beginning] “τῶν μιμνησκόμενος” the lines are athetized because they are cheap (εὐτελής). And with them lifted out, the grief of Achilles is made clear more emphatically:

- But he turned this way and that
- At times on his back...

And “ἀνδροτιήτα” and “μένος” indicate the same thing, for there is no difference, and [Homer] never uses “ἀνδροτιήτα” for “ἀνδρείαν”, instead he uses “ἠγορέαν”. And “remembering these things” is awkward, because he has said “remembering his companion” above. And Aristophanes athetized these lines earlier. If you don't want to athetize the lines, then either [ποθέων] should qualify everything (the main verbs ἐστρέφετ' [24.5] and εἶβεν [24.9]) or there needs to be explicit punctuation after τὸ κύματα πείρων.>

The comment is in dense scholarly Greek. It notes, first, that the scholar Aristarchus athetized four lines (as represented by the *obeloi* in the main text on the manuscript); before stating Aristarchus' reasons, it shows that the Iliadic text still makes sense with those four lines removed. It then gives two alternate ways of reading the text with those four lines in place, a “default” way, and a preferred way, seemingly based on Nicanor's (lost) work *On Iliadic Punctuation*. These three analyses can be clearly expressed with three different syntactic graphs (Figure 7, and expanded at Figures 15, 16, and 17 in the Appendix.)

The three treebanks *organize the same syntactic tokens*, so while we can cite each Iliadic line and each word in each line, it would be ideal to cite a word as a syntactic-token organized by a particular graph. The word “ἐστρέφετ'” (“he turned”) is shared across three analyses, as the same lexical entity with the same morphology, but its semantic identity is different in each of the three. We should be able to cite each of those identities.

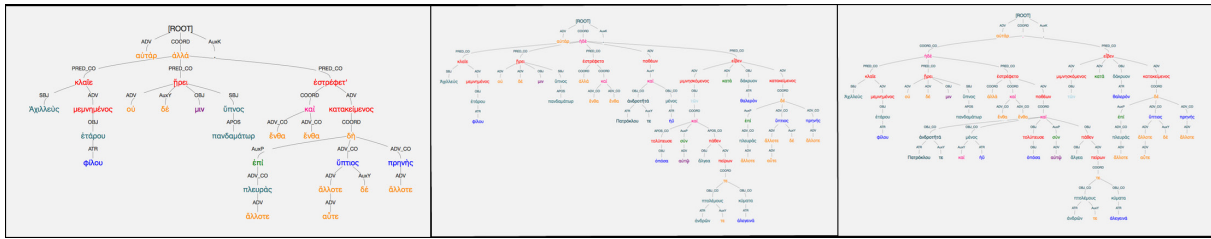


Figure 7: Three graphs of the same text, capturing three ancient readings of Iliad 24.3-24.11. Larger versions of these appear in the Appendix, Figures 15, 16, 17.

This kind of analysis permeates the Iliadic scholia. At *Iliad* 16.83–16.86, Achilles orders his friend Patroclus to drive the Trojans away from the Greek ships, but then to return and not pursue them onto the plain. The text (abridged for this example) looks like this:

πειθεο ... ὡς ἂν μοι τιμὴν μεγάλην καὶ κῦδος ἄρῃαι ... ἐκ νηῶν ἐλάσας ἰέναι πάλιν

Heed me ... so that you may raise up great honor and fame for me ... having driven them from the ships, come back again.

A scholion on this passage presents ancient arguments for how to understand the syntax of the sentence: does the purpose clause (“so that... for me”) act as an adverb on the verb “heed...” or as adverbial to the verb “come back”? The Greek of the scholion is dense and hard to follow, but we can express the two alternatives very clearly with two syntactic graphs (Figure 8).

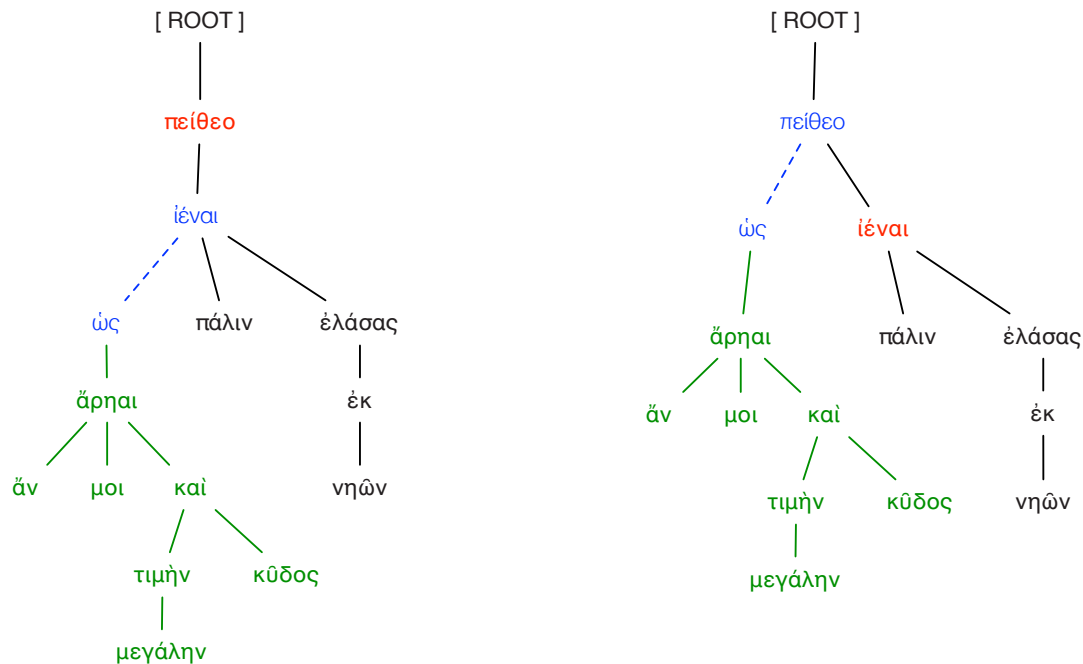


Figure 8: Two graphs of two readings, showing a relocation of a sub-graph. How can we cite these?

The ancient readers of Greek epic poetry present us with analyses, on virtually every folio of every Byzantine codex, that could best be visualized, taught from, and subjected to further automated or human analysis if the prose descriptions were made explicit as graphs. These graphs would organize the same Iliadic text in different ways. We can cite the Iliadic text with CTS URNs, and we can even cite very precisely each word-token of the text using CTS; we can likewise cite the text of the scholia. But how can we cite the graphs themselves as objects of scholarly study, concisely in a machine-actionable manner? In the example from *Iliad* 16, how can our citation practice identify the shared sub-graph (the purpose clause) whose dependency is the heart of the scholiast's comment?

4. CITE Objects and Extensions

In the CITE architecture, identifying a graph is relatively straightforward. We can create a collection of graph-objects, citing each with a URN, e.g. `urn:cite2:hmt:dseGraph.v1:1000`. This object, and all objects in this collection, might have only three or four properties: urn, label, author, and description.

But graphs are not simply collection-objects, in the sense of “objects sharing a set of properties”, since each graph will have an arbitrary number of nodes and edges. A CITE URN alone cannot allow us to cite with any granularity, individual nodes or edges, paths, or sub-graphs.

CITE URNs are limited to expressing `collection.version:object`. By design this forces us to separate concerns, even at the cost of verbosity. CITE offers two approaches to non-textual data in hierarchies deeper than `collection [+ version] + object`. The most commonly used approach is to use URNs as values in a CITE object's properties. So, for example, a “folio” object may include among its properties a “codex” property, whose value is a CITE URN identifying the volume of which the folio is a part; that codex- URN provides access to the properties of the codex.

For some types of data, we cannot express objects sufficiently in the tabular character data of a CITE collection. With images, for example, a necessary expression requires a CITE collection recording URNs and other metadata for an image, and (separately) binary image files, the images themselves. At the same time, we want to make requests specific to this kind of data, images, beyond those of the generic CITE Collection Service: `getBinaryImage`, format transformations, scaling, cropping, &c. CITE Extensions (the E in CITE) exist for this purpose. We define an extension, `cite:image`, for which we define a type-specific data source and type-specific requests.

A CITE Image Collection is a CITE collection, and can be treated as such. But the `cite:image` extension specifies that the collection have at least three properties: urn, rights, and caption (it may have others in addition). The extension further specifies an additional data file that maps image URNs to binary image files at some specified location. An Image Service is responsible for resolving URNs to images with binary image data. The URN remains a technology-independent citation, and the concern of identity is separate from that of retrieval. In addition, this extension defines a sub-reference on an image- URN that identifies a rectangular region-of-interest:

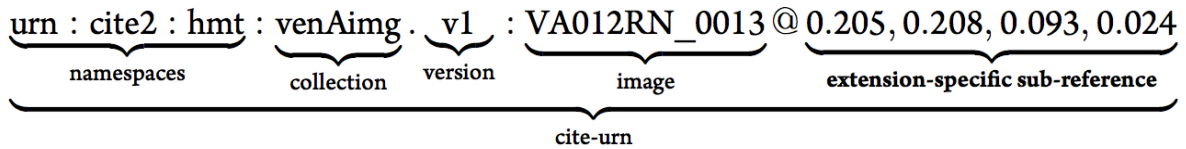


Figure 9: A CITE URN to an object in an extended collection, with a sub-reference identifying a region-of-interest on the image cited.

Following this model of CITE Extensions, to provide useful access to graphed data in CITE collections we are experimenting with a „CITE Graph Extension“, a CITE URN with a defined sub-reference for identifying parts of a graph. And we are experimenting with adding a CANONICAL GRAPH SERVICE to the *Homer Multitext*’s service architecture.

5. A Citable Graph Extension to CITE

A Graph Extension to CITE should allow us to cite graphs and parts of graphs, resolve those citations to various data formats, and do so *regardless of the kind of objects organized by the graph*, as long as the objects themselves are citable by URN.

So a prerequisite to any “citable graph” is citable data, either CITE collection-objects or CTS textual passages as nodes, and CITE objects defining relationships as the basis for edges.

What follows describes the generic implementation we are pursuing. A Graph Collection is an generic CITE collection, with at least six required properties; the values of two of those properties are themselves URNs to other CITE collections. All necessary data is thus abstracted from any particular expression or technology.

A Graph Collection consists of a CITE collection, Graphs, with these properties:

Property	Value
URN	[CITE URN] The URN identifying a graph.
Label	[String] A short human-readable label.
Description	[String] A human-readable description.
Ordered	[Boolean] Whether the objects constituting the nodes of the graph are members of an ordered collection.
Nodes	[CITE URN] A version-level URN to a collection of Node Objects
Edges	[CITE URN] A version-level URN to a collection of Edge Objects

Table 2: Properties of a Graph object in a CITE Collection.

The Nodes collection has these properties:¹¹

Property	Value
Node URN	[CITE or CTS URN] A URN identifying this Node.
Object URN	[CITE or CTS URN] A URN to a data-object organized by the graph.
Label	[String] A short label, for display.
ID	[String] A short ID, generated programmatically, identifying this node in the context of this graph. e.g. v1, v2...

Table 3: Properties of a Node object in a CITE Collection.

The Edges collections has these properties:¹²

Property	Value
Edge URN	[CITE URN] A URN identifying this Edge.
Relation URN	[CITE URN] A URN to a data-object that describes the edge’s relationship
Label	[String] A short label, for display.
Source URN	[CITE URN] A URN to a object in the Node Collection. If there is no source-node (e.g. a root-dependency) this value is the Graph’s URN
Target URN	[CITE URN] A URN to a object in the Node Collection.
ID	[String] A short ID, generated programmatically, identifying this Edge in the context of this graph. e.g. e1, e2...

Table 4: Properties of an Edge object in a CITE Collection.

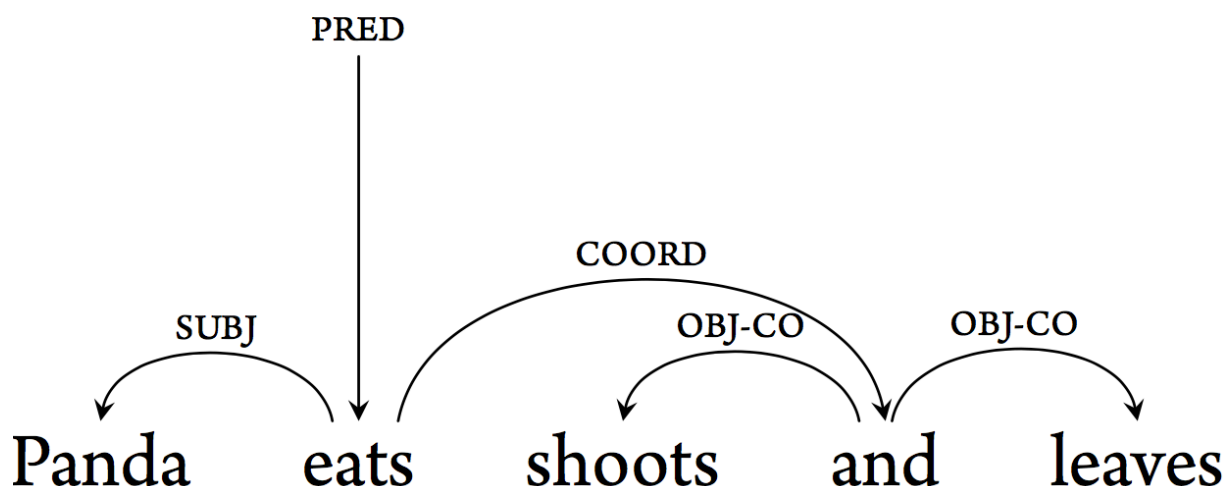


Figure 10: The Panda’s Diet: Syntactic Analysis

11 If the Nodes of a graph are members of an ordered collection, their sequence in the enumeration is significant.

12 The HMT operates on the belief that all scholarly graphs are directed graphs. Specifically, all scholarly graphs are “quivers” or “directed multidigraphs (edges with own identity)”. That is, a scholarly graph consists of a set of Nodes and a set of Edges; each Edge has an assigned source and target, and a scholarly asserted identity (the nature of the relationship between source and target); Nodes may be joined by more than one Edge.

6. Example Data

Figure 10 is a syntactic graph of a simple sentence that is famously subject to two interpretations. We can capture this graph in a CITE Graph Collection with the following data:

6.1 The Graph Object

URN:	urn:cite:demo:syntaxGraphs.v1:1
Label:	„The Panda’s Diet: Syntactic Analysis“
Description:	„A syntax graph of a sentence about a panda.“
Ordered:	true
Nodes:	urn:cite:demo:sn1.v1:
Edges:	urn:cite:demo:se1.v1:

Table 5: A single Graph object in a CITE Collection.

6.2 The Nodes Collection

Urn	ObjectUrn	Label	ID
urn:cite:demo:sn1.v1:1	urn:cts:fu:demo.panda:1.1	“Panda”	v1
urn:cite:demo:sn1.v1:2	urn:cts:fu:demo.panda:1.2	“eats”	v2
urn:cite:demo:sn1.v1:3	urn:cts:fu:demo.panda:1.3	“shoots”	v3
urn:cite:demo:sn1.v1:4	urn:cts:fu:demo.panda:1.4	“and”	v4
urn:cite:demo:sn1.v1:5	urn:cts:fu:demo.panda:1.5	“leaves”	v5

Table 6: Five Node objects in a CITE Collection.

6.3 The Edge Collection

Urn:	urn:cite:demo:se1.v1:1
Relation Urn:	urn:cite:demo:syntaxRelations.v1:PRED
Label:	„PRED“
SourceURN:	urn:cite2:demo:syntaxGraphs.1.v1
TargetURN:	urn:cts:fu:demo.panda:1.2
Index:	e1

Urn:	urn:cite:demo:se1.v1:2
Relation Urn:	urn:cite2:demo:syntaxRelations.v1:SUBJ
Label:	„SUBJ“
SourceURN:	urn:cts:fu:demo.panda:1.2
TargetURN:	urn:cts:fu:demo.panda:1.1
Index:	e2

Urn:	urn:cite:demo:se1.v1:3
Relation Urn:	urn:cite2:demo:syntaxRelations.v1:COORD
Label:	„COORD“
SourceURN:	urn:cts:fu:demo.panda:1.2
TargetURN:	urn:cts:fu:demo.panda:1.4
Index:	e3

Urn:	urn:cite:demo:se1.v1:4
Relation Urn:	urn:cite2:demo:syntaxRelations.v1:OBJ_CO
Label:	„OBJ_CO“
SourceURN:	urn:cts:fu:demo.panda:1.4
TargetURN:	urn:cts:fu:demo.panda:1.3
Index:	e4

Urn:	urn:cite:demo:se1.v1:5
Relation Urn:	urn:cite2:demo:syntaxRelations.v1:OBJ_CO
Label:	„OBJ_CO“
SourceURN:	urn:cts:fu:demo.panda:1.4
TargetURN:	urn:cts:fu:demo.panda:1.5
Index:	e5

Table 7: Five Edge objects in a CITE Collection.

6.4 Notes on this Data

The Relation URN values in the Edge collection point to objects in a CITE collection and can resolve to whatever properties are recorded for those objects. In the example above, the same “syntax-relation-object” (OBJ_CO) is attached to *two* edge-objects in the graph. The URN `urn:cite2:demo:syntaxRelations.v1:OBJ_CO` might resolve to a collection-object with properties containing a short description, and URNs to further documentation.¹³

¹³ Such as the excellent, cross-referenced documentation under development by Giuseppe Celano at the University of Leipzig: https://github.com/PerseusDL/treebank_data.

Likewise, while in this case each node-object’s data is textual, and identified by a CTS URN, there is no requirement that it be. Syntactic ellipsis (the omission of words) might be indicated by a CITE URN pointing to an “ellipsis” object in a collection of syntactic elements.¹⁴

For display to human readers, we can use the label value for nodes and edges; for automated processing, we can use the Relation URN values. For citation of parts of the graph, we can use their Index values as a sub-reference to the graph’s URN.

The graph is citable as itself. Its individual nodes and edges are uniquely identified both as the data being organized (words, syntactic relations) and as member of this graph.

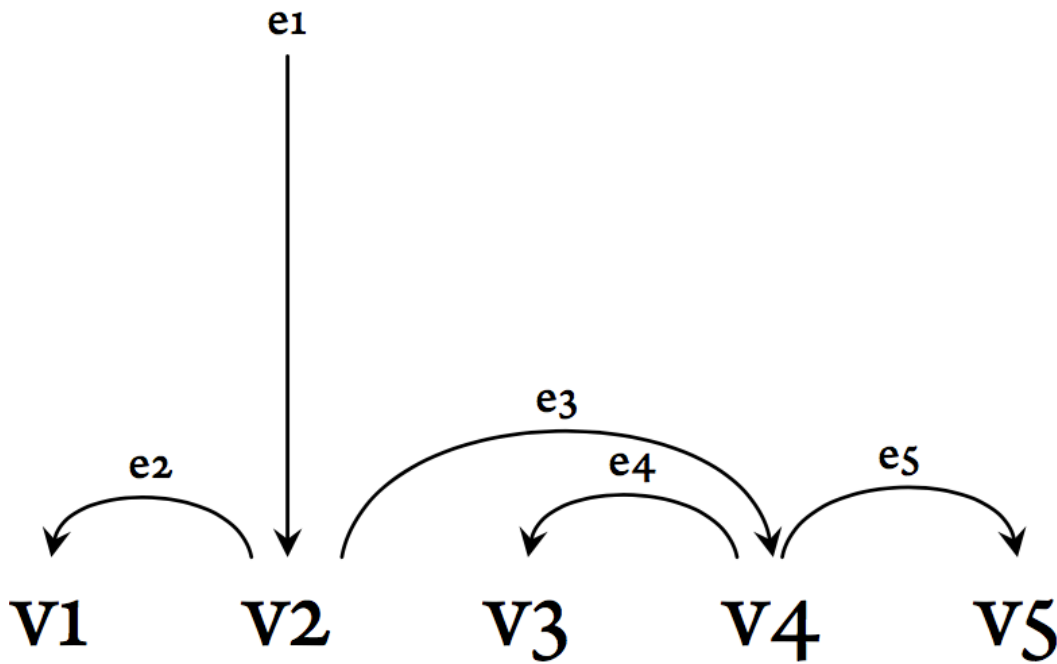


Figure 11: The Panda’s Diet: a generic graph with concerns separated.

7. Citing a Graph

The data above is how a graph like this would be recorded. Our CITE Manager utility would process that into (in the HMT’s implementation) data-objects defined by classes in the Scala language.¹⁵

A URN parameter of `urn:cite2:demo:syntaxGraphs.v1:1` returns an expression of the data, as above, in any of several formats: JSON, XML, &c.

¹⁴ This is another benefit to separating the concerns of objects of study, from graphs organizing those objects of study. A text has a sequence, but a syntactic analysis might have its own sequence, with extra-textual data inserted into the sequence of text-tokens.

¹⁵ [The Scala Programming Language](#). Scala has many benefits for work such as this, which we expect to generate a very large body of data to be processed. There is a well-supported library for working with graphed data in Scala, [scalax.collection.graph](#). Our CGS is a body of utilities for processing data, and an API mediating between the CITE architecture and *ScalaGraph*.

A sub-reference on the URN identifies individual edges or nodes. `urn:cite2:demo:syntaxGraphs.v1:1@v1` identifies the Node whose ID value is `v1` in the Graph's definition. Multiple nodes or edges can be identified by comma separated indices: e.g. `urn:cite2:demo:syntaxGraphs.v1:1@e1,v3`.

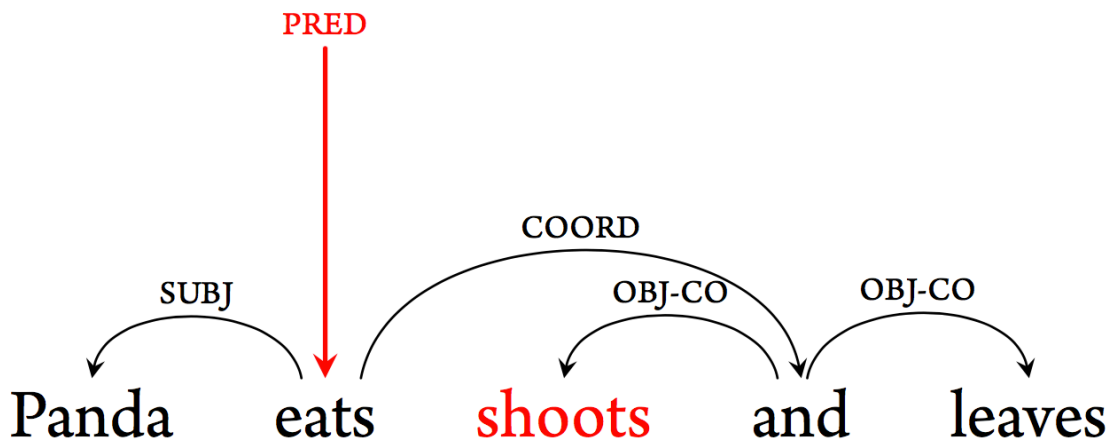


Figure 12: Citing a two objects in a graph: `urn:cite2:demo:syntaxGraphs.v1:1@e1,v3`

A range-notation in the sub-reference identifies a path in the graph; if the path identified in the URN is not valid for the graph, then the citation is a bad citation, like asking for Book 300 of the *Iliad*.

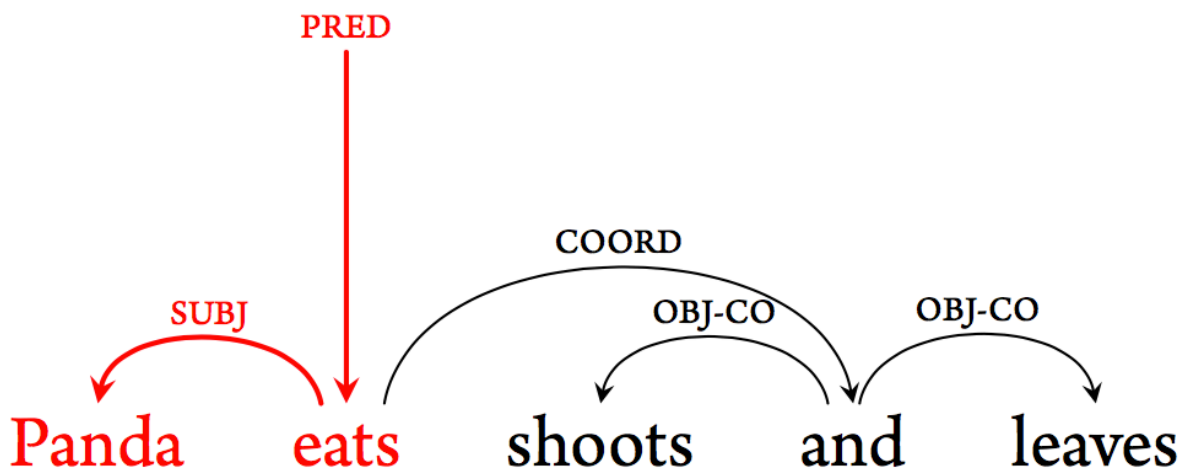


Figure 13: Citing a path between objects in a graph: `urn:cite2:demo:syntaxGraphs.v1:1@e1-v1`

8. Resolving Graph URNs

All work on graphed data in the HMT remains very experimental. Plans for 2017 are to implement a Graph Service that can resolve graph URNs in several ways: as JSON or XML data-structures, with the option to further transform those into d3 visualizations, .dot files, or LaTeX fragments.

9. Requests of a Graph Service

We plan initially to implement the following requests in a CITE Graph Service:

- `GetGraph [&urn=...]`. Given a URN parameter, return the graph; optional `&format=` parameters with possible values of “xml” or “json”. Nodes and Edges identified in any sub-reference on the URN would be identified as selected in the response.
- `FindInGraphs [&urn=...]`. Given a CITE URN or CTS URN parameter, return the URNs of all graphs for which the parameter URN is a data-value on a Node or an Edge.
- `isCyclic [&urn=...]`. Returns a boolean value; useful for deciding what sort of visualizations might be most appropriate.
- `ResolvePath [&urn=URN+SUBREF]`. Given a URN to a graph-object with an `@` delimited sub-reference to a path—*e.g.* `urn:cite2:demo:syntaxGraphs.v1:1@e1-v1` from Figure—returns a URN with the range-reference resolved to a comma-separated list of nodes and edges representing the shortest path.

The question of resolving paths in a graph highlights the particular challenges of humanist computing. For network analysis or GIS applications, a “path,” defined by a starting object and ending object, may be assumed to be defining the *shortest* sequence of nodes and edges between those points. Humanists are more likely to want to see *all* valid paths, and might want to take advantage of the OHCO2 text model in defining starting and ending points of a path. For example, assume a graph of (a) lines of the *Iliad*, (b) comments on those lines, and (c) Iliadic lines cited in comments. A scholar might reasonably ask for “all paths from lines in *Iliad* Book 2 (the catalogue of ships) to any line in *Iliad* Book 15 (when the Trojans are burning the ships).”

How properly to resolve the URN `urn:cite2:demo:syntaxGraphs.v1:1@e1-v1`? A principle of the CITE architecture has always been “you get what you ask for.” A graph URN with a range subreference identifies a range. A Graph Service can resolve that range to an explicit list of nodes and edges—*e.g.* `urn:cite2:demo:syntaxGraphs.v1:1@e1,v2,e2,v1`—using well-established algorithms for finding the shortest path in a graph.¹⁶ To identify all possible paths, a scholar could define a series of URNs explicitly identifying nodes and edges in a subreference. How that scholar might identify all possible paths between two objects in a graph is a separate concern.¹⁷ We are concerned with identification and retrieval of scholarly objects of study, whether they are identified, or created, computationally or through human insight and intuition.

Our experience with CTS and CITE suggest that as we work with data in a Graph Service, other requests will suggest themselves. In the case of CTS, for example, requests like “`GetFirstRef`” proved useful by pushing back onto the server methods that are possible, but inconvenient or inefficient, for client-side applications.

10. Further capabilities

In the examples from the Iliadic commentary on the Venetus A manuscript, described above, the ancient commentators offered competing interpretations of syntax. Those analyses, expressed as graphs, different in more or less subtle ways. A Graph Service, having access to

¹⁶ See, for example, Fuhao & Jiping (2009); Noto & Satou (2000).

¹⁷ It may be impossible to isolate all possible paths between two objects in a graph algorithmically, since this problem is “NP-Hard”. See Knuth (1974).

the objects organized as nodes in two graphs identified by CITE URNs, could recognize them as conflicting analyses of a single set of tokens. A CompareGraphs request, with two URNs as parameters, could return generic JSON or XML reply attaching two sets of edges to a single set of “unified nodes”, a set of pairs of graph-node URNs that share the same Relation Urn as described above.

For example, the demonstration sentence above is subject to two interpretations: either the Panda eats two things (shoots and leaves), or the Panda does three things: eats, shoots, and leaves. If each of those syntactic analyses were citable by a Graph URN, the request request=compareGraphs with the parameters urn1=urn:cite:demo:syntaxGraphs.v1:1 and urn2=urn:cite:demo:syntaxGraphs.v1:2 could return a generic data structure that could be visualized as in Figure 14.

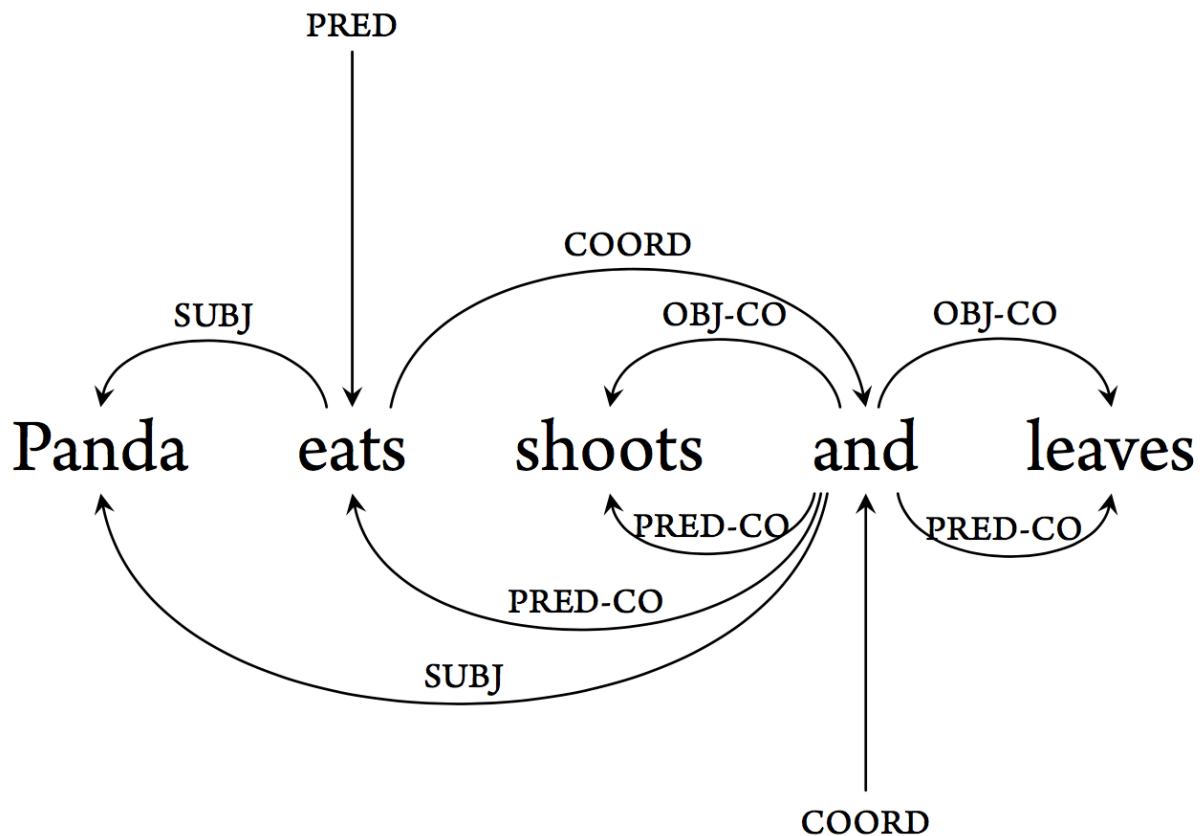


Figure 14: The Panda’s diet [top], or a panda crime-spree [bottom]? An example of overlaying two graphs of the same tokens.

11. Final Notes

The CITE Graph Service will not solve, or even address, any problems of Graph Theory. Things that are computationally expensive or impossible with graphs will remain so: minimum spanning tree, longest path, subgraph isomorphism, maximum clique, &c. (Unfortunately, many of the most desirable operations, for linguists, on collections of graphs fall into this category of “NP-Complete” problems.) But we hope that this extension to the CITE Architecture will let us work with graphed data as scholars have worked with textual data for millennia, using canonical citation for citation and reproduction of objects of scholarly interest, maintaining context, independent of any particular technology. Just as canonical citation of texts allows

integration of textual evidence regardless of language, translation language, or technology, canonical citation of graphed data might serve to help integrate analytical projects. And while scholars in quantitative fields often develop skills in creating and visualizing graphed data with technologies like TikZ for or [the d3 library](#) for web-based visualization, those technologies have very steep learning curves; a generic Graph Service, by separating concerns, might make creation, publication, and analysis of graphed data more accessible to a wider research community.

Immediate uses for a Graph Service would to capture syntax and DSE relationships, particularly among scholia on different manuscripts that reproduce the same ancient sources or seem to cross-reference ancient sources. Other kinds of semantic graphs, such as “tectogrammatic” graphs¹⁸, would be valuable additions, especially as they might analyze alternate readings (“multiforms”) of the poetic text preserved in the scholia.

In parallel to work on a service architecture for graphs, some attention will have to be paid to user-friendly interfaces for capturing URN-citable data, related by URN-citable relationships, in formats friendly to this service. The work of *Perseids*, particularly the modular [Arethusa](#) web-application, will be a valuable starting point.¹⁹

12. Abbreviations

CITE	Collections, Indices, Texts, Extensions. The digital library architecture developed for the HMT.
CTS	Canonical Text Services. A part of CITE.
HMT	Homer Multitext.
JSON	Javascript Object Notation.
OHCO2	Ordered Hierarchy of Citation Objects. An abstract model of “text”.
URN	Universal Resource Name.
XML	Extensible Markups Language.

18 F. Mambriani, “Thucydides 1.89-1.118: A Multi-layer Treebank,” *CHS Research Bulletin*, vol. 1, no. 2, 2013.

19 <http://www.perseids.org>.

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14. Appendix: Ancient Homeric Analyses

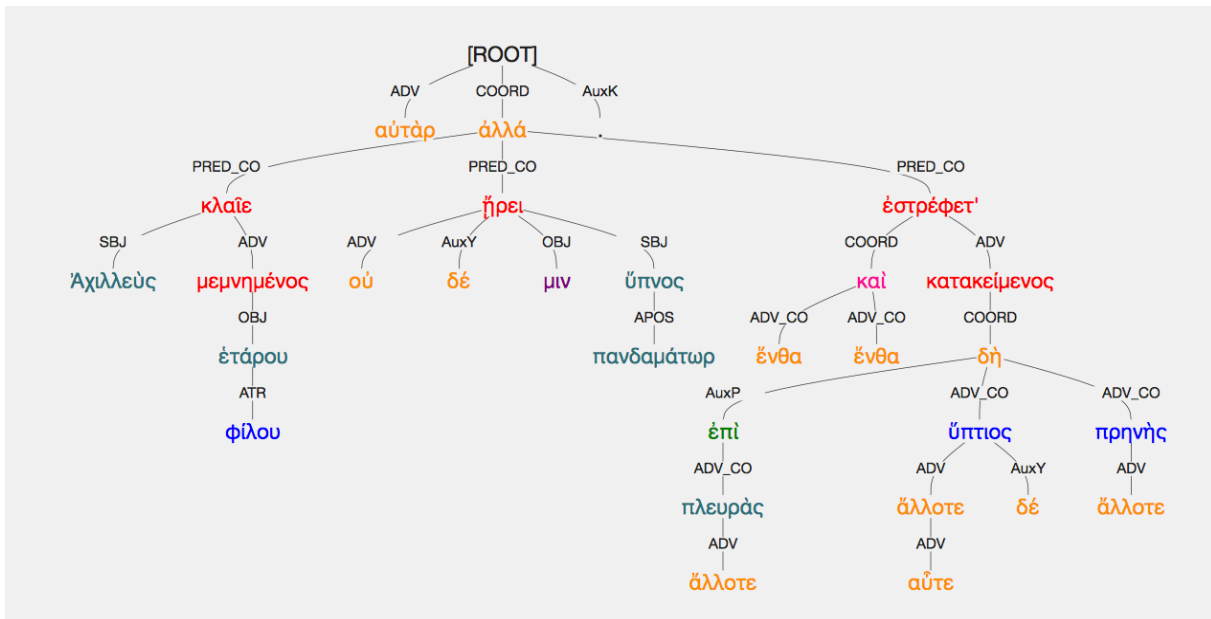


Figure 15: A treebank of *Iliad* 24.3–24.11, reading the text while omitting the lines Aristarchus athetized.

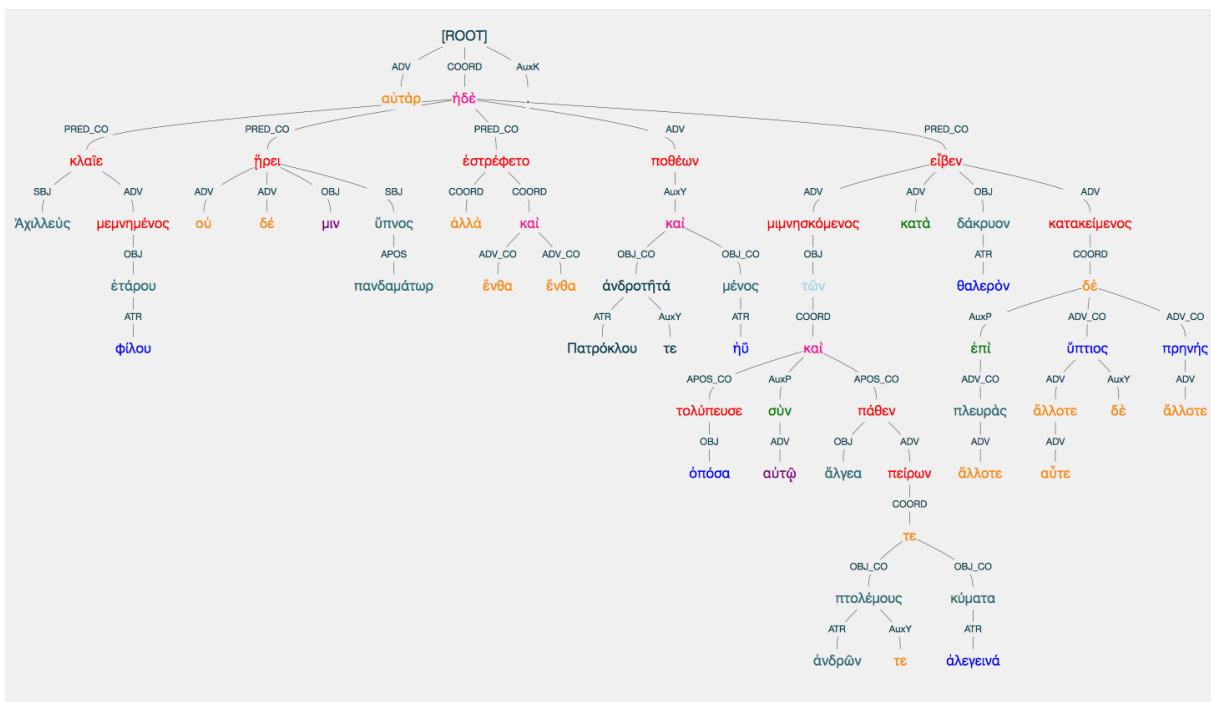


Figure 16: A treebank of *Iliad* 24.3–24.11, reading the text while including the lines Aristarchus athetized, but not following Nicanor's punctuation.

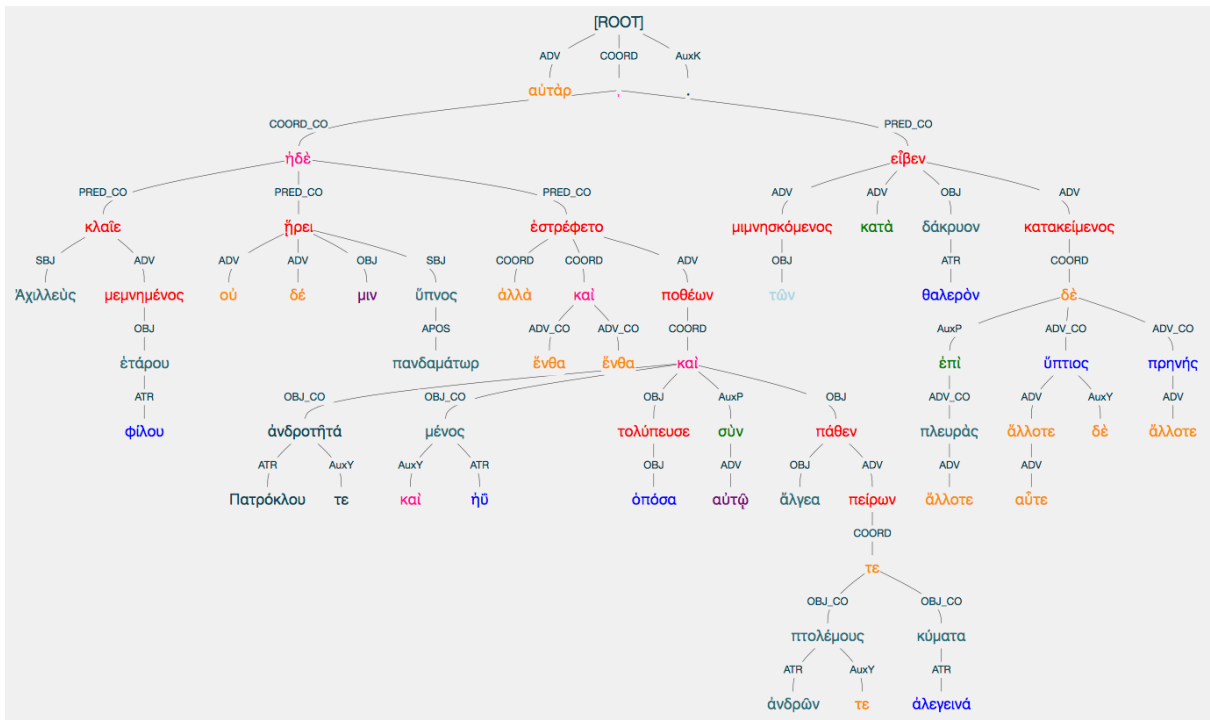


Figure 17: A treebank of *Iliad* 24.3–24.11, reading the text while including the lines Aristarchus athetized, and following Nicanor’s punctuation. This is the reading the scholiast prefers, if we do not accept the athetization.

15. Autorenkontakt²⁰

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Paraphrasensuche mittels word2vec und der Word Mover's Distance im Altgriechischen

Marcus Pöckelmann, Jörg Ritter, Eva Wöckener-Gade, Charlotte Schubert

Abstract: To find receptions of Plato's work within the ancient Greek literature, automatic methods would be a useful assistance. Unfortunately, such methods are often knowledge-based and thus restricted to extensively annotated texts, which are not available to a sufficient extent for ancient Greek. In this article, we describe an approach that is based on the distributional hypotheses instead, to overcome the problem of missing annotations. This approach uses word2vec and the related Word Mover's Distance to determine phrases with similar meaning. Despite its experimental state, the method produces some meaningful results as shown in three examples.

1. Einleitung

Neben dem Zitieren ist das Paraphrasieren einer Aussage für Autoren ein grundlegendes Mittel zur Überlieferung und Weiterentwicklung von Ideen. Um diese Prozesse (literatur-)historisch nachvollziehen zu können, ist es unerlässlich, solche Paraphrasen in großen Textkorpora aufzufinden. Vielfältige Ansätze computergestützter Verfahren helfen seit längerem bei dieser Aufgabe und erreichen für moderne Sprachen beachtliche Erkennungsraten. Sie basieren dabei häufig auf langjährigen Vorarbeiten zur Sprache, wie umfangreichen Wörterbüchern und computerlinguistischen Werkzeugen zur Lemmatisierung, Wortarterkennung sowie semantischer und syntaktischer Analyse von Texten.¹ Im Fall des Altgriechischen liegen solche Werkzeuge bisher nicht im erforderlichen Umfang vor,² sodass eine Adaption darauf basierender Verfahren zur Paraphrasensuche nicht oder nur mit schlechteren Erkennungsraten möglich ist. Eine Ausnahme bilden Verfahren auf Basis der distributionellen Hypothese,³ nach der Wörter, die in einem ähnlichen Kontext genutzt werden, tendenziell auch eine ähnliche Bedeutung haben. Auf Grundlage dieser Beobachtung kann semantisches Wissen zu einer Sprache allein aus einer großen Textmenge gewonnen und eine Paraphrasensuche ohne umfangreiche Vorarbeiten realisiert werden. Das folgende Experiment basiert im Kern auf der distributionellen Hypothese und ist im Rahmen des von der VolkswagenStiftung innerhalb der Programmlinie „Offen für Außergewöhnliches“ geförderten Projektes Digital Plato⁴ angesiedelt, welches sich der Untersuchung der Rezeption und Nachwirkung des platonischen Werkes in der griechischen Literatur bis zur Spätantike widmet. Bei der getesteten Methode

1 Androutsopoulos und Malakasiotis (2010).

2 Dik und Whaling (2008).

3 Harris (1954).

4 Weitere Informationen zum Projekt finden sich unter: <https://digital-plato.org>.

werden mit Hilfe der Word Mover's Distance,⁵ die auf dem word2vec-Verfahren⁶ aufbaut, alle Textstellen eines ausgewählten Werkes mit der zu suchenden Passage verglichen und die ähnlichsten Treffer ausgegeben. Obwohl bisher noch im Experimentierstadium, zeigt die vorgestellte Methode bereits sinnvolle Ergebnisse, die hier kurz vorgestellt werden sollen.

2. Daten und Methoden

2.1 Textkorpus

Der dem Experiment zu Grunde liegende Textbestand umfasst das Gesamtwerk der griechischen Literatur bis zur Spätantike nach dem *Thesaurus Linguae Graecae* (TLG),⁷ der Platons Werke in der Edition von J. Burnet beinhaltet.⁸

2.2 Methode zur Paraphrasensuche

Bei der Methode zur Paraphrasensuche handelt es sich um einen einfachen Brute-Force-Ansatz, d.h. dem Überprüfen aller in Frage kommenden Lösungen. Ausgehend von einer Wortgruppe aus einem Werk Platons sollen ähnliche Textstellen in einem Vergleichstext gefunden werden. Zunächst werden dazu die beiden Texte normalisiert und die Länge der eingegebenen Wortgruppe von Platon bestimmt. Für die Normalisierung wurden die vorkommenden Zeichen in der Normalform NFKD kodiert, alle nicht-griechischen Zeichen sowie Diakritika entfernt und das Wortendsigma „ς“ durch „σ“ sowie Großbuchstaben durch Kleinbuchstaben ersetzt. Darüber hinaus wurden die Stoppwörter entsprechend einer im Projekt erstellten Liste entfernt. Im zweiten Schritt der Paraphrasensuche werden nun alle Textstellen ähnlicher Länge im Vergleichstext durchlaufen und jeweils die Word Mover's Distance zwischen der Textstelle und der Wortgruppe bei Platon ermittelt. Die Methode gibt die 100 Textstellen mit der niedrigsten Distanz als Ergebnis aus, wobei bei Überlappungen nur der beste Treffer gewählt wird. Auf Grund des einfachen Ansatzes, der alle Textstellen direkt auf ihre Distanz überprüft, ergibt sich ein immenser Berechnungsaufwand und damit eine lange Laufzeit, sodass das Verfahren in dieser Form nur für einen bzw. wenige Vergleichstexte geeignet ist.

Die eingesetzte Word Mover's Distance wurde 2015 von Kusner et al. definiert und ist ein Distanzmaß zwischen zwei Wortgruppen auf der Basis von Wortvektoren. Sie beschreibt die minimalen „Umzugskosten“, um die Wörter der ersten Wortgruppe in die zweite zu überführen. Die Wortvektoren wurden, wie von Kusner et al. vorgeschlagen, mit Hilfe von word2vec bestimmt.

5 Kusner et al. (2015).

6 Mikolov (2013).

7 Der Textbestand basiert auf dem TLG-E.

8 Platonis Opera, Oxford 1900–1907, zahlreiche Neuauflagen und Nachdrucke.

Bei word2vec handelt es sich um ein 2013 von Tomas Mikolov et al. entwickeltes Verfahren zum Einbetten der Wörter eines Textkorpus in einen hochdimensionalen Raum, d.h. jedem Wort wird ein es charakterisierender Merkmalsvektor zugewiesen. Diese Einbettung erlaubt die Anwendung von mathematischen Operationen und Distanzmaßen, wie desjenigen der Word Mover's Distance, auf die Wörter bzw. ihre Wortvektoren. Im Rahmen des Experiments wurde mit gensim⁹ eine bestehende Implementierung des Verfahrens in Python genutzt. Als Eingabekorpus für das Training der Wortvektoren wurde dabei das o.g. Gesamtkorpus der griechischen Literatur verwendet. Es wurde zuvor nach den bereits genannten Kriterien normalisiert (Stoppwörter wurden beibehalten). Abgesehen davon fand das Training nach den Standardeinstellungen von gensim statt, d.h. insbesondere die Nutzung des CBOW-Verfahrens¹⁰ mit einer Fenstergröße von 5, Merkmalsvektoren mit 100 Dimensionen und einer Mindestanzahl von 5 Belegstellen für die Aufnahme eines Wortes in den Vektorraum.

Zur Nutzung der beschriebenen Methode wurde eine grafische Oberfläche geschaffen. Diese zeigt beim Auflisten der 100 besten Treffer neben der Distanz, der Fundstelle und den normalisierten Texten auch den Kontext der jeweiligen Textstelle im Vergleichstext an und verlinkt sie mit einer Volltextrepräsentation (siehe Abbildung 1).

Paraphrasensuche

Bestimmt die Ähnlichkeit zwischen dem gegebenen Text und allen Textstellen selber Länge in allen Werken entsprechend des TLG-Schlüssels und listet anschließend die besten Treffer auf. TLG-Schlüssel sind bspw. 2000-001 für Plotinus Enneades oder 0059 für alle Werke Platons (rechenintensiv). Der als Zeichenkette oder via CTS-URN übergebene Text wird für den Vergleich normalisiert (Stoppwörter und Diakritika werden entfernt, "c" wird mit "o" ersetzt und Großbuchstaben durch kleine ersetzt). Zur Bestimmung der Ähnlichkeit stehen drei unterschiedliche Distanzmaße zur Auswahl.

Text/CTS	τῷ μὲν θεῷ καὶ ἀθανάτῳ καὶ νοητῷ καὶ μονοειδεὶ καὶ ἀδιαλύτῳ καὶ
TLG-Key	2018-001

- via Word Mover's Distance (WMD)
- via Cosine Similarity
- via Levenshtein-Distanz

Word Mover's Distance: Werte zwischen 0 und 1 mit einem Wert von 0 für identische Textstellen. Berechnet die minimalen "Umzugskosten" um die Wörter der ersten Textstelle zur zweiten zu überführen. Als Grundlage dient Word2Vec.

	original:		normalisiert:
Text	τῷ μὲν θεῷ καὶ ἀθανάτῳ καὶ νοητῷ καὶ μονοειδεὶ καὶ ἀδιαλύτῳ καὶ αἰεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχῇ		θεῶν ἀθανάτων νοητῶν μονοειδεὶ ἀδιαλυτῶν αἰεὶ ὡσαυτῶν ἔχοντι ἑαυτῶν ὁμοιωτάτων ψυχῆν
TLG-Key	2018-001		Praeparatio evangelica

Nr.	Distanz	TLG-Key	Fundstelle	original
1	0.01250770920755872	2018-001	2018 001 Praep Evang 11 27 13 Zeile 3-5 urn:cts:ppd:tlg2018.tlg001:000:11_27_13.3@[12]-11_27_13.5@[5]	δε σῶμα τῷ θνητῷ. Σκόπει δὴ, ἔφη, ὁ Κέρβης, εἰ ἐκ πάντων τῶν εἰρημένων τάδε ἡμῖν ζυμβαίνει· τῷ μὲν θεῷ καὶ ἀθανάτῳ καὶ νοητῷ καὶ μονοειδεὶ καὶ ἀδιαλύτῳ καὶ αἰεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχῆν, τῷ δὲ ἀνθρωπίνῳ καὶ θνητῷ καὶ ἀνοήτῳ καὶ πολυειδεὶ καὶ διαλυτῷ καὶ μηδέποτε κατὰ ταῦτα ἔχοντι ἑα
2	0.12351479710922993	2018-001	2018 001 Praep Evang 11 27 13 Zeile 5-1 urn:cts:ppd:tlg2018.tlg001:000:11_27_13.5@[8]-11_27_14.1@[6]	φ καὶ μονοειδεὶ καὶ ἀδιαλύτῳ καὶ αἰεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχῆν, τῷ δὲ ἀνθρωπίνῳ καὶ θνητῷ καὶ ἀνοήτῳ καὶ πολυειδεὶ καὶ διαλυτῷ καὶ μηδέποτε κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι τὸ σῶμα. ἔχομεν τι παρὰ ταῦτα ἄλλο λέγειν, ὃ φιλεῖ Κέρβης, ὡς οἷχ οἴτως ἔχει· Οἷκ ἔχομεν. Τί οὖν, τούτων οὕτως ἔχοντι
3	0.13230953618399474	2018-001	2018 001 Praep Evang 15 22 32 Zeile 2-4 urn:cts:ppd:tlg2018.tlg001:000:15_22_32.2@[5]-15_22_32.4@[3]	κάν δι' ἑνὸς παικίλου, οἷον πρόσωπον. οὐ γὰρ ἄλλο μὲν μῖνος, ἄλλο δὲ ὀφθαλμοῦ, ἄλλο ταιῶν ὁμοίω πάντων. καὶ εἰ τὸ μὲν δι' ὁμμάτων, τὸ δὲ δι' ἄκοης, ἐν τῷ δεῖ εἶναι εἰς ὃ ἄμφω· ἢ πῶς ἂν εἴποι ὅτι ἕτερα ταῦτα, μὴ εἰς τὸ αὐτὸ ὁμοίω τῶν αἰσθημάτων ἐλθόντων; δεῖ τοίνυν ταῦτα ὡςπερ κέντρον εἶναι, γραμμῆς δὲ συμβαλλούσας ἐκ περιφερείας κύκλου τὸς πανταχῶθε
4	0.13312146012298973	2018-001	2018 001 Praep Evang 11 27 11 Zeile 5-1 urn:cts:ppd:tlg2018.tlg001:000:11_27_11.5@[4]-11_12.1@[15]	ς ἂν ἔμοιγε δοκεῖ, ἢ δ' ὅς, συγχωρήσαι, ὃ Σώκρατες, ἐκ ταύτης τῆς μεθόδου καὶ ὁ δυσμαθέστατος, ὅτι ἄλλο καὶ παντὶ ὁμοιότερόν ἐστιν ψυχῇ τῷ αἰεὶ ὡσαύτως ἔχοντι μάλλον ἢ τῷ μῆ. Τί δὲ τὸ σῶμα; τῷ ἑτέρῳ. Ὅρα δὴ καὶ τῆδε· ὅτι ἐπειδὴ ἐν τῷ αὐτῷ ὄσι ψυχῇ καὶ σῶμα, τῷ μὲν δουλεύειν καὶ ἄρχεσθαι ἢ φύσις προστατῆται, τῆ δ

Abb. 1: Screenshot der grafischen Benutzeroberfläche zur hier vorgestellten Paraphrasensuche

⁹ Řehůřek und Sojka (2010).

¹⁰ Beim CBOW-Verfahren wird das System darauf trainiert, ein Wort ausgehend von seinem Kontext vorherzusagen.


Pöckelmann, Ritter, Wöckener-Gade, Schubert: Paraphrasensuche mittels word2vec und der Word Mover's Distance im Altgriechischen 26
DCO 3,3 (2017)

2.3 Texteingaben

Im Rahmen des Experiments wurde geprüft, ob der oben vorgestellte Ansatz Textpassagen auffindet, die in einem erkennbaren Bezug zu der jeweiligen Wortgruppe aus einem Werk Platons stehen. Bei den genutzten Ausgangstexten handelt es sich um eine Passage aus Platons *Phaidon* und zwei Passagen aus Platons *Politeia*. Als Vergleichstexte wurden die *Praeparatio Evangelica* des Eusebius für die Textpassage aus dem *Phaidon* und die *Stromateis* des Clemens sowie Plutarchs *De cupiditate divitiarum* für die Passagen aus der *Politeia* gewählt.

2.3.1 Platon, *Phaidon* 80b1–3

Aus Platons Werk *Phaidon* ist die Textpassage τῷ μὲν θεῷ καὶ ἀθανάτῳ καὶ νοητῷ καὶ μονοειδεῖ καὶ ἀδιαλύτῳ καὶ ἀεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχὴ (Plat. Phaid. 80b1–3) als Testtextstück ausgewählt worden, da hier in einer für Platon charakteristischen Weise die Gegenüberstellung von Körper und Seele beschrieben wird. Der Satz lautet im Ganzen (Plat. Phaid. 80a10–b5): Σκόπει δὴ, ἔφη, ὦ Κέβης, εἰ ἐκ πάντων τῶν εἰρημένων τάδε ἡμῖν συμβαίνει, τῷ μὲν θεῷ καὶ ἀθανάτῳ καὶ νοητῷ καὶ μονοειδεῖ καὶ ἀδιαλύτῳ καὶ ἀεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχὴ, τῷ δὲ ἀνθρωπίνῳ καὶ θνητῷ καὶ πολυειδεῖ καὶ ἀνοήτῳ καὶ διαλυτῷ καὶ μηδέποτε κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον αὐτὸ εἶναι σῶμα.¹¹ In die Paraphrasensuche ist jedoch nur die genannte Textpassage *Phaidon* 80b1–3 eingegeben worden, um für den Test ein möglichst großes Suchspektrum zu ermöglichen. Als Vergleichswerk, innerhalb dessen die Paraphrasensuche durchgeführt wurde, ist die *Praeparatio Evangelica* des Eusebius gewählt worden. Eusebius, ein christlicher Gelehrter und Bischof von Caesarea, lebte von ca. 260–339/340 n. Chr. und hatte in Caesarea eine beachtliche Bibliothek zu seiner Verfügung, die es ihm ermöglichte, Werke der antiken Philosophen ausgiebig zu verwenden. Seine Arbeitsweise zeichnet sich dadurch aus, daß er ganze Passagen aus den von ihm verwendeten Werken zitiert. In der *Praeparatio Evangelica* (Vorbereitung auf das Evangelium, eine Apologie des Christentums) sind dies vor allem Passagen aus Platon, aber auch aus u.a. Diodor, Plutarch, Xenophon, Porphyrius, Plotin.

Text/CTS	τῷ μὲν θεῷ καὶ ἀθανάτῳ καὶ νοητῷ καὶ μονοειδεῖ καὶ ἀδιαλύτῳ καὶ ἀεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχὴ		<input checked="" type="radio"/> via Word Mover's Distance (WMD)
TLG-Key	2018-001		<input type="radio"/> via Cosine Similarity
			<input type="radio"/> via Levenshtein-Distanz

Word Mover's Distance: Werte zwischen 0 und 1 mit einem Wert von 0 für identische Textstellen.

Berechnet die minimalen "Umzugskosten" um die Wörter der ersten Textstelle zur zweiten zu überführen. Als Grundlage dient Word2Vec.

	original:
Text	τῷ μὲν θεῷ καὶ ἀθανάτῳ καὶ νοητῷ καὶ μονοειδεῖ καὶ ἀδιαλύτῳ καὶ ἀεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχὴ
TLG-Key	2018-001
Key	


Abb. 2: Eingabemaske der Paraphrasensuche für Platon, *Phaidon* 80b1–3 und den Vergleichstext *Praeparatio Evangelica* von Eusebius (TLG Nr. 2018–001)

¹¹ Übersetzung Schleiermacher: Sieh nun zu, sprach er, o Kebes, ob aus allem gesagten uns dieses hervorgeht, daß dem göttlichen, unsterblichen, vernünftigen, eingestaltigen, unauflöslchen, und immer einerlei und sich selbst gleich verhaltenden am ähnlichsten ist die Seele, dem menschlichen, und sterblichen und unvernünftigen und vielgestaltigen und auflöslchen und nie einerlei und sich selbst gleichbleibenden diesem wiederum der Leib am ähnlichsten ist?

2.3.2 Platon, *Politeia* 521c5–8

Für das zweite Beispiel ist eine Textpassage aus Platons *Politeia* ausgewählt worden, in der es um die ‚Umlenkung der Seele‘ durch die wahre Philosophie geht. Als Vergleichswerk dienen hier die *Stromateis* (‘Teppiche’) des Clemens von Alexandria (150–215 n. Chr.), da auch dieses Werk eines christlichen Autors ein bekannter Fall von Zitatensammlungen, darunter auch viele aus Platons Schriften, ist.

Die Textpassage Platon *Politeia* 521c5–8, in der es um die Bildung (Ausbildung) der Philosophen geht, ist diesmal als ganzer Satz in die Suchmaske eingegeben worden: τοῦτο δέ, ὡς ἔοικεν, οὐκ ὀστράκου ἂν εἶη περιστροφή, ἀλλὰ ψυχῆς περιαγωγή, ἐκ νυκτερινῆς τινοῦς ἡμέρας εἰς ἀληθινὴν τοῦ ὄντος οὕσαν ἐπάνοδον, ἣν δὴ φιλοσοφίαν ἀληθῆ φήσομεν εἶναι.¹²

Text/CTS	τοῦτο δέ, ὡς ἔοικεν, οὐκ ὀστράκου ἂν εἶη περιστροφή, ἀλλὰ ψυχῆς		<input checked="" type="radio"/> via Word Mover's Distance (WMD)
TLG-Key	0555-004		<input type="radio"/> via Cosine Similarity <input type="radio"/> via Levenshtein-Distanz

Word Mover's Distance: Werte zwischen 0 und 1 mit einem Wert von 0 für identische Textstellen. Berechnet die minimalen "Umzugskosten" um die Wörter der ersten Textstelle zur zweiten zu überführen. Als Grundlage dient Word2Vec.

	original:
Text	τοῦτο δέ, ὡς ἔοικεν, οὐκ ὀστράκου ἂν εἶη περιστροφή, ἀλλὰ ψυχῆς περιαγωγή, ἐκ νυκτερινῆς τινοῦς ἡμέρας εἰς ἀληθινὴν τοῦ ὄντος οὕσαν ἐπάνοδον, ἣν δὴ φιλοσοφίαν ἀληθῆ φήσομεν εἶναι.
TLG-Key	0555-004

Abb. 3: Paraphrasensuchmaske mit Platon, *Politeia* 521c und dem Vergleichstext Clemens, *Stromateis* (TLG-Nr. 0555–004) als Eingabe

2.3.3 Platon, *Politeia* 329b6–c4

Das dritte Beispiel entstammt einer Sammlung bereits bekannter Paraphrasen. Als Ausgangstext fungiert ebenfalls eine Textstelle aus Platons *Politeia*, in der eine Anekdote über den Tragödiendichter Sophokles wiedergegeben wird: καὶ δὴ καὶ Σοφοκλεῖ ποτε τῷ ποιητῇ παρεγενόμενῃ ἐρωτώμενῳ ὑπό τινοσ: ‘πῶς,’ ἔφη, ‘ὦ Σοφόκλεις, ἔχεις πρὸς τὰ φροδίσια; ἔτι οἷός τε εἶ γυναικὶ συγγίγνεσθαι;’ καὶ ὅς, ‘εὐφήμει,’ ἔφη, ‘ὦ ἄνθρωπε: ἀσμενέστατα μέντοι αὐτὸ ἀπέφυγον, ὥσπερ λυττῶντά τινα καὶ ἄγριον δεσπότην ἀποδράς.’¹³ Sophokles tut hier seine Freude darüber kund, im Alter von der Libido befreit zu sein und vergleicht sich mit einem Sklaven, der einem choleralischen Herrn entkommen ist. Von der nachfolgenden Literatur wurde diese Anekdote in teils recht enger sprachlicher Anlehnung an Platon aufgegriffen, so auch von Plutarch in seiner Abhandlung *De cupiditate divitiarum* (‘Von der Liebe zum Reichtum’), die hier als Vergleichstext dient.

12 Übersetzung Schleiermacher: „Das ist nun freilich, scheint es, nicht wie sich eine Scherbe umwendet, sondern es ist eine Umlenkung der Seele, welche aus einem gleichsam nächtlichen Tage zu dem wahren Tage des Seienden jene Auffahrt antritt, welche wir eben die wahre Philosophie nennen wollen.“

13 Übersetzung Teuffel: „Namentlich war ich einmal dabei, wie jemand an den Dichter Sophokles die Frage richtete: »Wie sieht's bei dir aus, Sophokles, mit der Liebe? Vermagst du noch einem Weibe beizuwohnen?« Der antwortete: »Nimm deine Zunge in acht, Mensch; bin ich doch herzlich froh, daß ich davon erlöst bin, wie ein Sklave, der von einem obsüchtigen und wilden Herrn erlöst worden ist!«“

Text/CTS	καὶ δὴ καὶ Σοφοκλεῖ ποτε τῷ ποιητῇ παρεγενόμην ἐρωτώμενον ὑπὸ
TLG-Key	0007-103



- via Word Mover's Distance (WMD)
- via Cosine Similarity
- via Levenshtein-Distanz

Word Mover's Distance: Werte zwischen 0 und 1 mit einem Wert von 0 für identische Textstellen.

Berechnet die minimalen "Umzugskosten" um die Wörter der ersten Textstelle zur zweiten zu überführen. Als Grundlage dient Word2Vec.

original:
καὶ δὴ καὶ Σοφοκλεῖ ποτε τῷ ποιητῇ παρεγενόμην ἐρωτώμενον ὑπὸ τινος: 'πῶς,' ἔφη, 'ὄ Σοφόκλεις, ἔχεις πρὸς τἀφροδίσια; ἔτι οἷός τε εἶ γυναικὶ συγγίγνεσθαι'; καὶ δς, 'εὐφήμει,' ἔφη, 'ὄ ἄνθρωπε: ἀσμενέστατα μέντοι αὐτὸ ἀπέφυγον, ὥσπερ λυττωντά τινα καὶ ἄγριον δεσπότην ἀποδράς.

Text

TLG-Key 0007-103

Abb. 4: Eingabemaske für Platon, *Politeia* 329b6–c4 und Plutarch, *De cupiditate divitiarum* (TLG Nr. 0007–103)

3. Ergebnisse und Diskussion

3.1 zu Platon, *Phaidon* 80b1–3

Das Ergebnis der Paraphrasensuche zeigt für die ersten drei Treffer folgendes Ergebnis:

Nr.	Distanz	TLG-Key	Fundstelle	original
1	0.01250770920755872	2018-001	2018 001 Praep Evang 11 27 13 Zeile 3-5 urn:cts:ppd:tlg2018.tlg001:000:11_27_13.3@[12]-11_27_13.5@[5]	δὲ σῶμα τῷ θνητῷ. Σκόπει δὴ, ἔφη, ὁ Κέβης, εἰ ἐκ πάντων τῶν εἰρημένων τάδε ἡμῖν ξυμβαίνει- τῷ μὲν θεῷ καὶ ἀθανάτῳ καὶ νοητῷ καὶ μονοειδεῖ καὶ ἀδιαλύτῳ καὶ αἰεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχῆν, τῷ δὲ ἀνθρωπίνῳ καὶ θνητῷ καὶ ἀνοήτῳ καὶ πολυειδεῖ καὶ διαλυτῷ καὶ μηδέποτε κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι τὸ σῶμα. ἔχομέν τι παρὰ ταῦτα ἄλλο λέγειν, ὃ φιλεῖ Κέβης, ὡς οὐχ οὕτως ἔχει; Οὐκ ἔχομεν. Τί οὖν; τούτων οὕτως ἔχοντι
2	0.12351479710922993	2018-001	2018 001 Praep Evang 11 27 13 Zeile 5-1 urn:cts:ppd:tlg2018.tlg001:000:11_27_13.5@[8]-11_27_14.1@[6]	ῶ καὶ μονοειδεῖ καὶ ἀδιαλύτῳ καὶ αἰεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχῆν, τῷ δὲ ἀνθρωπίνῳ καὶ θνητῷ καὶ ἀνοήτῳ καὶ πολυειδεῖ καὶ διαλυτῷ καὶ μηδέποτε κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι τὸ σῶμα. ἔχομέν τι παρὰ ταῦτα ἄλλο λέγειν, ὃ φιλεῖ Κέβης, ὡς οὐχ οὕτως ἔχει; Οὐκ ἔχομεν. Τί οὖν; τούτων οὕτως ἔχοντι
3	0.13230953618399474	2018-001	2018 001 Praep Evang 15 22 32 Zeile 2-4 urn:cts:ppd:tlg2018.tlg001:000:15_22_32.2@[5]-15_22_32.4@[3]	κἂν δὲ ἑνὸς ποικίλον, οἷον πρόσωπον. οὐ γὰρ ἄλλο μὲν ῥινός, ἄλλο δὲ ὀφθαλμοῦ, ἄλλα ταύτων ὅμοιο πάντων. καὶ εἰ τὸ μὲν δὲ ὀμμάτων, τὸ δὲ δὲ ἄκοις, ἔν τι δεῖ εἶναι εἰς ὃ ἄμφο- ἢ πᾶς ἂν εἴπαι ὅτι ἕτερα ταῦτα, μὴ εἰς τὸ αὐτὸ ὅμοιο τῶν αἰσθημάτων ἐλθόντων, δεῖ τοίνυν τοιοῦτο ὥσπερ κέντρον εἶναι, γραμμῆς δὲ συμβαλλούσας ἐκ περιφερείας κύκλου τῆς πανταχῶθε

Abb. 5: Die ersten drei Treffer der Paraphrasensuche zu Platon, *Phaidon* 80b1–3

Bei dem Treffer Nr. 1 handelt es sich um ein wörtliches Zitat aus dem elften Buch der *Praeparatio Evangelica* des Eusebius (11, 27, 13). Die im Suchfeld eingegebene Passage τῷ μὲν θεῷ καὶ ἀθανάτῳ καὶ νοητῷ καὶ μονοειδεῖ καὶ ἀδιαλύτῳ καὶ αἰεὶ ὡσαύτως κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον εἶναι ψυχῆν ist gelb markiert.

Bei dem Treffer Nr. 2 handelt es sich um den bei Eusebius ebenfalls zitierten zweiten Teil des Satzes (Plat. Phaid. 80b3–5) τῷ δὲ ἀνθρωπίνῳ καὶ θνητῷ καὶ πολυειδεῖ καὶ ἀνοήτῳ καὶ διαλυτῷ καὶ μηδέποτε κατὰ ταῦτα ἔχοντι ἑαυτῷ ὁμοίωτατον αὐτὸ εἶναι σῶμα, der im platonischen Text direkt an die gesuchte Passage anschließt. Interessant ist dieser Befund vor dem Hintergrund der algorithmischen Berechnung. Für den menschlichen Leser erschließt sich die Zusammengehörigkeit der Textpassagen natürlich sofort, da sie unmittelbar aufeinander folgen. Eine algorithmisch berechnete Relation basiert demgegenüber jedoch auf einem rechnerischen Zusammenhang und nicht auf einem Lektüervergleich: Insofern zeigt das Ergebnis, daß für den zweiten Teil des Satzes – der inhaltlich das Gegenteil der ersten Passage aussagt und nur am Ende wörtliche Überschneidungen mit der ersten Textpassage aufweist – eine semantische Ähnlichkeit zu dem ersten *errechnet* wurde. Diese semantische Ähnlichkeit ergibt sich für den ersten Teil aus den Gegensatzpaaren:

θείω – ἀθανάτω – νοητῶ – μονοειδεῖ – ἀδιαλύτῳ
göttlich – unsterblich – vernünftig – eingestaltig – unauflöslich

ἀνθρωπίνῳ – θνητῶ – πολυειδεῖ – ἀνοήτῳ – διαλυτῶ
menschlich – sterblich – unvernünftig – vielgestaltig – auflöslich

Bei dem Treffer Nr. 3 handelt es sich um eine Passage aus Eusebius, *Praeparatio Evangelica* 15, 22, 32, die eine längere Ausführung aus Plotin (Ennead. IV 7,6) zitiert: κἂν δι' ἑνὸς ποικίλον, οἷον πρόσωπον. οὐ γὰρ ἄλλο μὲν ῥινόζ, ἄλλο δὲ ὀφθαλμοῦ, ἀλλὰ ταῦτὸν ὁμοῦ πάντων. καὶ εἰ τὸ μὲν δι' ὀμμάτων, τὸ δὲ δι' ἀκοῆς, ἕν τι δεῖ εἶναι εἰς ὃ ἄμφω· ἢ πῶς ἂν εἴποι ὅτι ἕτερα ταῦτα, μὴ εἰς τὸ αὐτὸ ὁμοῦ τῶν αἰσθημάτων ἐλθόντων; δεῖ τοίνυν τοῦτο ὡσπερ κέντρον εἶναι, γραμμᾶς δὲ συμβαλλούσας ἐκ περιφερείας κύκλου τὰς πανταχόθεν αἰσθήσεις πρὸς τοῦτο περαίνειν, καὶ τοιοῦτον τὸ ἀντιλαμβανόμενον εἶναι, ἕν ὃν ὄντως.¹⁴ Eusebius zitiert aus der Vierten Enneade Plotins (205–270 n. Chr.), der sich an dieser Stelle mit dem Verhältnis von Körper und Seele beschäftigt. Der Neuplatoniker Plotin geht gerade in der Vierten Enneade dem Thema Teilbarkeit und Nicht-Teilbarkeit der Seele nach und in IV 7 speziell der Unsterblichkeit der Seele. Die hier als Paraphrase gekennzeichnete Textpassage ist keine Paraphrase zu Platon im engeren Sinn, aber sie gehört in den Kontext der Nachwirkung der platonischen Vorstellung vom Verhältnis Körper/Seele. Die Paraphrasensuche führt hier also auf ein Ergebnis, das die Tradition der platonischen Rezeption in der Kommentierung und Interpretation in der Linie Platon-Plotin-Eusebius zeigt, und dies auch mit der direkten Beziehung Eusebius-Plotin verbindet.

3.2 zu Platon, *Politeia* 521c5–8

Das Ergebnis der Paraphrasensuche zeigt für die ersten drei Treffer folgendes Ergebnis:

Nr.	Distanz	TLG-Key	Fundstelle	original
1	0.0	0555-004	0555 004 1 5 14 133 5 Zeile 2-1 urn:cts:ppd:tlg0555.tlg004:000:5_14_133_5.2@[1]-5_14_133_6.1@[4]	σθεν ἔφαμεν εἶναι μέγιστον, ἰδεῖν τε τάγαθόν καὶ ἀναβῆναι ἐκεῖνην τὴν ἀνάβασιν». τοῖτο δέ, ὡς ἔοικεν, οὐκ ὑστράκου ἔν εἰπῆ περιστροφή, ἀλλὰ ψυχῆς περιαγωγή, ἐκ νεκτερινῆς πινος ἡμέρας εἰς ἀληθινήν τοῦ ὄντος οἴσαν ἐπ'ἀνάδοσιν, ἣν δὴ φιλοσοφίαν ἀληθῆ φήσομεν εἶναι.» καὶ τοῖς ταύτης μετασχόντας τοῖς χρυσοῦ γένους κρίνει, «ἐστὲ μὲν δὴ πάντες ἀδελφοί» λέγων.
2	0.07348566950702158	0555-004	0555 004 1 6 3 34 2 Zeile 1 urn:cts:ppd:tlg0555.tlg004:000:6_3_34_2.1@[6]-6_3_34_3.1@[2]	ἦν ἀκολουθίαν, εἰς ἐπιστροφήν τῆς μηδέτω πιστευούσης ψυχῆς καὶ παραδοχῆν τῆς διδομένης ἐντολῆς. νεφέλης δ' οἴσης καὶ ἄρους ἀψηλοῦ πῶς οὐ δυνατόν διάφορον ἦχον ἐξακούσθαι, πνεύματος κινουμένου διὰ τῆς ἐνεργούσης αἰτίας; διὸ καὶ φησὶν ὁ προφήτης: «φρονῶν ῥημάτων ἡμεῖς ἠκούετε, καὶ ὁμοίωμα οὐκ εἶδετε.» ἄρα, ὅπως ἡ κυριακὴ φωνὴ λόγος ἀσχημάτιστος· ἢ ἄρα τοῦ
3	0.07578539577269876	0555-004	0555 004 1 6 11 94 6 Zeile 1-2 urn:cts:ppd:tlg0555.tlg004:000:6_11_94_6.1@[9]-6_11_95_1.2@[2]	ὁ τοῦ κυριακοῦ· χορὸς δὲ ἀναῦδων ἰχθύων ἐπερρέθει, ἢ μοῖσα ἢ τραγικὴ εἰρηκὲς που. «κάμει δὲ ἐλαττοῖσθαι, σίξεν» δὲ μόνον ἦδη λοιπὸν τῶν κυριακῶν λόγων, εἰς ὃν περασιεῖται ὁ νόμος, ὁ προφήτης εἶρηκεν Ἰωάννης. σῦνεξ ἦδη μοι τὸ μυστήριον τῆς ἀλη-θείας, συγγνώμην ἀπονέμων, εἰ περαιτέρω προβαίνειν τῆς ἐξεργασίας ὀκνῶ, τοῦτι μόνον ἀνακηρύσσων· «πάντα δι' αἰτίου ἔ

Abb. 6: Die ersten 3 Treffer der Paraphrasensuche zu Platon, *Politeia* 521c in Clemens' *Stromateis*

14 Übersetzung H. Müller: „... ja selbst wenn durch das Eine ein Vielgestaltiges erscheint, z.B. das Gesicht; denn nicht nimmt eines die Nase, ein anderes die Augen wahr, sondern ein und dasselbe alles zusammen. Und wenn das eine durch das Gesicht, das andere durch das Gehör eingeht, so muss es ein Einheitliches geben, in welches beides eingeht. Oder wie könnte man sagen, dass diese Wahrnehmungen verschieden sind, wenn die Gegenstände der sinnlichen Wahrnehmung nicht zugleich in ebendasselbe Eine eingehen? Demnach muss dies dem Centrum vergleichbar sein, die sinnlichen Wahrnehmungen aber müssen von allen Seiten her wie die Linien aus der Peripherie des Kreises zu diesem hindertieren und derartig muss das Wahrnehmende sein, ein wahrhaftes Eins.“

Der erste Treffer ist ein wörtliches Zitat der Platonpassage bei Clem. Strom. 5,14,133: εικότως τοίνυν καὶ Πλάτων ἐθίζει «τὰς βελτίστας φύσεις ἀφικνεῖσθαι πρὸς τὸ μάθημα, ὃ ἐν τῷ πρόσθεν ἔφαμεν εἶναι μέγιστον, ἰδεῖν τε τάγαθόν καὶ ἀναβῆναι ἐκείνην τὴν ἀνάβασιν». «τοῦτο δέ, ὡς ἔοικεν, οὐκ ὀστράκου ἂν εἴη περιστροφή, ἀλλὰ ψυχῆς περιαγωγή. ἐκ νυκτερινῆς τινος ἡμέρας εἰς ἀληθινὴν τοῦ ὄντος οὕσαν ἐπάνοδον, ἣν δὴ φιλοσοφίαν ἀληθῆ φήσομεν εἶναι.»¹⁵ Auf Grund der exakten wörtlichen Übereinstimmung beträgt die Word Mover's Distance für dieses Paar exakt 0.

Der zweite Treffer bei Clem. Strom. 6,3,34 lautet: Καὶ ταῦτα μὲν ταύτη· θεῶ δὲ τῷ παντοκράτορι καὶ μηδενὸς ὄντος ὑποκειμένου φωνὴν καὶ φαντασίαν ἐγγενῆσαι ἀκοῆ δυνατόν, ἐνδεικνυμένῳ τὴν ἑαυτοῦ μεγαλειότητα παρὰ τὰ εἰωθότα φυσικὴν ἔχειν τὴν ἀκολουθίαν, εἰς ἐπιστροφὴν τῆς μηδέπω πιστευούσης ψυχῆς καὶ παραδοχὴν τῆς διδομένης ἐντολῆς. νεφέλης δ' οὔσης καὶ ὄρους ὑψηλοῦ πῶς οὐ δυνατόν διάφορον ἦχον ἐξακούεσθαι, πνεύματος κινουμένου διὰ τῆς ἐνεργούσης αἰτίας; διὸ καὶ φησιν ὁ προφήτης· »φωνὴν ῥημάτων ὑμεῖς ἠκούετε, καὶ ὁμοίωμα οὐκ εἶδετε.»¹⁶ Im Kontext der ausgegebenen Passage geht es bei Clemens um die Bekehrung der noch ungläubigen Seele (εἰς ἐπιστροφὴν τῆς μηδέπω πιστευούσης ψυχῆς), was man mit der platonischen „Umlenkung der Seele“ (οὐκ ὀστράκου ἂν εἴη περιστροφή, ἀλλὰ ψυχῆς περιαγωγή) vergleichen kann. Die konkret markierte Passage zeigt allerdings keine wörtlichen Übereinstimmungen mit Platon.¹⁷

Der dritte Treffer ist Clem. Strom. 6,11,94: καὶ πῶς οὐκ ἄλογον τεκτονικῆς καὶ ναυπηγικῆς χεῖρον νομίζειν φιλοσοφίαν; τάχα που καὶ ὁ κύριος τὸ πλῆθος ἐκεῖνο τῶν ἐπὶ τῆς πόας κατακλιθέντων καταντικρὺ τῆς Τιβεριάδος τοῖς ἰχθύσι τοῖς δυσι καὶ τοῖς ε' τοῖς κριθίνοις διέθρεψεν ἄρτοις, αἰνιστόμενος τὴν προπαιδείαν Ἑλλήνων τε καὶ Ἰουδαίων πρὸ τοῦ θείου πυροῦ τῆς κατὰ τὸν νόμον γεωργουμένης τροφῆς· προπετεστέρα γὰρ εἰς ὄραν θέρους τοῦ πυροῦ μᾶλλον ἢ κριθή. τὴν δὲ ἀνά τὸν κλύδωνα τὸν ἐθνικὸν γεννωμένην τε καὶ φερομένην φιλοσοφίαν Ἑλληνικὴν οἱ ἰχθύες ἐμήνυον, εἰς διατροφήν ἐκτενῆ τοῖς ἔτι χαμαὶ κειμένοις δεδομένοι· αὐξήσαντες μὲν οὐκέτι καθάπερ τῶν ἄρτων τὰ κλάσματα, τῆς δὲ τοῦ κυρίου μεταλαβόντες εὐλογίας τὴν ἀνάστασιν τῆς θειότητος διὰ τῆς τοῦ λόγου δυνάμεως ἐνεπνεύσθησαν. ἀλλ' εἰ καὶ περίεργος εἶ, ἔκλαβε θάτερον τῶν ἰχθύων τὴν ἐγκύκλιον, τὸν λοιπὸν δὲ αὐτὴν ἐκείνην τὴν ἐπαναβεβηκυῖαν μηνύειν φιλοσοφίαν, αἱ δῆτα † συνάλογοι λόγου τοῦ κυριακοῦ· χορὸς δὲ ἀναύδων ἰχθύων ἐπερρόθει, ἢ μούσα ἢ τραγικὴ εἴρηκέν που. «κάμῃ δεῖ ἐλαττοῦσθαι, αὐξεῖν» δὲ μόνον ἦδη

15 Übersetzung Stählin: „Mit Recht will daher Platon es den »Hervorragendbegabten« zur Pflicht machen, »sich mit derjenigen Wissenschaft zu beschäftigen, die wir im Vorhergehenden für die wichtigste erklärten, nämlich das Gute zu betrachten und den Aufstieg zu jener Höhe zu beginnen«. »Das ist aber, wie mir scheint, nicht ein Umdrehen eines Scherbenstücks, sondern eine Umkehrung der Seele aus einer Art nächtlichen Tages zum wahren Tag, der in einem Aufstieg zum Seienden besteht, den wir für die wahre Philosophie erklären werden.«“

16 Übersetzung Stählin: „Soviel hiervon! Gott dem Allmächtigen ist es aber möglich, in dem Gehör den Eindruck einer Stimme und einer Erscheinung zu erzeugen, auch wenn nichts Wirkliches vorhanden ist er beweist damit seine Erhabenheit über die gewöhnlichen Naturvorgänge mit ihrer Folge von Ursache und Wirkung und bringt damit die noch nicht gläubige Seele zur Bekehrung und zur Annahme des von ihm gegebenen Gebotes. Da aber eine Wolke und ein hoher Berg da war, wie sollte es nicht möglich sein, daß ein mannigfacher Laut gehört wurde, indem durch die wirkende Ursache ein Wind erregt wurde? Deshalb sagt auch der Prophet: »Einen Schall von Worten hörte ihr, aber eine Gestalt sahete ihr nicht.«“

17 Übersetzung Stählin: 1. Soviel hiervon! Gott dem Allmächtigen ist es aber möglich, in dem Gehör den Eindruck einer Stimme und einer Erscheinung zu erzeugen, auch wenn nichts Wirkliches vorhanden ist er beweist damit seine Erhabenheit über die gewöhnlichen Naturvorgänge mit ihrer Folge von Ursache und Wirkung und bringt damit die noch nicht gläubige Seele zur Bekehrung und zur Annahme des von ihm gegebenen Gebotes. 2. Da aber eine Wolke und ein hoher Berg da war, wie sollte es nicht möglich sein, daß ein mannigfacher Laut gehört wurde, indem durch die wirkende Ursache ein Wind erregt wurde? Deshalb sagt auch der Prophet: „Einen Schall von Worten hörte ihr, aber eine Gestalt sahete ihr nicht.“

λοιπὸν τὸν κυριακὸν λόγον, εἰς ὃν περαιοῦται ὁ νόμος, ὁ προφήτης εἶρηκεν Ἰωάννης.¹⁸ Dies ist eine sehr weitgehende Übertragung des platonischen Gedankens in den christlichen Glauben, wonach erst die wahre Philosophie, in diesem Fall der Glaube an Gott, zur wirklichen Bildung führt. Allerdings ergibt sich diese Relation wiederum erst aus dem weiteren Kontext, wenn man die vorangehenden Ausführungen des Clemens zu diesem Gedanken einbezieht. So ist einerseits die Relation – d.h. eine Beziehung auf Platons Werk und insbesondere die *Politeia* hier deutlich zu erkennen. Andererseits kann man hier kaum mehr von einer Paraphrase sprechen, sondern diese Textpassage ist in den weiteren Kontext des Platonismus, d.h. der Nachwirkung Platons einzuordnen.

3.3 zu Platon, *Politeia* 329b6–c4

Das Ergebnis der Paraphrasensuche zeigt für die ersten drei Treffer folgendes Ergebnis:

Nr.	Distanz	TLG-Key	Fundstelle	original
1	0.0689352667058647	0007-103	0007 103 Oth 525 A Zeile 9-13 um:cts:ppd:tlg0007.tlg103:000:525_A.9@[1]-525_A.13@[4]	πρὸς τοὺς οἰκέτας πρὸς τοὺς γεωρ- γοὺς πρὸς τοὺς χρεώστας· Ἄπολλων, ἀνθρώπων τιν' ἀθλιώτερον ἔρακας; ἄρ' ἐρώντα δυσποτιμώτερον; (Men. fr. 337) Ὁ Σοφοκλῆς ἐρωτηθεὶς, εἰ δύναται γυναικὶ πλησιάζειν, εὐφήμει, ἄνθρωπε! εἶπεν ἑλεύθερος γέγονα λυττῶν- τας καὶ ἀγρίους δεσπότης διὰ τὸ γῆρας ἀποφυγῶν. ἄξιον γὰρ ἔμα τὰς ἡδοναῖς συνεκλείπειν τὰς ἐπιθυμίας, ἅς μήτε † ἤδραν μὲν φησὶν ἄλλκας (fr. 108) μήτε γυναικα. τοῦτο
2	0.08235797614731566	0007-103	0007 103 Oth 525 C Zeile 1-5 um:cts:ppd:tlg0007.tlg103:000:525_C.1@[5]-525_C.5@[6]	οἷκ ἔχουσιν. ὁ γοῖν Δημάδης ἐπιστάς ἀριστῶντι ποτε Φωκίωνι καὶ θεασά- μενος αὐτοῦ τὴν τράπεζαν αὐστηρὸν καὶ λιτὴν ἑθαυμάζω σ' ὡ Φωκίων' εἶπεν ὅτι οὕτως ἀριστῶν δύναμενος πολιτεῖν (αὐτὸς γὰρ εἰς τὴν γαστέρα ἐδημαγῶγει, καὶ τὰς Ἀθήνας μικρὸν ἠγούμενος τῆς ἁσπιάς ἐφόδιον ἐκ τῆς Μακεδονίας ἐπεσιτίζετο· καὶ διὰ τοῦτ' Ἀντίπατρος εἶπε θεασάμενος αὐτὸν γέροντα 'καθάπερ ἱερέϊου διαπεπραγμένου μηδὲν ἐπι λοιπὸν ἢ τὴν γλῶσσαν εἶναι κα
3	0.0830689261243757	0007-103	0007 103 Oth 528 B Zeile 2-6 um:cts:ppd:tlg0007.tlg103:000:528_B.2@[5]-528_B.6@[6]	οἷτε τοὺς χρυσοὺς ἐκπώμασιν ἀλλὰ χρῆται τοὺς προσυχοῦσι, καὶ ἢ γυνὴ ἄχρυσος καὶ ἀπόρφρος καὶ ἀφελῆς παρέστιν· ὅταν δὲ σύνδειπνον, τοῦτέστι πομπῆ καὶ θεάτρον, συγκροτῆται καὶ δράμα πλουσιακὸν εἰσαγάγῃ, ἢ ἡνὸν δ' ἔκπερε λήρητάς τε τρίποδάς τε' (Ψ 259), τῶν τε λυχῶν αἱ θῆκαι περισημῶν- ται, τὰς κύλικας ἀλλάσσοσι, τοὺς οἰνοχόους μεταμφιεν- νύουσι, πάντα κινῶσι, χρυσοῦν ἄργυρον ληθοκόλληται, ἄλλοις πλοῦτειν ὀμολογοῦντες, ἀλλὰ

Abb. 7: Die ersten 3 Treffer der Paraphrasensuche zu Platon, *Politeia* 329b6–c4

An erster Stelle listet das Verfahren die bekannte Paraphrase der Platonstelle durch Plutarch (*De cupiditate divitiarum* 525a10–12): Ὁ Σοφοκλῆς ἐρωτηθεὶς, εἰ δύναται γυναικὶ πλησιάζειν, εὐφήμει, ἄνθρωπε! εἶπεν ἑλεύθερος γέγονα λυττῶντας καὶ ἀγρίους δεσπότης διὰ τὸ γῆρας ἀποφυγῶν.¹⁹ Dies ist in verschiedener Hinsicht beachtlich: Obwohl deutlich ist, dass die

18 Übersetzung Stählin: „Und wie sollte es nicht unvernünftig sein, die Philosophie für etwas Geringeres zu halten als Zimmermannsarbeit und Schiffsbaukunst? Vielleicht speiste der Herr jene Menge, die sich gegenüber dem See Tiberias auf dem Rasen gelagert hatte, mit den zwei Fischen und den fünf Gerstenbrote, um damit auf den Unterricht hinzuweisen, durch den die Griechen und die Juden vorbereitet wurden, bevor sie den göttlichen Weizen, die durch das Gesetz zur Reife gebrachte Speise, erhielten. Denn zur Sommerzeit ist die Gerste früher reif als der Weizen. Auf die griechische Philosophie aber, die in den stürmischen Wogen des heidnischen Lebens entstand und getrieben wurde, wiesen die Fische hin, die denen zu reichlicher Nahrung gegeben wurden, die noch auf dem Erdboden lagerten. Denn ihre Menge wurde nicht größer, wie das bei den Brotbrocken geschah; aber sie hatten Anteil an den segnenden Worten des Herrn und wurden durch die Macht des Wortes mit dem Geiste der Auferstehung der Gottheit erfüllt. Wenn du aber auch noch eine besondere Deutung wissen willst, so faß es so auf, daß der eine der beiden Fische auf die allgemeine, die Einzelwissenschaft umfassende Bildung, der andere Fisch aber gerade auf jene höherstehende Philosophie hindeute, die freilich beide die Lehre des Herrn nicht übermitteln können. »Ein Schwarm von stummen Fischen schwamm jetzt rasch herbei«, hat die tragische Dichtung irgendwo gesagt. „Und ich muß abnehmen, zunehmen aber muß« von jetzt an in Zukunft nur mehr das Wort des Herrn, das das Ziel des Gesetzes ist; so hat der Prophet Johannes gesagt.“

19 Übersetzung Kaltwasser: „Sophokles wurde einst gefragt, ob er wohl bei einem Mädchen schlafen könne – «Behüte Gott«, antwortete er, «ich bin nun frei geworden und durch Hilfe des Alters so tollen und grausamen Herren entronnen.«“

Paraphrase auf den platonischen Text zurückgeht,²⁰ unterscheiden sich die Passagen signifikant in der Länge (41 zu 20 Wörtern) und Plutarch hat seine Vorlage nicht nur gekürzt, sondern auch umformuliert und mehrfach die Wortfolge abgeändert. So gibt er z.B. die an Sophokles gerichtete Frage anders als Platon in indirekter Rede wieder und ersetzt verschiedene Begriffe durch Synonyme. Z.B. wird der Abschnitt ἀσμενέστατα μέντοι αὐτὸ ἀπέφυγον („bin ich doch herzlich froh, dass ich davon erlöst bin“) verkürzend umgeformt zu ἐλεύθερος γέγονα („ich bin frei geworden“). Von Stoppwörtern, die in der Suche nicht berücksichtigt werden, abgesehen, teilen die Texte in Form und Lemma nur noch die drei Wörter γυναικί, εὐφῆμει und ἄνθρωπε, die übrigen Wörter wurden entweder grammatikalisch angepasst, weggelassen oder durch andere ersetzt.

Die beiden folgenden Ergebnisse haben keine nähere Verbindung zur Textstelle Platons. Beim zweiten Treffer besteht immerhin eine gewisse Ähnlichkeit darin, dass es sich wiederum um die Wiedergabe einer Anekdote handelt, in welcher jemand etwas zu einer bekannten Person sagt bzw. diese befragt. Für den dritten Treffer, die Beschreibung der Vorbereitung eines Banketts, ist kein wesentlicher Sinneszusammenhang zu erkennen. In beiden Treffern finden sich Synonyme zu bei Platon verwendeten Verben. Wir nehmen an, dass diese ausschlaggebend für die Platzierung der beiden Fundstellen waren, zumal es in dem recht kurzen Werk keine weiteren Paraphrasen gibt.

4. Fazit und Ausblick

Der vorgestellte Ansatz liefert qualitativ vielversprechende Ergebnisse. Zum einen werden auf Grund der Eigenschaften der Word Mover's Distance die im Experiment als Eingabe verwendeten Passagen in Form von Zitaten gefunden. Zum anderen werden aber auch andere Formen von Rezeption teils ohne wortwörtliche Übereinstimmung als erste Treffer gelistet. Neben echten Paraphrasen handelt es sich dabei um weiterführende, aber auch gegenteilige Formulierungen. Für die Treffer der ersten beiden Beispiele sind die Ergebnisse geeignet, der Überlieferung und Weiterentwicklung der Ideen Platons nachzugehen. Beim dritten Beispiel wird eine verkürzte Paraphrase einer Passage gefunden, die schon bei Platon als Anekdote mit paradigmatischem Charakter erscheint und sich daher zur Wiederverwendung in neuen Kontexten besonders anbietet.

Aufbauend auf der hier vorgestellten ersten qualitativen Auswertung ist eine systematische Evaluation des Verfahrens im Rahmen des Projekts Digital Plato in Arbeit. Dabei steht insbesondere die Frage im Raum, inwieweit sich das Ergebnis auf die Breite des platonischen Werkes übertragen lässt. Darüber hinaus steht die Verbesserung der Paraphrasensuche im Fokus. Das betrifft sowohl die Steigerung der Effizienz des Algorithmus, sodass größere Textmengen durchsucht werden können, als auch dessen Effektivität, insbesondere in Bezug auf die Qualität der Worteinbettungen mittels word2vec, die maßgeblich von einer optimalen Wahl der Parameter beim Training abhängt. Ferner könnte das Auflisten wortwörtlicher Zitate unter den Treffern durch einen automatischen Nachbearbeitungsschritt technisch leicht unterbunden werden, insofern diese nicht im Forschungsinteresse liegen. Perspektivisch wäre es zudem

²⁰ Man kann davon ausgehen, dass Plutarch die Passage, die auch von anderen Autoren aufgegriffen wurde, direkt aus Platon entlehnt und nicht einer Zwischenquelle entnommen hat: Die Schrift *De cupiditate divitiarum* setzt sich mit platonischer und aristotelische Philosophie auseinander und zeigt an verschiedenen Punkten direkte Bezüge auf Schriften der Philosophen. Außerdem findet sich die Anekdote bei Plutarch in etwas abgewandelter Form noch zweimal an anderer Stelle.

sinnvoll, wenn das Verfahren aus falschen Treffern lernt, die durch eine manuelle Korrektur erkannt wurden. Eine Möglichkeit wäre ein der Suche nachgelagerter Bewertungsschritt der Ergebnisliste, bei dem die gefundenen Kandidaten erneut wortweise geprüft und frühere Trugschlüsse dabei negativ gewichtet werden. Entgegen der eigentlichen Suche, müssen in diesem Schritt nur noch wenige Textstellen betrachtet werden, sodass die Prüfung eines Kandidaten auch aufwändiger ausfallen kann.

Trotz des frühen Entwicklungsstandes zeigt das Experiment bereits deutlich, dass word2vec auf das Altgriechische anwendbar ist und der darauf basierende Ansatz bei dem Auffinden bisher übersehener oder aufgrund der Breite der platonischen Tradition nicht vollständig erschließbarer Paraphrasen von Nutzen sein kann.

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The Third Side of the Coin: Using Google Earth to Visualize Numismatic Data

Kristina Neumann, John Wallrodt

Abstract: This article presents one digital approach to ancient numismatics. The proposed methodology maps geo-referenced quantities of coin finds within the platform of Google Earth – a free virtual globe available through the Internet. Especially for the uninitiated scholar, Google Earth efficiently visualizes both the spatial and chronological distribution of thousands of coins and provides an intuitive and interactive space for exploring regional and empire-wide patterns in their movement. While the practical applications of this methodology are many, this article focuses on an ongoing study of Antioch-on-the-Orontes in northern Syria and its regional evolution after Roman annexation. This project draws upon Google Earth as an invaluable first step in synthesizing the wealth of disparate coin data available for the city. After outlining the methodology to achieve such a visualization, this article highlights several promising patterns revealed by Google Earth in the dataset.

Ancient coin finds represent one of the most valuable sources of historical information for the ancient world.¹ From their iconography to the archaeological context in which they are found, the “multi-disciplinary” quality of coins can contribute to questions of state ideology, political formation, economic health, financial policy, and socio-cultural identity.² Scholarship increasingly appreciates this value as digital technologies and digital humanities are opening a new era for channeling large quantities of numismatic evidence.³ In other words, digital programs allow for not only the collection and curation of big, disparate datasets of coin finds, but also for the visualization, examination, and sharing of this material more efficiently than ever before.⁴

With this expansion in the scholarship, it can be difficult for more analog-oriented academics to know where to begin with their own forays into digital numismatics. The following paper presents one digital approach that is specifically geared towards the uninitiated scholar interested in pursuing the potential of both quantitative and digital numismatics. The proposed methodology maps geo-referenced quantities of coin finds across time and space within the

1 Many thanks are due to Dr. Peggy Lindner (Center for Advanced Computing and Data Systems, University of Houston) for her wise suggestions on this article, as well as to the two anonymous readers for this journal.

2 Kemmers and Myrberg (2011) 87-89; Howgego (1995); Howgego (2005), 1-17.

3 The image of the third side of the coin – the edge – is used here in a metaphorical sense. To see something from the edge means to be able to see both sides, to see the „big picture“. While the quantity of coins currently collected cannot compare to the millions of data points available in the modern world, assembling large collections of ancient evidence is one step closer to realizing the potential of “big data” for the ancient world. See Gattiglia (2015), 113-24.

4 Current digital numismatic projects include The Coin Hoards of the Roman Empire Project (<http://chre.ashmus.ox.ac.uk/content/about>), Nomisma (<http://nomisma.org>), Online Coins of the Roman Empire (<http://numismatics.org/ocre/>), and the Portable Antiquities Scheme’s database of British coin finds (<https://finds.org.uk/romancoins>). See also the questions raised by Meadows and Gruber (2014).

platform of Google Earth – a free virtual globe available through the Internet. This accessible program quickly organizes substantial volumes of numismatic material from multiple excavations and hoards into a dynamic visualization of spatial and chronological patterns. Presenting the data in such a format aids in further quantitative analysis of political, economic, and social change within antiquity.

In order to demonstrate the potential of this approach, this paper presents results from an on-going study on the annexation of Antioch-on-the-Orontes and greater Syria into the Roman empire. The dynamic presentation offered by Google Earth proved to be an important first step in identifying regional and long-term patterns of change dependent on the involvement of the different authorities active in Antioch and the East. In other words, while the visualization created by this program was not intended as either a substitute for rigorous data analysis or a generator of publication quality maps, Google Earth did provide a quick and dirty method for cutting through the noise of a large dataset in order to begin exploration of long-discussed problems.

1. A Rationale for a Digital Approach to Coin Finds

The impetus for mapping coin data with Google Earth originated from difficulties encountered in reconstructing the immediate and long-term change experienced by Antioch after Pompey's conquest in 64 BCE. Compared to many other urban centers of the ancient Mediterranean, literary and archaeological evidence for Hellenistic and Roman Antioch can appear limited. Textual records before the fourth century CE only refer to Antioch in short snippets or in passing.⁵ From an archaeological perspective, the joint expedition of Princeton University and several French and American museums in the 1930s did uncover hundreds of stunning mosaics, coins, and pottery sherds. Despite the five-volume publication in the years after excavation, much of the archaeological material is only gradually becoming available through the recent efforts of Princeton University faculty, staff, and students and an international team of scholars.⁶ Survey and salvage work have also added to the topographical understanding of the city and the surrounding settlement, but all archaeological projects are hindered by the modern city of Antakya overtop and the ongoing Syrian war in the region.⁷ Neither texts nor much of the material culture currently provide a consistent standard by which to measure the city's development in both a local and regional context.

This paper proposes coin finds as an untapped resource for the study of Antioch. Many political entities in the East issued coins during the Hellenistic and Roman periods, including Seleucid kings, Roman emperors, and a variety of client-kingdoms, provinces, and individual cities.⁸ The mint or mints at Antioch alone produced coins in both base and precious metals for three different tiers of issuing authorities: the central governments of the Seleucid kings and

5 See Downey (1961), 35-44. This is the case generally for northern Syria in the Hellenistic period. See Millar (2006), 29; Cohen (2006), 3-13.

6 For information about current work on the original publications at Antioch, see <http://antioch.princeton.edu>.

7 Survey projects include the Amuq Valley Regional Projects (AVRP) and the Orontes Delta Archaeological Project. See Leblanc and Poccardi (1999), 91-126; Casana (2003); Pamir (2012), 259-270.

8 According to the estimations of T. B. Jones, over 530 eastern cities, leagues, and kingdoms issued coins at some point during the Roman imperial period (Jones (1963), 310).

Roman emperors, the provincial Roman government of Syria and occasionally other eastern provinces, and the civic government of Antioch and other cities of the region.⁹ Some of these coins circulated in a very restricted territory, whereas others circulated more freely over a wide geographical area; all circulation depended on social, economic, and political factors often related to the original issuing authority.¹⁰ The theoretical foundation to this study is that ancient boundaries to coin circulation can be uncovered through which types of coins appear where, when, and in what quantities within the archaeological record.¹¹ While spatial gaps certainly exist in the archaeological record, mapping the general limits to a particular coin's distribution – such as civic coins issued by the Antiochenes – and how these limits evolved over time and space can draw out the activity and policies of the different authorities issuing the coins and the various public and private groups making use of them. This in turn can point towards broader and more abstract changes experienced by a single city, region, and even whole empire.¹²

The success of such a study first depends on assembling a large dataset, as this will minimize or at least better contextualize discrepancies, gaps, or idiosyncrasies of individual assemblages of coins.¹³ This project initially considered c. 85,000 coins from a total of 75 excavations and 120+ hoards (i.e. deposits of more than one coin) found throughout the Mediterranean.¹⁴ This quantity includes c. 20,000 local and foreign issues recovered from excavation at Antioch and those originally minted at Antioch for various regal/imperial, provincial, and civic authorities and found elsewhere. With the exception of hoards – whose entire deposit was considered – the coins range in date from the time of Antiochus III (223 BCE) through the early centuries of the late antique period (423 CE) in order to provide a context for the material from the Roman imperial period (30 BCE through 235 CE).

The fusion of such a diverse dataset demands a digital approach for its collection, organization, and visualization. The database management system FileMaker Pro fulfilled the first two requirements of collection and organization. The database used tables for Territory, City, Object, and Bibliography. Within this data structure, all the coins collected from excavation reports and hoard inventories could be sorted and summarized according to a conceptual model of seven attributes (e.g., date, metal; see below).¹⁵ The Territory and City tables allowed us to augment these coin attributes with spatial data (e.g., find spot, mint location). Although Excel can also aggregate data, recording the coins in this way allowed faster searches of the material, such as for all coins dating to a certain period of issue and/or all coins of a specific metal. Drop-down lists for each field also made data entry faster and more consistent than Excel. The results of these queries were still easily exported to other formats or databases, such as Excel, where the dataset could be further analyzed using numerical and graphical methods.

As helpful as the database proved to be in organizing and analyzing coin data, this study also needed a dynamic map to integrate the disconnected finds within their spatial context and

⁹ See Butcher (2004), 3, 17-22, 239-64, 298-412; McAlee (2007), 1-2.

¹⁰ Howgego (1995), 88-110; Burnett (1987), 86-104; Butcher (2004), 143-49; Butcher (2001-2002), 35-41.

¹¹ Casey (1986), 68-113; Butcher (2004), 149-51; Newton (2006), 211-27. This is not to suggest a one-to-one correlation between coin use and coin finds ignoring ancient process and the vagaries of survival.

¹² For a similar approach, see Evans (2006); Howgego (1985); Butcher (2004); Beliën (2009), 61-80; Kemmers (2006).

¹³ See Ryan (1988), 27-37, 60-63. Although some web-based numismatic databases exist (such as the OCRE database by the ANS), they lacked the variables necessary for this study.

¹⁴ A full bibliography is available for download at <https://scholar.uc.edu/show/zp38wc66m>.

¹⁵ For more on database management systems, see Connolly and Lake (2006), 51-60.

highlight geographical patterns in their distribution.¹⁶ Because the goal was to quickly visualize the data to see if any patterns were worth pursuing, the non-traditional research tool of Google Earth appeared as a viable option.¹⁷ First launched in 2005, Google Earth is an Internet-based, geographical information platform with 3D modeling of the planet based upon high-resolution satellite, aerial photographs, and a modern database of world places.¹⁸

For the purposes of this study, Google Earth facilitated the creation and exploration of an interactive, thematic map charting quantities of coins with specific attributes over space and time (ill. 1).¹⁹



Illustration 1: A screenshot of geo-referenced quantities of coin finds in Google Earth Pro.

Navigation controls granted a wide view of the entire Mediterranean or a narrower focus on a particular region – all in real time and from multiple-angles. Google Earth uniquely supported a top-down examination of coin data distributed across a two-dimensional map and – by tilting the view of the globe – a ground-level comparison of quantities of coin finds represented

16 Bodenhamer (2008), 223-225; Goodchild (2008), 18; Knowles (2008), 18; Shennan (1997), 21.

17 Compared to similar platforms available at the start of this project, such as Google Maps, Google Earth offered stronger aesthetics, additional measuring tools, and the ability to view data through multiple angles (see below).

18 <http://earth.google.com>. For an excellent overview on the mechanics of Google Earth, see Goodchild (2008). According to Goodchild, “Google Earth and other geobrowsers address what previous generations of developers had seen as insuperable challenges: feeding vast amounts of data through comparatively limited Internet pipes, manipulating three-dimensional images in real time, and zooming through a hierarchical data structure over at least four orders of magnitude of resolution” (22). For the updated applications now available in Google Earth and similar software programs, see Goodchild (2012), 11088-11094.

19 Compare with the comments of Henry (2009), 3-4.

by weighted 3D bar charts at each location.²⁰ Search tools simplified locating specific sites or geographical coordinates and adding new placemarks or uploading additional data. Folders organized data and easily toggled what information appeared within a single screenshot or viewing. It was also possible to layer historical maps with ancient trade routes and settlements to contextualize the data beyond its basic geographical location.²¹ The newest model – Google Earth Pro – created videos capturing a tour of places or showing an animated evolution of data. Overall, the flexibility in perspective and the amount of material displayed in its temporal and spatial context by Google Earth surpassed a traditional static map and instead provided a working tool for finding distribution patterns worthy of in-depth exploration.

For the uninitiated scholar, Google Earth can also provide a “child’s play” alternative to more conventional geographical information system (GIS) programs like QGIS or ArcGIS.²² Although developers continue to improve the accessibility of these packages, the steep learning curve and, with the exception of open-source programs like QGIS, the expense limits the scholarly audience. Conversely, as Michael Goodchild argues, Google Earth “represents a distinct democratization” in granting scholars without GIS training “access to comparatively simple ways of displaying geo-referenced data, and gaining the insights that a spatial perspective can provide.”²³ In this project, only a minor investment of time at the outset in setting up and querying the database was needed before the clear and dynamic visualization of coin distribution in Google Earth became possible. For an initial exploration of the data, the basic tools offered by Google Earth were more than sufficient to take simple measurements, draw paths, and create overlays and layers such as with historical maps or information (e.g., roads, settlements).²⁴ Of course, as future iterations of the project have demanded more advanced modeling tools, the data has been easily incorporated into more sophisticated mapping and analysis programs.²⁵ For initial exploratory stages, however, Google Earth more than fulfilled the conditions of this project to engage visually with imperfect material in order to uncover and explore patterns worthy of further study.

2. Methodology for Visualizing Coin Find Distribution in Google Earth

As accessibility and replication of this digital approach to coins was a primary goal of this project, the following section outlines the methodology applied within this study. Several issues needed to be addressed, including which coins to consider, best practices for creating a visual display, and where to store the final maps. As will be pointed out below, many of the decisions made were directed towards analysis of the numismatic material beyond its initial visualization in Google Earth.

20 Such a multiplicity of views – especially in comparing the bar charts through tilting the globe – is not possible in Google Maps.

21 On Google Earth’s capacity for approximately layering historical maps on top of the globe imagery, see Knowles (2008), 12.

22 ‘Think Global’ (2006), 763. See also Goodchild (2012), 11088.

23 Goodchild (2008), 22.

24 See Goodchild (2008), 16-17. On the limits of these calculations, see Goodchild (2012), 11089-90.

25 See Henry (2009).

Any digital approach to coins must first begin with a careful selection of which finds to include within the dataset. The aims of this project necessitated that coins could be identifiable by mint of origin and/or issuing authority, had an identifiable find spot (whether a specific site or general region), and were published as part of a wider coin assemblage (i.e., not a lone find). This last criterion extended less from any visualization requirements and more from the long-term aims of the project to study the proportions in which Antiochene coins were discovered. Though not required, this study also gave preference to coins identifiable by metal and type in pursuance of better defining distribution patterns.

Two separate sources best met these criteria: official excavation reports and published lists of coin hoards.²⁶ Because the greater aim of this project focused on applications of big numismatic collections, most of the assemblages in which an individual coin was found – whether excavation or hoard – exceeded 100 total finds. The paucity of information for certain regions of the East also meant including a few smaller assemblages of at least twenty coins in order to construct as comprehensive picture of coin distribution as possible. In the end, this initial study consisted of fifteen publications from Syria, five publications from East of Syria (e.g. Mesopotamia), 22 publications from the Southern Levant, thirteen publications from greater Asia Minor and Cyprus, and twenty publications from Europe and North Africa.²⁷ A few of these reports also included publications of hoards found through excavation, but the majority of hoards considered in this study were from assembled lists.²⁸

All acceptable coins were recorded into a FileMaker Pro database according to seven attributes:

1. Coin “Material”: silver, bronze, antoninianus, or uncertain.²⁹
2. Coin Origin: source territory (e.g., Syria) and minting city/issuing authority (e.g., Antioch).³⁰

26 All selected excavations were occupied during the Roman period; most also had occupation and coin material dating to the Hellenistic and late antique periods. Hoards were included only if the latest datable coin was issued during the chronological span of 223 BCE – 423 CE and only if the hoard contained Antiochene coins. This study excluded other sources of coin information, such as survey data, chance finds, museum catalogs, private collections, and – with the exception of certain hoards – antiquities sales. Not enough surveys have been conducted in Syria to provide a body of evidence that can be internally compared, as is the case with excavation reports or hoards. Many museum and private collections have lost the original context or assemblage of the coin, which does not help in a distribution study.

27 A detailed bibliography of all publications consulted can be found at <https://scholar.uc.edu/show/zp38wc66m>. A map of these sites is located at <https://scholar.uc.edu/show/zp38wc685> (doi:10.7945/C2201C). Some gaps did exist in this geographical span. For instance, excavations in both Armenia and Cappadocia either lacked a large enough quantity of coins or did not meet the necessary standards of publication.

28 e.g., Thompson, Mørkholm, and Kraay (1973); *Coin Hoards* (1975-2010).

29 Although antoninianus refers to a denomination and not an individual material, coins of this denomination were given a separate attribution in order to study how increasingly low levels of silver content affected their distribution. In general, the fiduciary nature of bronze coins is believed to restrict provincial bronze circulation, whereas the high intrinsic value of silver coins greatly expands it (with the exception of Egypt). See Butcher (2001-2002), 22. Gold coins proved to be too rare a find to form a part of this distribution study.

30 In an attempt to retain as many finds as possible, it was sometimes necessary to assign a coin’s origin to the wider province rather than a specific mint or authority. For example, coins of nations without a certain mint (e.g., Jewish coins) were assigned to a province or general geographical territory (e.g., Southern Levant). All locations were given geographical coordinates gathered from Google Maps. For many of the less familiar ancient locations (e.g. Singara in Mesopotamia), approximate locations or the modern equivalent were found using a combination of the Barrington Atlas and additional resources such as the New Pauly. Finds with only a broad classification of a province were tied to a single coordinate in the center of the region with the designation “[Province Name] – GENERAL.”

3. Antiochene Subcategory (if applicable): as mentioned above, the mint or mints at Antioch produced coins for several different issuing authorities, which may have impacted how a coin circulated. Therefore, if a coin was minted at Antioch, it was assigned to a subcategory:

- Central coin: royal Seleucid or imperial Roman
- Provincial coin: provincial Roman
- Civic coin: Seleucid or Roman
- Uncertain

4. Date Range of Coin Issue³¹

5. Find Spot: region (e.g., Syria) and specific find location (e.g., Antioch).³²

6. Nature of Find: single excavation find or hoard.³³

7. Quantity: The recording method for the quantity of finds differed between site finds and hoards:

- For site finds, like coins of a particular issue date, type, and metal were quantified into a single number.³⁴
- Individual hoards were recorded as a single entry, adding all Antiochene coins together into one quantity, regardless of differences in date or type. The rationale for this choice is that whether the hoard resulted from a single or series of deposits over time, intentional or unintentional, the contents represent a collective loss. For the sake of visualization and comparison to the site finds, the hoards were dated by the latest material contained in them rather than by the issuing date of the individual coins.³⁵

31 The date range of a coin issue was recorded to the greatest level of specificity as possible, at times to a single year. The variation in how a publication described coin finds occasionally forced artificial chronological assignments. For example, a numerical date span was assigned (e.g., 200-225 CE) in the place of vague identifications (e.g., Early Third Century). When two dates were provided, the date range was recorded as spanning the earliest to the latest point. This is an admittedly imperfect solution to the lack of standard notation among coin records. See Guest (2012), 108.

32 The locations of several of the smaller excavation sites were poorly described by their publications (e.g., Tell Abou Danne – in the region of Djabboul), so the maps depict the best approximate locations (see Doyen (1987)). Many hoards were discovered outside a controlled excavation and published with little detail about their original location; they were therefore assigned to a general find spot (e.g., Syria).

33 Given the differences between excavation finds and hoard finds, it was important to keep the material separate both within the database and final quantitative analysis. Broadly speaking, excavations yield an assemblage of often base metals left unintentionally by multiple individuals over a long period of time. In this study, only 1% of a total of 5,522 coin finds from the Princeton excavation are silver (Waage (1952); see Butcher (2004), 150. Quite in contrast, hoards are often intentional deposits meant to be recovered later, whether an attempt to hide one's money in an emergency or gradually adding to one's savings. This type of loss was meant to safeguard money and often resulted in hoards of selected precious metal coins like silver and gold. See Casey (1986), 51-60; Harl (1996) 14-16; Kemmers (2006), 132-36.

34 For example, the excavation records at Antioch reported two bronze civic issues of Antiochene origin dating to 18/17 BCE with an obverse of Zeus. See Waage (1952), no. 297. At times this level of specificity was not possible or necessary and resulted in larger groupings. For instance, as this study was more interested in late antique finds as a block comparison to the earlier periods, all Antiochene finds of this period were added into a single quantity.

35 While the individual contents of hoards are easily compared to other hoards, it is more difficult to compare hoards to site finds. The method proposed may seem like setting up a data set incompatible to site finds, which are recorded here as separate entries and dated by issuing period and not stratigraphic deposit. However, the purpose of including hoards was to serve as a check to the pattern of site finds. Even though it is not yet possible to examine all coin finds according to their date of deposit (perhaps a closer indication to original circulation patterns), the hoard finds may be the best indicator we have at this time. A more practical reason also dictates different recording methods: the hoard lists do not always detail individual issuing periods of the contents, but instead simply describe the quantity of coins by issuing city or mint (e.g., Coin hoards, Royal Numismatic Society 7 (1985), no. 154). Rather than throw out the material, they were grouped into one entry in order to cover such inconsistent records. That said, where detailed information about individual coins was present, it was added to the "Description" section of that entry for later analysis.

After recording all coin finds in the FileMaker Pro database, the data needed to be transformed into a format understood by Google Earth. Google Earth reads Keyhole Markup Language (KML), a file format which is used to display spatially-linked data to its proper geographical coordinates.³⁶ In this study, each KML file was derived from a series of searches on the FileMaker Pro database according to time period, “material,” and, if minted at Antioch, subcategory of coin. For this study there were two distinct sets of queries:

- Antiochene coins generally (keeping hoard data separate from site finds)
- Coins found through excavation at Antioch

This database viewed the summary of the search results by either where the coins originated – important for finds at Antioch – or where the coins were found – important for finds originating at Antioch. For example, a search for all the records of *site finds* of *civic Roman bronze* coins *minted at Antioch* during the *time of Tiberius* (14-37 CE) yielded four cities where this type was found: Antioch (2 coins), Dura-Europos (2 coins), Seleucia Pieria (2 coins), and Tall Seh Hamad (2 coins). These results were gathered and then saved into a single text file. Each query was then exported into a KML file. To organize these searches, each KML file was assigned a code based upon the attributes of the coin.³⁷ If the coin was minted at Antioch, these attributes consisted of the nature of find (site or hoard), the coin subcategory (e.g., Royal Seleucid, Provincial Roman), the “material” (e.g., Bronze, Silver), and date of the issue. For non-Antiochene finds at Antioch, search results were saved simply according to nature of find, material, and date of issue.

The KML files were then imported to Google Earth, which mapped the results of individual searches with a 3D stacked bar chart representing summary coin quantities at each location. Bar charts emerging from the earth were chosen instead of proportional circles in order to take full advantage of Google Earth’s multiple viewpoint capabilities for top-down or horizon-level comparison.³⁸ For finds of Antiochene coins, bar charts appeared at the *find spot* of the hoards or excavations.³⁹ For coin finds excavated at Antioch, bar charts depicted the *origin* of the coins. Each bar chart is tied to the original quantities of coins, but amplified by 10,000 meters above the earth in order to permit analysis over a wide territory. Pink tabs at the top of each bar chart could be clicked to reveal the actual quantity of coins displayed. In addition, each quantity of coins was color-coded to the time-period of site finds issue or hoard deposit date (e.g., Late Seleucid: purple; Julio-Claudian: pink), allowing the display of a third⁴⁰ attribute in addition to geographical location and quantity of coins.⁴¹ Again, the goal of this approach was not in-depth statistical analysis, but rather to provide a quick, initial visual comparison of coin finds in their spatial context.

Following the import of all KML files into Google Earth, a few additional steps were required to improve the visualization of data. First, queries were organized into subfolders under the

36 The export file is originally saved as txt and requires a manual change to a kml extension. See Henry (2009), 3-4; Goodchild (2008), 15: “Google Earth’s API allows users not affiliated with Google to create their own applications and extensions... Clicking on the file name will execute Google Earth, pan and zoom to the [location in the kml file], and add a placemark over the...location at latitude..., longitude... Similar scripts will paste coloured patches, images, three-dimensional structures and many other kinds of features on the Earth’s surface.”

37 A detailed breakdown of the code is available for download at <https://scholar.uc.edu/show/zp38wc642>.

38 Shepherd (2008), 201-02, 210. See Henry (2009), 11-16: Henry generated multiple bar charts in GIS to be depicted in Google Earth’s browser.

39 The polygon tool in Google Earth can be used to create individual bar charts, but Wallrodt included this in the script exported from the FileMaker Pro database.

40 For the reference to the metaphor of the “third side of the coin” see above.

41 Both the amplification of data and color-coding were options in the database before export.

“Places” panel (ill. 2). One subfolder divided queries into different coin “material,” such as silver or bronze. Another subfolder sorted queries by the subcategory of Antiochene coin, whether Roman provincial or Roman civic. A last subfolder organized queries into five major chronological periods⁴²:

- Later Seleucid (223-91 BCE)
- The transitional period between Seleucid and Roman imperial rule (90-31 BCE)
- Roman imperial rule (30 BCE-235 CE) with subdivision by dynastic family
- Third century crisis (236-283 CE)
- Early centuries of Late Antiquity (284-423 CE)



Illustration 2: A screenshot of the Google Earth Pro platform with the Places panel highlighted. Individual data points can be organized into folders in order to control what information is visualized.

Selecting any of these folders in the “Places” panel toggled the appearance of that data and created a straightforward method for easily comparing hoard data to site data or coins of different issuing authorities or metals. Placemarkers were also added for each excavation included in this study in order to account for locations that had been examined, but had no Antiochene coins. Rough maps of ancient trade routes and borders were displayed beneath the coins as a basic method of contextualizing whatever data was viewed.

⁴² This is an imperfect division, but these broad periods do more than a fine-toothed approach in accounting for the many provisions involved in using coin finds: the complex minting, socio-economic, and political history of the Roman east and empire; the longevity of coin circulation; the varying legibility of coin finds; and the different ways of dating site finds (by issue and not deposit) and hoards (by latest datable coin). The one questionable move may be combining the Julio-Claudian and Flavian finds into one period, but based upon hoard evidence, scholars predict much overlap in circulation for the first century CE (see Butcher (2004), 180-92; Butcher (2002), 145-52). The two earliest chronological periods focus on eastern events. For example, 90 BCE was chosen as the end of the Seleucid empire because the minting of royal Seleucid bronze ceased in that year and Antioch began producing its own municipal coin. The Roman imperial dates and following periods of the third century crisis and Late Antiquity follow a more Mediterranean model because the city was then part of the Roman empire. In the end, how closely these divisions correlate to possible “coin-use periods” is uncertain, but this chronological division does represent the best compromise currently available between artificially even segments (e.g., ten year periods) and the complex life cycle of each coin. On “striving towards coin-use periods,” see Lockyear (2007), 218-21.

The final step in this methodology was to ensure permanent and open access to the visualizations created in Google Earth. All maps for and information related to the distribution of coins finds in Google Earth were stored in the University of Cincinnati's digital repository: Scholar@UC (<http://scholar.uc.edu>). Three interactive maps are available for download in KMZ format (a zip file for a collection of KML files): the location of excavation sites consulted for the distribution study of Antiochene coins⁴³; the quantities and find spots of coins minted by the ancient mint(s) at Antioch, as sorted by metal, Antiochene subcategory, and chronology⁴⁴; and the origins and quantities of coins found through excavations at Antioch with material sorted by metal and chronology.⁴⁵ These files are not only readable in Google Earth, but can be viewed as text files to examine the data directly or transfer to other visualization platforms.

3. Sample Patterns from Google Earth

Visualizing coin finds in Google Earth quickly connected these disparate data points and revealed both empire-wide and more regional patterns in their spatial and chronological distribution. This visualization was not intended to be the end of analysis, but rather a method for contextualizing the data in order to uncover paths for future research and further quantitative study. The following section highlights select, broad patterns gleaned from Google Earth alone, which prove promising for addressing questions of change to Antioch and the region following Roman annexation. Although these patterns are intended to be viewed within the platform of Google Earth, for visual ease within this publication format, several screenshots are provided with the columns representing the quantities of coin flattened to circles.⁴⁶

Beginning with a broad look at the data, mapping coins in Google Earth provided a clear visualization of how the city of Antioch realigned from a capital of the Seleucid empire to first a provincial Roman center in Syria and then an imperial center oriented to the west in the late Roman empire (ill. 3). In other words, the data in Google Earth illustrated that the authority or authorities who controlled Antioch and its mint(s) had a significant impact on the outward boundary limits of Antiochene coin distribution. That said, other influential factors were already apparent from even these overarching distribution patterns.

43 doi:[10.7945/C2201C](https://doi.org/10.7945/C2201C)

44 doi:[10.7945/C25P4B](https://doi.org/10.7945/C25P4B)

45 doi:[10.7945/C25P4B](https://doi.org/10.7945/C25P4B)

46 This adjustment can be done directly within Google Earth by modifying the display altitude of the data points. Right click on an individual folder within the places file, and then select "get info." This will display an edit window, which allows multiple modifications in how the data is displayed.



Illustration 3 a: The distribution of Antiochene coins during the Seleucid period (c. 223-91 BCE).



Illustration 3 b: The distribution of Antiochene coins during the Roman imperial period (c. 30-235 CE).



Illustration 3 c: The distribution of Antiochene coins during the late third century CE through late antique period (c. 235-423 CE).

During the Hellenistic period, bronze and silver coins minted at Antioch exclusively for the Seleucid kings spread from Asia Minor far into the eastern reaches of their empire. Based upon the relative quantities of the coin finds from each location, Antiochene coin finds were not evenly distributed within this span, but appeared in a higher concentration within Syria. This aligned with what is already known about the initial distribution of royal mints within Seleucid territory and the subsequent importance of Antioch as the Seleucid empire crumbled under other governmental powers.⁴⁷ Even though these ever-shrinking political boundaries greatly limited the movement of Antiochene coins out of Syria, small quantities of both silver and bronze nevertheless appeared in the Parthian empire and likely reflect commercial traffic still connecting the Mediterranean to further east.⁴⁸

After the Romans annexed Antioch, finds of Antiochene silver and bronze coins stayed predominately within the confines of Syria and the Levant. Antioch minted chiefly for the provincial government of Syria and the city itself with only irregular imperial issues in the early centuries of Roman rule.⁴⁹ Traditional divisions created by the fallout of the Hellenistic kingdoms, denominational differences, as well as stronger provincial borders under the Romans presumably contributed to keeping Antiochene finds within Syria and the Levant.⁵⁰ Large-scale change in the distribution pattern only occurred in the third century CE and late antique periods, when Antiochene coin finds stretch far into the western Mediterranean. Antioch now minted coins exclusively for the Roman state, which enforced a homogenized currency throughout the

⁴⁷ Houghton (2002), 354-55; Aperghis (2004), 235-36, 245; see Mørkholm (1984), 93-97; Duyrat (2015), 375.

⁴⁸ Seyrig (1955), 101-04. See Raschke (1978), 604-1361; Young (2001).

⁴⁹ Antioch minted silver denarii for the central Roman state under Vespasian, Titus (see Tacitus (Hist. 2.82)) and Hadrian. As these issues had an express military purpose, it is possible that these coins were shipped outside Syria and then reabsorbed by the imperial government to produce newer issues. See Butcher (2004), 95-98.

⁵⁰ See Butcher (1996), 101-09.

empire.⁵¹ While previous scholarship has discussed such a reorientation from the Hellenistic period to Late Antiquity, the visualized data within Google Earth clarified when and in what ways that change occurred within a spatial context.⁵²

Google Earth also helped illuminate finer patterns in the relationship between Antioch and the wider Mediterranean and East. For instance, this program opened up new possibilities for the diverse body of single finds of non-Antiochene coins from the excavations at Antioch. These coins have not attracted significant study, largely because the vast majority of coins from Antioch's own mint(s) overwhelms their numbers (ill. 4).⁵³ While the dominance of Antiochene coins testifies to the continued importance of the city's mint(s) in meeting its own currency demands, Google Earth provided the perfect platform for making sense of the disparate foreign coins that arrived in the city.⁵⁴ When these coins were mapped according to where they originated, several patterns materialized in their spatial and chronological distribution.



Illustration 4: A screenshot in Google Earth Pro of the distribution by origin of Roman era coins found through excavation at Antioch. The three highest quantities of coins are highlighted: those from Rome, those from Antioch, and those from the southern Levant.

The overall geographical spread of the coins was immediately apparent (ill. 5). The Roman east contained a diversity of local communities issuing their own coins, many of which are represented by one or two coins found at Antioch. Their origins span from Rome, down the coast

⁵¹ Butcher (2004), 260-61.

⁵² See for instance Jones (1940); Jones (1971); Sartre (2005); Millar (1993).

⁵³ Waage (1952).

⁵⁴ Based upon a count of 5,522 identifiable finds from 223 BCE-423 CE, 76% are Antiochene in origin (see Waage (1952)). Butcher ((2002), 145-51; see also (2004), 174-76) has argued that civic authorities within Syria regulated which coins would be accepted as currency within city limits. In the case of Antioch, Butcher proposes that city officials limited acceptable currency to only Antiochene coin. While an attractive proposal, one has to wonder whether the uneven coin finds at Antioch represent an active and strict policy by the Antiochene municipal government to set currency limits or are the indirect result of the relatively strong and consistent production of coins at Antioch compared to other regional mints. In other words, the products of the Antiochene mint(s) may simply have overwhelmed what else could be used within the city and what therefore appears within the archaeological record. Deciding between these two explanations is equally difficult in assemblages comparable to Antioch's (e.g., Athens, Corinth), where local production appears to overwhelm all other sources of coinage. See MacDonald (1976), 45; Johnston (2007), 5-6; Kroll (1993), xviii-xxvi, 166-70.

of Asia Minor, past Cilicia and into the southern Levant. Ancient and modern sources have commented on Antioch's strategic location, through which many traders and travelers passed.⁵⁵ The Google Earth maps provided a partial visualization of that movement into the city.

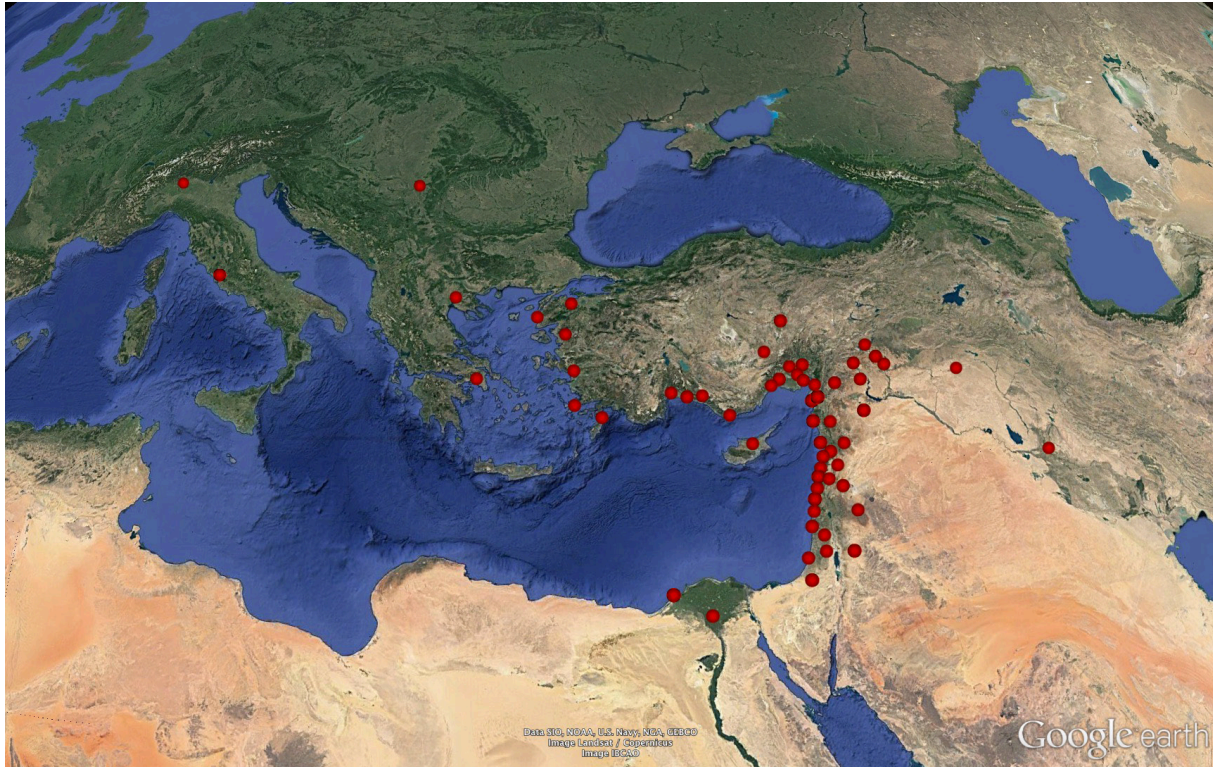


Illustration 5: The geographical spread by origin of foreign coins found at Antioch as visualized in Google Earth Pro.

When this spread was broken down over time, an interesting pattern emerged within Google Earth. Despite Antioch's inclusion within the Seleucid and Roman empires, not until the Severan period did a true diversity of coins from a wide geographical span appear in the city's assemblage.⁵⁶ Scattered finds dating to the earlier periods originated from places like Egypt and Athens, but only after the wave of civic self-promotion through coins in the later second and early third centuries CE do issues regularly appear from greater Syria, Mesopotamia,

⁵⁵ Str. 16.2.1, 5-8; Libanius *Or.* 11.34-41, 258-65; see Downey (1961), 46; Butcher (2003), 11-15.

⁵⁶ Finds dating to the late Seleucid period originated predominately from northern Syria and Phoenicia with a few exceptions from places like Tarsus, Egypt, Athens, and Rome. Their makeup provides a partial reflection of coins generally circulating within the northern Seleucid empire (compare with the maps of Seleucid and civic mints of the east in Newell and Mørholm (1977), 3; Hoover (2009), 282); Duyrat (2016). Coins from eastern Seleucid mints – like Seleucia on the Tigris, Carrhae, and Dura – do appear in the Antiochene assemblage before the reign of Antiochus III, but their absence in the later assemblage is likely because of the gradual loss of Seleucid territory in the East. All the same, such a collection overall is not as diverse as one could expect with the Seleucid's open currency policy and Antioch's position on major trade routes. As for the first centuries of the Roman period, besides two clusters discussed, the origins of non-Antiochene coins were even more constrained to regions close to the city with a smattering of finds from Egypt, Cyprus, Pamphylia, Cappadocia, and Mesopotamia. However, it bears repeating that the majority of these finds are bronze, rather than silver, which may explain the strong localization of the finds.

Cilicia, and Cappadocia.⁵⁷ Once the empire transitioned as a whole to a more uniform body of imperial currency in the late third century CE, finds from western mints formed an integral part of assemblage at Antioch.⁵⁸

Because of this chronological disparity, two clusters of higher quantities stood out within the finds of the earlier Roman imperial period (ill. 4). The first group consisted of coins from the Nabataean kingdom and what Waage described in her catalog as “coins of the Jews.”⁵⁹ Both Nabataean and Jewish coins dating to the first century CE are common finds throughout the northern Levant. Their appearance at Antioch may be an indication of loose territorial boundaries in the Levant during the early years of Roman control or – in the case of the Jewish coins – the presence of like ethnic communities or associations between the south and the northern Syrian city.⁶⁰ The latter explanation may be more likely considering the striking absence of Phoenician coins within the first century CE assemblage at Antioch. Granted, a small number of cities issued their own currency during this period, but Phoenician coins do not have strong representation at Antioch even in the previous century.⁶¹ This may indicate that Syrian coins continued to circulate differently in the north and south, even after Roman reorganization of the Levant.⁶² In any case, both the presence of Jewish and Nabataean coins and the absence of Phoenician coins at Antioch during this period offer interesting clues to Antioch’s connections within its region, clues which may have been missed without their visualization in Google Earth.

The second quantity standing out among the distribution of non-Antiochene coin finds were those originating from Rome (ill. 4). A negligible presence among the finds dating to the first centuries BCE and CE, these coins make their strongest appearance within the Antonine

57 In the second and third centuries an increasing number of cities issued coins in celebration of their own mythological foundations, civic cults, and honorific titles (see Millar (2006), 120-25). The finds from Cilicia and Cappadocia are the first relatively substantive body of coins from these territories to appear in the Roman imperial assemblage. This is somewhat surprising, because of the proximity of these regions to Syria and the common traffic passing through them. Then again, it may be that either denominational or political restraints limited the movement of these coins. The general rarity of coins from Cilicia and Asia Minor in the northern Levant would suggest that whatever the political, geographic, or economic ties between the two regions, these coins did not circulate in Roman Syria. Cappadocian bronze coins more commonly appear than silver, but also not in extensive quantities within Syria; they too did not likely circulate within the Levant. See Butcher (2004), 176-77.

58 The late antique finds are still weighted towards the mints of the eastern Mediterranean, such as those in Asia Minor and at Alexandria. However, much like the pattern of late antique finds of Antiochene coins mentioned above, the geographical span reflects one way in which Antioch had transitioned into a fully integrated part of the empire.

59 See Waage (1952), 87. Waage includes in the latter group one coin for King Archelaus, two coins for Herod Agrippa I, four coins of the procurators, and one coin of the first Jewish revolt.

60 Millar (1993), 31; Butcher (2004), 177; Butcher (1996), 108.

61 See the map in Jones (1963), 311. See also Burnett, Amandry, and Ripollès (1992), 581-582; Butcher (2004), 177.

62 The distribution of Antiochene silver tetradrachms reinforces this conclusion: not until the second century CE do these coins appear in noteworthy quantities within southern Syria and the Levant. The continued production of civic silver at Tyre possibly provided a denominational or a preference barrier to the circulation of Antiochene silver further south. This changed during the reign of Nero, when Antiochene tetradrachms were switched to a Tyrian standard and type, and the mint at Tyre stopped producing silver. Butcher has argued that these changes prompted the circulation of Antiochene tetradrachms within Phoenicia and the southern Levant. If the evidence is weak for the end of the first century CE, the hoards from the second century CE do reveal the distribution of Antiochene coins to the south alongside other Syrian issues, Roman denarii, and a few other silver issues from the East. Roman annexation of the region therefore appears to have increased the circulation of Antiochene silver coins (see Butcher (1996), 104-06). It is probable that the Roman bureaucracy orchestrated these changes. Within the diverse currency pool of the Near East, the tetradrachms acted as a bridge between local bronze and the denominations of the Roman state for substantial transactions within the public and private sectors. See Harl (1996), 98-99; Butcher (2004), 245-53, 257-61.

period.⁶³ The majority of these coins are regular imperial bronzes and a few silver denarii of the Roman mint dating from Trajan through Marcus Aurelius. Almost a third of the coins, however, are provincial issues struck at Rome for circulation in Syria.⁶⁴ Since all these coin finds date to the reign of Trajan, it is reasonable to link their presence to the emperor's Parthian campaigns. After all, Antioch became the focus of Roman investment as a political and military center during this period.⁶⁵ A few Roman coins also appear in the Severan period, but at remarkably lower quantities than in the previous era, despite the continuation of military activity in the region. Once again, mapping pages of coin find tallies in Google Earth linked the data together in such a way as to facilitate comparison of the Roman coins both against other finds of the period and against other finds over time.

In addition to highlighting changes within the assemblage of foreign coins at Antioch, Google Earth also helped uncover finer patterns in the distribution of Antiochene coins outside of the city. This is best illustrated with a comparison of the bronze provincial and civic coins minted at Antioch during the Roman imperial period. Scholars have generally claimed that because of the difference in issuing authority, provincial coins moved widely around the province, whereas civic coins stayed close to their city of origin.⁶⁶ The same should be expected for coins from Antioch, as the iconography on the coins clearly defines the civic authority from the Roman provincial authority. The provincial coins normally bear the emperor's portrait on the obverse with either Latin or Greek inscriptions and a wreath encircling the letters SC, presumably for *senatus consulto* – “by the decree of the senate” – on the obverse.⁶⁷ Quite in contrast, the civic coins of Antioch often celebrate the city with the name of the Antiochenes (e.g., ANTIOXEΩN) boldly displayed, titles usually in Greek, and civic iconography celebrating both Antioch's history and its mythology.⁶⁸

When both types of coins were mapped in Google Earth, nuances in the pattern were revealed suggesting that coin distribution in the East was not as simple as previously thought. The provincial Roman coins were introduced at latest around 5 BCE and, according to the visualization in Google Earth, had a strong presence throughout Syria for the following century (ill. 6).⁶⁹

63 Because Waage's report combines the central Roman finds from Antioch and Seleucia Pieria, it is possible that the number of Roman coins is inflated. Still, as coin assemblages from other Syrian sites demonstrate that Roman coin was more prevalent in the East by the second century BCE, it is certain that a number reached Antioch as well.

64 For the provincial SC issues, see Waage (1952), nos. 1016-17. Waage attributed these to the mint at Antioch, but see Butcher (2004), 35-38, 406-12. For the coins of the Koinon of Syria, see Waage (1952), nos. 400-01. Waage had also attributed these to the mint at Antioch, but see Butcher (2004), 409. For coins bearing the legend ΔΗΜΑΡΧ ΕΞ ΥΠΙΑΤ Β, see Waage, nos. 390-99. Traditionally attributed to Caesarea in Cappadocia, Waage argues that the amount found at Antioch meant that they were struck in this city. For the attribution to Rome, see McAlee (2007), 192; Butcher (2004), 35-38, 408-09.

65 See Downey (1961), 211-13.

66 See Butcher (2004), 18-22; Harl (1996), 107-13; Wallace-Hadrill (1986), 72-73.

67 Unlike the civic coins, the provincial coins bore Latin legends until the time of Trajan (98-117 CE), when they switched to Greek; the reason for the change in language is uncertain. The significance of the letters SC is also a matter of debate. Compare Burnett (1987), 19; Butcher (2004), 235-236; Bay (1972), 118-19; Grant (1946), 97-98, 101; McAlee (2007), 3-5.

68 For a succinct overview of these types, see the examples in McAlee (2007), 88-107.

69 Antioch began to mint the bronze SC coins during the reign of Augustus. Many scholars link their introduction to Quinctilius Varus, who served as governor of Syria beginning in 7/6 BCE, but it is possible that their production started earlier. The titles for the emperor Augustus appearing on these coins only signify that the coins must have been minted after 23 BCE. Howgego (1982), 7-11; Butcher (2004), 28-29; Downey (1961), 167. The RPC editors suggest between 20 and 10 BCE (see Burnett, Amandry, and Ripollès (1992), 603, nos. 4101-5).



Illustration 6: The roughly weighted distribution pattern of provincial SC coins as visualized in Google Earth Pro. All orange circles represent coins dating to the first century CE. The teal circles represent provincial SC coins dating to the second and third century CE. Inset of a provincial SC coin image is used with permission of wildwinds.com and George Clegg.

These coins were likely part of an attempt by the Roman government to standardize regional bronze coinage in the immediate years after annexation.⁷⁰ The military also affected the distribution of these coins as those with legionary countermarks appeared in small quantities beyond the limits of Syria to the east and further south.⁷¹ Despite this use, however, the maps in Google Earth did not reinforce scholarly claims that this type acted as “the official Roman bronze coinage of the far eastern provinces of the Empire.”⁷² Additionally, the distribution of provincial finds dating to the later second and third centuries CE suggested a lessening of importance in this type of coin even within the provincial confines of Syria.⁷³ It is possible that the increase of individual cities minting their own bronze coinage lessened the need or enforcement of the provincial coin’s circulation. Only at Antioch did the quantities of provincial SC coins appear to increase, which may point to the city’s role as a regional center of the Roman government rather than a completely independent city.⁷⁴

As for the city coins of Antioch, a different pattern surfaced within Google Earth. For the most part, the maps showed what could be anticipated – that Antiochene civic coins predominately

⁷⁰ Butcher (2004), 29. See Burnett (1987), 19.

⁷¹ See Howgego (1985), 17-23; Howgego (1982), 10-11. For examples of the legionary countermarks on these coins, see Brunk (1980), 63-76; Bellinger (1949), nos. 1604a, 1604b, 1604c, 1625d.

⁷² Carradice (1983), 17. See also Howgego (1985), 84; Reece, et al. (2008), 424.

⁷³ Cf. Butcher (1996), 108; Butcher (2004), 257.

⁷⁴ See Downey (1961), 163-164; Tacitus Hist. 2.78.

circulated around the city with a few stray finds moving further away with travelers (ill. 7). After all, the coins celebrate the internal values of Antioch's own citizens and were likely directed toward use by this audience within the confines of the city and the immediate territory.⁷⁵ Neighboring cities may have adopted the same practice and possibly refused to accept Antiochene coin as currency within their borders.⁷⁶



Illustration 7: The roughly weighted distribution of Antiochene civic coins as visualized in Google Earth Pro. The circles are weighted to relative quantities. Inset of Antiochene civic coin image used with permission of wildwinds.com (ex Pegasi Numismatics Auction 140, lot 218).

Although this should have been the general case throughout Syria – cities relying on their own coins or those of cities closest to them – the Google Earth maps revealed an unexpected line of relatively high percentages of Antioch's civic issues running east of the city, along a major communication route well towards Mesopotamia. This unusual extension of the civic coins away from their issuing city may partially be explained by the lack of a local mint in this eastern region during this period. However, other Syrian cities along the Orontes and Mediterranean issued their own civic coinage in the first century BCE, but they are rare finds along this line eastward from Antioch.

It is therefore conceivable – though in need of further evidence – that Antiochene civic coins were somehow more legitimate among the people of this region because of their clear identification with the previous Seleucid capital of Syria (ANTIOXEON / ΤΗΣ ΜΗΤΡΟΠΟΛΕΩΣ - “of the metropolis of the Antiochenes”). The Antiochenes started to produce these coins regularly in the waning years of Seleucid control over the city, which may have initially contributed to their eastward movement within the kingdom.⁷⁷ The fact they continued to appear through

⁷⁵ Heuchert (2005), 40. See also Howgego (1985), 89-91; Harl (1987), 11, 21-22.

⁷⁶ See Butcher (2002), 145-52.

⁷⁷ Nixon (2002), 298-99. See also Waage (1952), 24; Butcher (2004), 24-27, 307-12; McAlee (2007), 60-61.

later decades may be related to an established precedent and/or their explicit ties to a city at the top of the civic hierarchy. Even though the Romans were strengthening their control of the region, perhaps coins boldly printed with Antioch's name held more weight abroad than coins of other cities. This connection or influence did not last past the first century CE.

Without the visualization provided by Google Earth, it would have been incredibly difficult or perhaps even impossible to synchronize and compare the distribution of these two bronze types out of Antioch. By rendering the data in a digital platform which accounted for quantity, space, and chronology, the necessary connections could be made and developments in the coins' distribution highlighted.

4. Conclusion

These few sample patterns to emerge from Google Earth are certainly not the only ones of significance, nor is noting their presence the end of analysis. In this project on the annexation of Antioch, every pattern appearing on the maps has been quantitatively analyzed on the level of individual site assemblages and regional groupings from the city of Antioch and sites within Syria, Mesopotamia, the southern Levant, Asia Minor, and the western Roman Empire. Explicit testimony about the city and region from other sources has been brought into conversation with this analysis, both as comparison and check to the results surfacing from the numismatic material. This multi-faceted approach already suggests that even as Antioch was a metropolis of great regional stature, its importance was much more mutable in the hands of the different authorities making use of it than previous scholarship has assumed.

Even with the need for further analysis, the maps provided by Google Earth have nevertheless proved to be an invaluable first step within this project. The program quickly rendered endless pages of disparate data points from multiple excavation reports and hoards lists into a cohesive, interactive map. This map could account for change across both time and space, thereby offering a much more comprehensive picture of Antioch within its regional and imperial contexts. As a result, Google Earth's visual translation of the quantified data offered by the numismatic evidence created new entry points into old material and long-discussed questions.

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Das eManual Alte Geschichte – ein digitales Lernszenario der Alten Geschichte

Jan Seehusen

Abstract: The *eManual Alte Geschichte* is a digital introduction to Ancient History and contains mostly *Open Educational Resources*. Users can learn about Ancient history by using podcasts, ancient sources in translation (and with comments), secondary literature, and other material (such as lists of Roman emperors). Under the direction of Werner Riess, a team of seven contributors created the contents and layout of the blog from November 2015 until June 2017. In a second phase of the project in 2018, the blog will be extended and re-launched in 2019.

1. Einleitung

Open Educational Resources (OER) haben das Ziel, Bildungsangebote für jeden öffentlich zugänglich zu machen. Im Rahmen der Digitalisierung, die vielfach in unseren Alltag hinein wirkt, werden gegenwärtig vermehrt Anstrengungen unternommen, *Open Educational Resources* durch das Internet zur Verfügung zu stellen.

Das *eManual Alte Geschichte* hat an dieser jüngsten Entwicklung Anteil und fühlt sich dem Ziel der OER verpflichtet. Von November 2015 bis Juni 2017 wurde in einem Team aus sieben Mitarbeiter/-innen unter der Leitung von Werner Riess eine digitale Einführung in die Alte Geschichte, ein so genanntes ‚Lernszenario‘, erstellt, das als Blog frei nutzbar ist. Mittels Podcasts, Quellen, Sekundärliteratur und Zusatzmaterialien kann ein User die faszinierende Epoche der antiken Geschichte auf verschiedenen Lernwegen erkunden und kennenlernen. Die Erstellung des *eManual* fand unter dem Schirm und mit großer Unterstützung der *Hamburg Open Online University* (HOOU) statt. Die HOOU vereint die Digitalisierungsbestrebungen verschiedener Hochschulen der Stadt Hamburg, akademische Bildung im Sinne von OER in einem weitaus größeren Maße als bisher der Öffentlichkeit zur Verfügung zu stellen. Der folgende Beitrag führt in die Zielsetzung und den Aufbau des *eManual*¹ ein.

2. Ziel und Aufbau des eManual Alte Geschichte

Von Anfang an verfolgte das Projekt im Sinne der HOOU zwei Ziele. Einerseits soll eine breite Zielgruppe angesprochen werden. Während bisherige Angebote entweder bewusst auf akademische oder auf populärwissenschaftliche Zielgruppen hin ausgerichtet waren, ist es das Ziel des *eManual*, alle an der Alten Geschichte Interessierten anzusprechen. Andererseits soll der

¹ <http://emanualaltegeschichte.blogs.uni-hamburg.de/>.

User nach individuellem Kenntnisstand eigenständig Lernmaterialien und Lernwege auswählen können – Alte Geschichte lässt sich so im Online-Bereich deutlich lernendenzentrierter lehren und lernen, als es bisher der Fall war.

Der Aufbau des *eManual* basiert auf vier ‚Säulen‘ des Wissenserwerbs (vgl. Abb. 1):

- I. **39 Podcasts** zu allen Epochen der Alten Geschichte und ein Glossar zu Begriffen, Namen und Orten der antiken Geschichte.
- II. **Quellen** zu allen Epochen der Alten Geschichte in englischer oder deutscher Übersetzung mit Kommentaren und Leitfragen zu den Quellen.
- III. **Sekundärtexte** zu Methoden und Theorien der Geschichtswissenschaft mit Leitfragen und Kommentaren sowie eine Zotero-Bibliothek zu übergreifenden und einzelnen Themen der Alten Geschichte.
- IV. **Arbeitsmaterialien** mit inhaltlichen Ergänzungen zu den Epochen der Alten Geschichte (z.B. Zeittafeln) und Übungsteilen zu den Formalia des Abfassens von geschichtswissenschaftlichen Arbeiten.



Abb. 1: Greift man auf das *eManual Alte Geschichte* zu, ist eine Auswahl verschiedener Inhalte über die vier Säulen möglich, die als Reiter abgebildet sind.

Die Inhalte der vier Säulen lassen sich unabhängig voneinander nutzen. Dies bietet besondere Vorteile beispielsweise in der universitären Lehre, in der das *eManual* als Ergänzung zur klassischen Präsenzlehre dienen kann. Lehrende und Lernende können so inhaltsorientiert eine bestimmte Epoche der Alten Geschichte (z.B. Kaiserzeit) wählen oder sich methodenorientiert auf eine bestimmte Domäne des Wissenserwerbs (z.B. Quellen) konzentrieren. Im Folgenden soll das Beispiel ‚Die Athenische Demokratie‘ vorgestellt werden.

3. Ein Fallbeispiel: Die Athenische Demokratie

Interessiert sich ein User für die Athenische Demokratie, ist zunächst der Zugriff auf einen Podcast möglich (vgl. Abb. 2). Der User wählt die passende Epoche („Griechische Geschichte II – Klassik“) und den dazugehörigen Podcast „Die Athenische Demokratie“ aus. Es öffnet sich ein Podcast, der einleitend ereignis-, sozial-, religions- oder verfassungsgeschichtliche Hintergründe des jeweiligen Themas erläutert. Parallel dazu lässt sich der Podcasttext in einem darunter liegenden Fenster mitlesen – selbstverständlich ist auch die ausschließliche Wahl einer der beiden Lernwege möglich. Ein User kann auch nur Teile des Podcasts oder des dazugehörigen Textes rezipieren und verwenden, was beispielsweise in der schulischen und akademischen Lehre von großem Nutzen ist. Als Hilfsmittel steht zusätzlich ein Glossar zur Verfügung, das für den Anfänger schwierige Begriffe erläutert und sich per Klick auf den Begriff (hier: „Souverän“) öffnet.

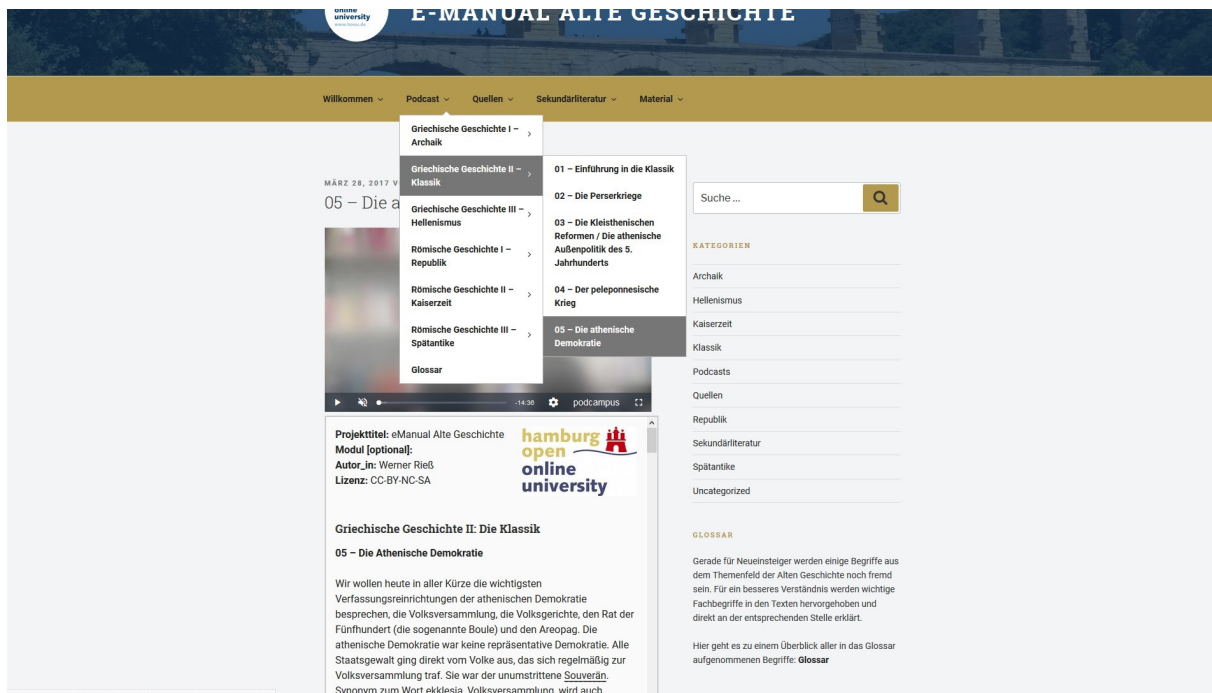


Abb. 2: Interessiert man sich für einen grundlegenden Einstieg in ein althistorisches Thema, bietet sich der Zugriff auf einen der 39 Podcasts an, die nach den Epochen der Alten Geschichte geordnet sind.

Möchte der User nun auf andere Domänen des Wissenserwerbs zugreifen, ist ein Blick in die Quellen möglich (vgl. Abb. 3). Die Quellen sind dabei den Podcasts passgenau zugeordnet. Wählt man unter dem Reiter „Quellen“ erneut „Griechische Geschichte II – Klassik“ und „Athenische Demokratie“, eröffnet sich ein Panorama verschiedener Quellen, die Einzelaspekte dieses Themas beleuchten. Möchte man nun die Genese der Athenischen Demokratie genauer verstehen, bietet sich die Auswahl „Kleisthenische Reformen“ an. Die Quellenstelle wird zunächst im Original und in Übersetzung aufgeführt. Darunter folgen Leitfragen und ein Kommentar, die den Zugang zur Quelle erleichtern sollen. Die Leitfragen sind in verschiedenen Operatorenstufen angesiedelt (beschreiben – erklären – beurteilen) und der Kommentar verhilft zur historischen Einordnung der Quelle und zur Erläuterung schwieriger Quellenpassagen. Zusammen erschließen Leitfragen und Kommentar den Blick auf die Vergangenheit, der sich aus der Quelle ergibt.

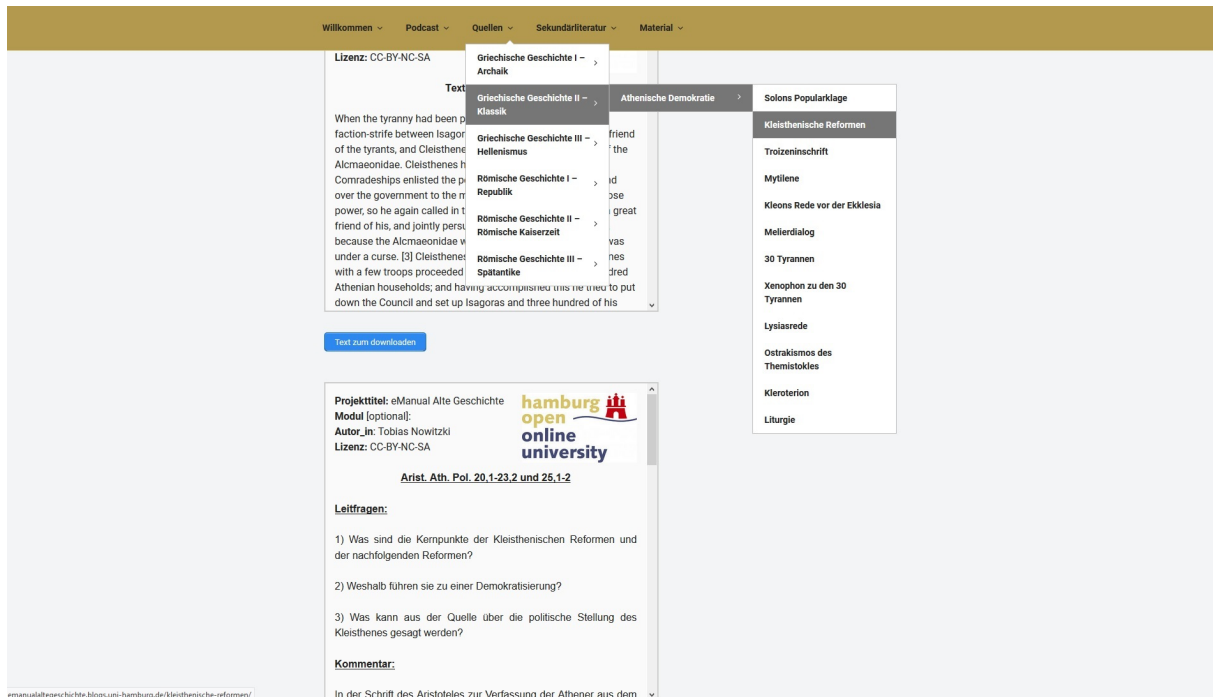


Abb. 3: Möchte der User tiefer in das Thema einsteigen, sind einzelne Podcasts Quellenstellen zugeordnet, die eine eigenständige Rekonstruktion vergangener Lebenswelten ermöglichen.

Eine weitere Möglichkeit, sich mit der Athenischen Demokratie zu beschäftigen, bietet ausgewählte Sekundärliteratur. Exklusiv geschlossene Lizenzverträge mit Verlagen ermöglichen den Zugriff auf das Volltext-PDF (vgl. Abb. 4). Auch hier bieten Leitfragen und Kommentare zu den Sekundärtexten die Gelegenheit, Forschungspositionen und schwierige Textpassagen besser nachzuvollziehen. Inhaltliche Ergänzungen bieten schließlich Zusatzmaterialien wie Zeittafeln zur griechischen und römischen Geschichte (vgl. Abb. 5).

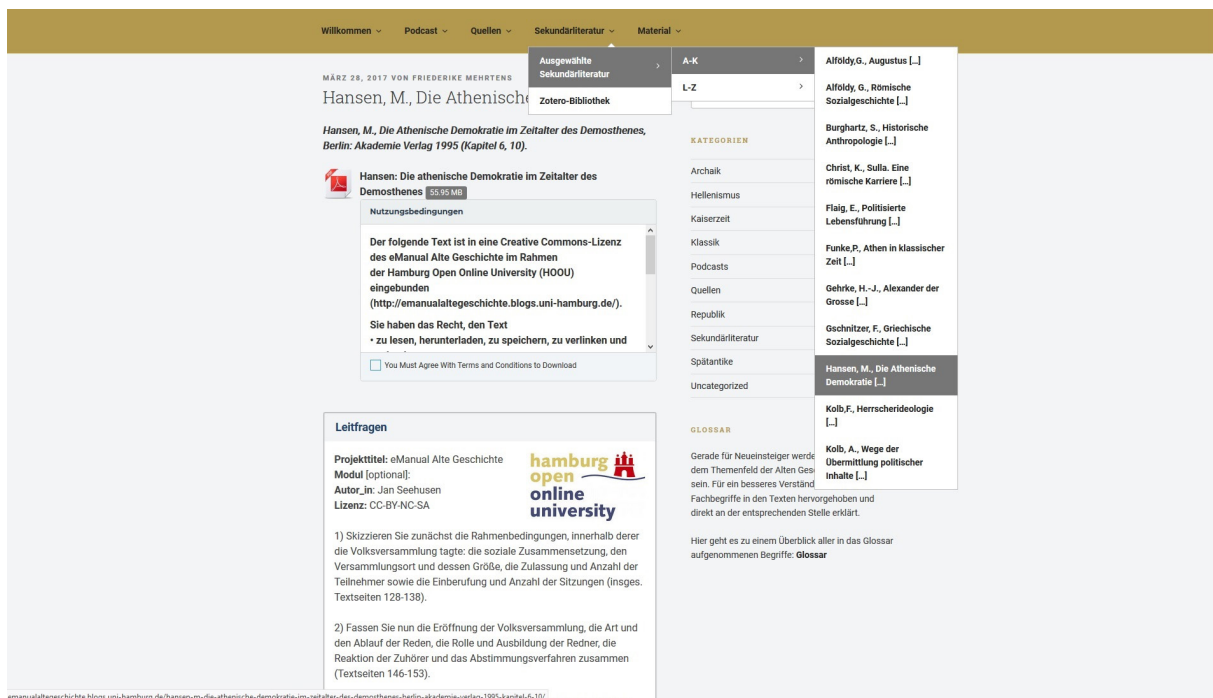


Abb. 4: Sekundärtexte ermöglichen die Erschließung und Beurteilung althistorischer Forschungsliteratur

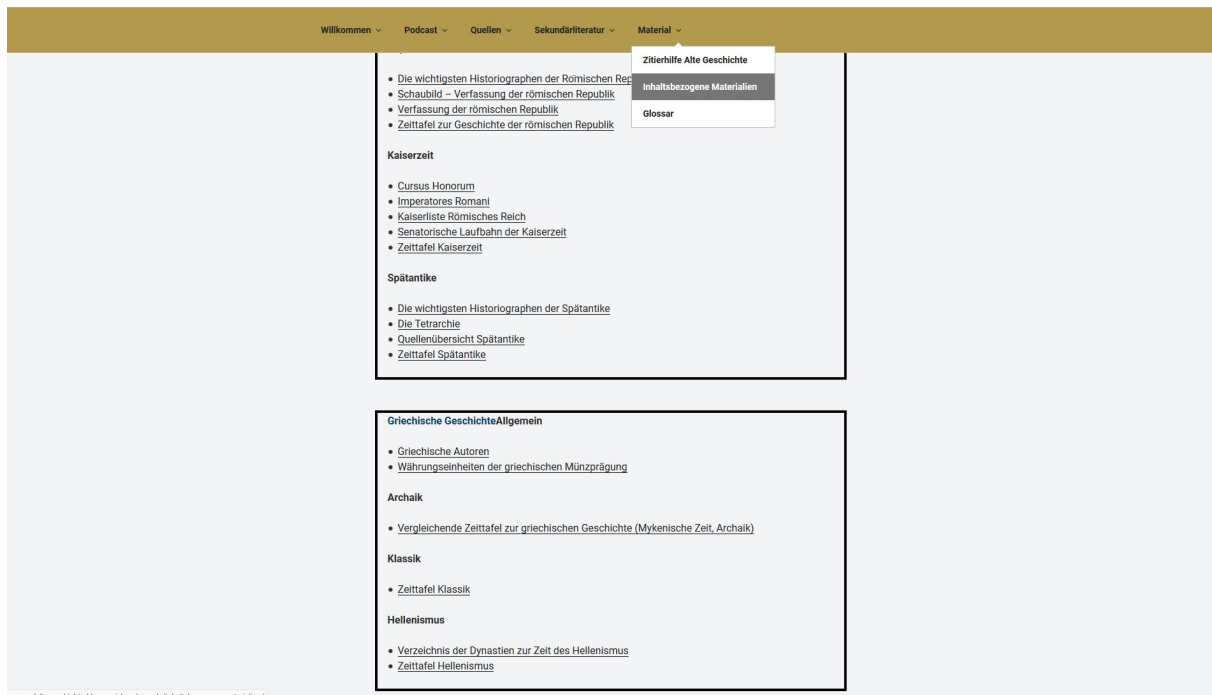


Abb. 5: Zusatzmaterialien ermöglichen eine inhaltliche Ergänzung des bisher gewonnenen Wissens.

4. Fazit

Durch die vier ‚Säulen‘ bieten sich sowohl für den Anfänger als auch für den Experten vielfältige Möglichkeiten, das *eManual Alte Geschichte* als Lernszenario zur Gewinnung einer soliden Wissensbasis im Bereich der antiken Geschichte zu nutzen. Alle Inhalte, ausgenommen die Sekundärtexte, stehen dabei unter einer CC-BY-NC-SA-Lizenz. Nichtsdestotrotz verbleiben einige Desiderata, um den Blog weiter auszubauen. So fehlen bisher interaktive Elemente wie Hilfe-Tools und Austauschmöglichkeiten der User untereinander. Vor allem aber sind zu 32 Podcasts noch keine Quellenstellen ausgearbeitet, die den Podcasts passgenau zugeordnet werden können. Die Ergänzung dieser Quellenstellen, das Einwerben weiterer Sekundärliteratur und die Generierung weiterer Zusatzmaterialien wie Karten und Genealogien stellen daher den inhaltlichen Schwerpunkt der Weiterarbeit dar: Bis Ende des Jahres 2018 wird das *eManual Alte Geschichte* mit weiteren Mitteln der HOOU gefördert, sodass ab Anfang des Jahres 2019 der Blog überarbeitet und ergänzt veröffentlicht wird.

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