Off the Record:
On Studying Lost Arabic Books and their Networks

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In this paper we discuss the notion of Arabic literary works which, to the best of our knowledge, have been lost over the course of history. We examine factors contributing to the likelihood of transmission, address current interdisciplinary debates, and discuss digital tools applied to estimating the loss of literary heritage or to retrieving information on lost works. Our aim is to highlight the potential that bio-bibliographical works hold for the study of lost texts and manuscripts. Three possibilities are presented for studying lost books mentioned in Ibn Abī Uṣaybiʿa's *History of Physicians* (*ʿUyūn al-anbāʾ fī ṭabaqāt al-aṭibbāʾ*), and these include the identification of lost works in bio-bibliografical reference works, the encoding of attestations for manuscripts written by the authors themselves, and the reconstruction of scholarly networks which contributed to a certain lost work. The examples discussed demonstrate the advantages prosopographical networks can offer if they include works and manuscripts. Therefore, we put a particular focus on the use of machine-readable assertions which involves encoding the claims and statements from primary sources in a format that enables computer systems to process and analyse them.

Keywords: Near East/Middle East, history of literature, biographical literature, networks, medie-val sciences, knowledge exchange, Arabic, lost literature, digital humanities, book history

Introduction

History of literature has always been hampered by the fact that it relies heavily, if not exclusively, on texts that have survived. Ultimately, our understanding of literary heritage is based on the fraction of sources that have been handed down, whether that was through coincidence or resulted from factors which facilitated the survival of a particular work. While it is difficult to take into account texts and books that have been forgotten over the course of time, it is still vital to consider knowledge that has not been transferred or has been lost, in order to grasp the exchange of ideas within a community.

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The seventh-century AH/thirteenth-century CE biographer Ibn Abī Uṣaybiʿa from Damascus tells us, for example, in his *History of Physicians* (*ʿUyūn al-anbāʾ fī ṭabaqāt al-aṭibbāʾ*) of a once well-known private library established by the emir and scholar al-Mubashshir ibn Fātik (fifth/eleventh century, Cairo) who – according to Uṣaybiʿa's informant – believed that his books »were more important than anything else that he possessed«.[1] His library comprised a large number of manuscripts likely covering the subjects of his interest, which were medicine, astronomy, mathematics, logic, and philosophy. Ibn Fātik may be considered a key figure in the intellectual scholarly networks in fifth-century/eleventh-century Egypt. He fostered close relationships and studied together with renowned scholars such as the mathematician and astronomer Ibn al-Haytham (d. 430/1039), the court physician and astrologer ʿAlī ibn Riḍwān (d. 452/1061), and the philosopher Abū l-Ḥusayn ibn al-Āmidī (fifth/eleventh century).[2] We may assume that Ibn Fātik's private library contained several works of these associates, but, when he died, »his wife, accompanied by her slave girls, betook herself to his library. She was resentful of the books because of the time he spent with them, all the while neglecting her. While lamenting him, she and the servant girls threw the books into a big pool of water in the courtyard. The books were subsequently retrieved from the water, but by then most of them had become waterlogged.«[3]

The severe damage to Ibn Fātik's library, among other circumstances, may have contributed to the fact that only about 23 of more than one hundred texts written by Ibn Fātik's close friend ʿAlī ibn Riḍwān have been handed down to us today.[4] Furthermore, only one of Ibn Fātik's own works survived the fate of history, but it quickly became a bestseller in medieval Europe.[5] *The Book of the Choicest Maxims and Best Sayings* (*Kitāb mukhtār al-ḥikam wa-maḥāsin al-kalim*), a compilation of 20 biographies of wise and prophetic figures, was translated into at least four European languages and cited extensively.[6] Gerard of Cremona (d. 1187), for example, used this source for the introduction of his translation of Ptolemy's *Almagest*.[7]

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1   Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al.*, §14.23.2.

2   Note that this cannot be the Sayf al-Dīn Abū l-Ḥasan al-Āmidī (d. 631/1233) mentioned in the recent edition of Ibn Abī Uṣaybiʿa's work (see §14.23.1 n. 4), since Sayf al-Dīn lived about 150 years after Ibn Fātik. Langermann (One ethic for three faiths, 200) states furthermore that Abū l-Ḥusayn ibn al-Āmidī was in close contact with ʿAlī ibn Zurʿa (d. 398 / 1008).

3   Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbá*, ed. and trans. Savage-Smith *et al.*, §14.23.2.

4   See also Seymore, *The Life of Ibn Riḍwān*, 22.

5   Cottrell, al-Mubashshir ibn Fātik, 815-818.

6   For an edition of this treatise, see Ibn Fātik, *Mukhtār al-ḥikam wa-maḥāsin al-kalim*, ed. ʿAbd al-Raḥmān Badawī.

7   Cottrell, al-Mubashshir ibn Fātik, 815-818.

Ibn Abī Uṣaybiʿa's report about the bibliophile Ibn Fātik is one of many examples which allow us to trace the history of texts that were once well known but are to our knowledge not witnessed in any extant manuscripts. In his extensive history of medicine, Ibn Abī Uṣaybiʿa summarises the interactions of more than 450 physicians along with their social environment and almost 4,000 work titles connected to them. For modern researchers, the basic use of historical bio-bibliographical works such as this has so far been mostly limited to finding a scholar's biography and citing additional information on their life and works.[8]

If, however, narrative descriptions are turned into machine-readable data, more in-depth analyses and answers to specific questions (such as, »Who owned a certain lost work?«) may be possible. In this paper, we contemplate the problem of lost Arabic manuscripts, address a variety of interdisciplinary approaches to tackle the issue, and present three options for studying lost texts in bio-bibliographical reference works.

Factors Influencing the Likelihood of Transmission

As Arnold Esch highlighted in his pioneering article, it should be noted that there is a certain element of randomness of transmission (*Überlieferungs-Zufall*) which stands in contrast to the likelihood of transmission (*Überlieferungs-Chance*).[9] *Überlieferungs-Zufall* is unpredictable in that it can cause the disappearance of important literary works like Homer's *Margites*, or the survival of a writing exercise or a shopping list which was never intended to be transmitted. However, contrary to the randomness of transmission, likelihood of transmission can be estimated as dependent on a number of different factors, which often work in conjunction with each other in effecting the disappearance of a text or its survival. Thomas Haye conducted an extensive examination focusing on the causes and patterns of non-transmission of medieval Latin literature.[10] However, we currently lack comparable research on the transmission of texts from the region of the Middle East and North Africa. Despite the significant attention paid to certain brief and impactful events, such as book burnings, which are often seen as symbolic of the loss of literary transmission, the gradual neglect of libraries is an underestimated factor that can have a far more severe impact on the continuity of a literary tradition. A brief discussion will be given here of eight aspects relating to the transmission of manuscripts and texts to highlight some of the dynamics most relevant to those produced in the Near and Middle East.[11]

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8   See studies and methodological approaches suggested by Romanov, Developing text-mining techniques, and Romanov, Algorithmic analysis of biographical collections.

9   See Esch, Überlieferungs-Chance und Überlieferungs-Zufall, 529-570.

10   Haye, *Verlorenes Mittelalter*.

11   Research in this field has so far particularly been conducted by medievalists. Some outstanding examples are a short overview by Bourgain and Light, *Bestsellers*; Regazzoni (ed.), *Schriftlose Vergangenheiten*; and Kühne-Wespi, *et al.* (eds.), *Zerstörung von Geschriebenem*. In the field of European studies, there is Grafton and Blair (eds.), *Transmission of Culture*.

1) To begin, there are issues relating to materials. Paper is often more vulnerable than parchment, which can be washed or scraped and reused. On the other hand, insects prefer parchment over paper. Therefore bindings were often treated with adhesives[12] to ward off insects, especially the larvae of beetles – commonly referred to as »bookworms«. Paper of thicker and higher quality often had a longer life than books of lower quality, for example those comprised of paper with splitting layers of pulp (*démariage*).[13] Slow burning and the corrosion of metallic gall inks is unfortunately another common cause of the destruction of many manuscripts. While manuscripts written with gall inks may still be readable after immersion in water (as was the case with those of Ibn Fātik's books which were still witnessed by Ibn Abī Uṣaybiʿa), humidity and mould will over time accelerate the deterioration of the paper. Dry climates and deserts, on the other hand, create ideal conditions for the long survival of written artefacts.

2) The circumstances of conservation and the efforts employed to preserve cultural heritage of course play a crucial role for the lifespan of a book. Of particular interest for cultural studies are old preserved repositories like genizahs or storage areas in mosques (such as the famous Qubba of Damascus) which preserved documents and letters whose transmission would otherwise be very improbable.[14] Furthermore, it is important to highlight that works are especially susceptible to the risk of being lost shortly after their creation. The wider their distribution and incorporation into private and institutional collections, the higher the likelihood of their preservation over time. Within libraries, books are entrusted to the care of librarians whose responsibilities encompass both safeguarding literature and engaging in a selection process influenced by various factors. These factors include considerations of usefulness, the social status of the author, aesthetics, literary trends, and even political and religiously motivated criteria.[15] Even though neglect and mismanagement of libraries has, in comparison to brief stirring events (such as environmental disasters), received little attention in society, it has led to the loss of many valuable collections and should not be underestimated. Richard Ovenden, for example, highlights the creeping neglect that led to the gradual destruction of the famous library of Alexandria in antiquity.[16]

3) Whether books are transmitted or not may depend on the use of a text and consequently its format. For example, beautifully illustrated manuscripts of the Quran, often commissioned or acquired at high cost, and treated and stored with particular caution or even reverence, are not necessarily more likely to survive than books serving a practical purpose. Cutting the codices into separate folios or removing miniatures and illuminations can bring higher financial profit to later owners who decide to sell the manuscript as pieces. Similarly, small pamphlets or booklets which were carried around more frequently were naturally susceptible to damage. We can think of the library of Muwaffaq al-Dīn ibn al-Muṭrān (d. 587/1191), which allegedly comprised about ten thousand books, most of which he had copied in

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12 Gacek, *Arabic Manuscripts*, 187. Pastes to keep worms away were mostly produced with aloe, wormwood, or colocynth.

13 This terminology on »splitting« paper was used by François Déroche at a summer school at San Lorenzo de El Escorial in June 2019.

14 Further examples of preservation through conservation efforts in antiquity are the Dead Sea Scrolls found in the Qumran Caves. For a thorough study on the Damascene Qubba, see D'Ottone Rambach *et al., Damascus Fragments.*

15 See Haye, *Verlorenes Mittelalter*, 125-137.

16 Ovenden, *Bedrohte Bücher*, 56.

single volumes »on small-format paper, one-sixteenth the size of Baghdādī paper[17] [since] he would never leave his house without a book in his sleeve, which he would read at the gate of the Sultan's palace or wherever else he might go«.[18] However, to our knowledge, none of Ibn al-Muṭrān's miniature books survived and it has long been assumed that only Quran manuscripts were produced in such small formats. Furthermore, less wealthy readers kept unbound manuscripts or practised the habit of loaning single quires to others, which caused the distortion of works.

4) The context in which a text circulates can also have a significant impact on the quantity and types of copies it generates. For instance, within a scholarly environment, there is a tendency to produce specific texts that are created or promoted by the teaching staff. In Samarqand, Qāḍī Zāda al-Rūmī (d. 840/1436) authored an astronomical textbook, which today is extant in over 300 manuscript copies in Turkish libraries alone.[19] In the same scholarly setting, al-Fanārī (d. 834/1431), an Ottoman theologian and legal scholar, even granted his students one day off each week, allowing them to dedicate time to copying relevant texts.[20] However, such an environment can also give rise to texts that are mere summaries or personal notes, not originally intended for widespread dissemination.

5) Transmission may hinge on a reader's preferences or the value that a certain culture attributes to particular books. If a culture keeps producing vast numbers of literary works, which books are given preference when it is to be determined what to preserve? ʿAlī ibn Riḍwān advises keeping only a smaller number of important books:

> I prefer to concentrate on the following: five books of belles-lettres (*adab*), ten books on Sharia, the books of Hippocrates and Galen on the art of medicine and related topics, such as Dioscorides' *The Book of Herbs*, the books of Rufus, Oribasius, Paul and al-Rāzī's *The Comprehensive Book*. Of books on agriculture and pharmacology there are four; of technical books (*kutub al-taʿālīm*), the *Almagest* and its introduction and whatever else is useful, as well as »The Four Books« of Ptolemy. Of books by sages (*kutub al-ʿārifīn*), there are books by Plato, Aristotle, Alexander, Themistius, and Muḥammad al-Fārābī, and whatever else may be of use.
> Other books I either sell at any price I can get or I store in cases; however, selling them is better than storing them.[21]

As we see, there is here a particular interest in keeping the books of famous Greek scholars. However, ʿAlī ibn Riḍwān decides not only to keep books featuring the translations of important Greek texts but also other literature useful for their study, such as an introduction to Ptolemy's *Almagest*. This leads us to another factor influencing a work's survival.

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17 Muwaffaq al-Dīn's miniature books were thus not much bigger than 69×45 mm. According to Gacek (*Arabic Manuscripts*, 192), Baghdādī paper designated a sheet of paper in the largest size (1099×733 mm), but the paper may also have had a particular high quality. See Bosch *et al.*, *Islamic Bindings & Bookmaking*, 30-31; Bloom, *Paper before Print*, 53-55.

18 Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al.*, §15.23.4.

19 İhsanoğlu, *Osmanlı astronomi literatürü tarihi*, 8-20.

20 van Ess, *Die Träume der Schulweisheit*, 101.

21 Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al.*, §14.25.2.

6) Everything spawning additional works has a higher chance of survival.[22] We can almost certainly say that classical astronomical literature was studied through commentaries guiding a reader's interpretation more than through the original works. Some outstanding examples are Naṣīr al-Dīn al-Ṭūsī's (d. 672/1274) recension of the *Almagest*, ʿAlī ibn Riḍwān's commentary on the *Tetrabiblos*, and the commentary of Abū Jaʿfar (i.e., Ibn al-Dāya, d. 264/878) on the Pseudo-Ptolemaic *Centiloquium*. The numbers of these commentaries are overwhelming in comparison to the texts on which they are based. But even though the texts were primarily studied in the form of commentaries, there was a strong interest in preserving the basic texts, even leading scribes to feel compelled to recreate the original works (or what they assumed to be the original works). Thus, we learn that the copyist al-Bughāyrī from Harand in Khorasan extracted Ptolemy's quotes from a commentary when he made a copy of the *Tetrabiblos*,[23] and Emanuele Rovati observes that the extant Arabic witnesses of the *Centiloquium* were (almost) exclusively created through the extraction of literal quotes from its commentaries.[24] In some cases, this further demonstrates that agents witnessing the loss of manuscripts intervened in the imminent decline of a manuscript tradition they considered indispensable.

7) Additional factors in the transmission of texts are patronage and censorship. Financial support for the enhancement of a scholarly environment is certainly a factor that contributes to a blooming literary production. It facilitates the dissemination and transmission of specific works and authors, sometimes at the cost of others. Censorship is similarly directed at individual genres and authors, but can, on occasion, lead to an effect opposite to the original intention. Indeed, in some cases, it seems to have sparked renewed interest in a particular genre. When, for example, »[a]l-Manṣūr [i.e., Yaʿqūb Abū Yūsuf] decided that no book of logic and philosophy should remain in his lands, and many were burnt«,[25] the teacher al-Ḥafīd Abū Bakr smuggled in a book of logic and read it with his students which led to renewed interest in the topic.[26]

8) Nonetheless, the destruction of cultural heritage caused through wars or political upheaval as well as by theft is a major factor that contributes to the loss of literature.

In contemplating such multiple effects contributing to the loss or survival of Arabic books, we ask with Arnold Esch: »What, then, is a historian to do?«[27]

If we consider recent publications, we can see that the problem has been addressed from different perspectives involving methods borrowed from various fields such as ecology, computational sciences, and material studies. In the following we briefly summarise a number of promising approaches and refer to some projects that have applied them.

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22   See also Esch, Überlieferungs-Chance und Überlieferungs-Zufall, 541.

23   Löhr, MS Tehran, Kitābkhāna-yi Millī-yi Īrān.

24   Ongoing research by Emanuele Rovati, *pers. comm.*, July 2020. See also Rovati, *Pseudo-Ptolemy*.

25   Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al.*, §13.63.5.

26   Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbā* ed. and trans. Savage-Smith *et al.*, §13.63.6.

27   Esch, Überlieferungs-Chance und Überlieferungs-Zufall, 569.

Researchers Approaching Lost Manuscripts, Books, and Texts

The notion of »lost works« is not necessarily meant to indicate that such texts do not exist anymore, but rather that we are currently unaware of any surviving copies. Thanks to a number of research projects addressing manuscript and cataloguing activities, hitherto unknown or lost treatises have been found in private libraries as incorrectly titled codices or as overlooked parts of multiple-text manuscripts. Furthermore, fragments of texts (especially commentaries) reappear when attention is paid to marginal and interlinear annotations, inserted leaves, and palimpsests. In any case, a work which appears to have failed to be transmitted is either really lost or very rare and so is worthy of our attention whether or not it may some day be partially or fully rediscovered.

Here some projects can be highlighted that have greatly contributed to uncovering evidence of works which were believed to be lost or previously unknown. For individual treatises, the study and examination of text fragments may be profitable. This concerns physical fragments on the one hand, but also textual fragments transmitted in the margins of a codex or as quotes in other sources. The »Lost Manuscripts« project is compiling a catalogue of manuscript fragments, most of which appeared recycled in later book covers or bindings.[28] The project introduced a new term for the conceptualisation of lost manuscripts with a traceable existence: »manuscripts of Babel« which refers to manuscripts existing »in a virtual space, in a no-place« (similar to the term »Utopia« applied to manuscripts in anonymous private possession).[29] I decided against the use of the term »manuscripts of Babel« in this paper for two main reasons. First, »Babel« as a place of historical, religious, or fictional longing may promote unnecessary romanticisation and mystification where our goal should be shedding light on lost works in order to understand their dissemination and reception. Second, in my opinion the metaphor does not work very well. Such fragments and pieces of information may be understood as the remains of a destroyed Tower of Babel, but the project also points out that the term refers to Luis Borges' literary masterpiece »La biblioteca de Babel«.[30] The novel demonstrates the idea of a library in which everything exists (and at the same time very little makes sense); Borges' books feature everything that was written and that will ever be written. But the number of lost Arabic books is not endless, and with sufficient research it is possible to get at least a rough impression of what was written where and when.

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28   www.lostmss.org.uk (accessed on 17 June 2022); principal investigator: Dr. David Rundle, University of Kent, UK, Centre for Medieval and Early Modern Studies.

29   See Why Babel, on the Lost Manuscripts website, www.lostmss.org.uk/project/why-babel (accessed on 17 June 2022).

30   A tale of a universe in a never-ending library comprised of books that contain every possible combination of letters. In 2012, Jonathan Basile based on the short story's idea a computer algorithm for the creation of a digital Library of Babel containing all possible pages of 3,200 characters, about 10^{4677} books (libraryofbabel.info, accessed on 17 June 2022).

Material studies and spectral imaging can reveal texts on parchment that have been washed or scraped off to make parchment reusable. Here we may refer to the »Sinai Palimpsest Project« which is one of the few projects that study lost texts of non-Western scripts. It is examining thousands of palimpsest folios preserved at St. Catherine's Monastery by illuminating them with different wavelengths of light and subsequently processing the digital images. The palimpsest manuscripts preserved in the monastery feature ten languages and various scripts from different religious backgrounds. The research results can be accessed through a digital palimpsest library published in collaboration with the UCLA Library and the Early Manuscripts Electronic Library.[31]

The works of specific authors can on occasion be identified among texts without attribution if stylistic analyses are applied (i.e., stylometry). Hence hitherto unknown or lost texts can be attributed to their rightful authors. »Kallimachos: Zentrum für digitale Edition und quantitative Analyse« at the University of Würzburg applied stylometry for identifying the authors of anonymous medieval Latin translations from Greek and Arabic. By studying non-technical and non-disciplinary vocabulary, Dag Hasse and Andreas Büttner identified a number of textual markers individual to specific translators, which allowed for the identification of authors for several anonymous Latin treatises.[32]

If a researcher is interested in a general understanding of the size of a textual tradition, mathematical approximations for clever guessing of a manuscript tradition can deliver further insights. We will briefly highlight two examples for such methods.

Estimating the production of literature in the past and its survival
In February 2022, Mike Kestemont and colleagues published an article in *Science* which suggested the application of »unseen species models« to the survival of books.[33] To correct survivorship bias,[34] the team applied statistical analyses of rare species to the survival of culture. The research is based on a mathematical formula for the estimation of the number of classes in a population, originally presented by Anne Chao in 1984.[35] In simpler words: the authors treated manuscript copies as sightings of a rare species. The overall extant exemplars of the species in a given (cultural) ecosystem are then statistically estimated through the Chao1 method. Kestemont *et al.* conducted a case study for a number of heroic and chivalric fictional works preserved in Dutch, English, French, German, Icelandic, and Irish manuscripts. The researchers counted the handwritten documents and applied non-parametric methods to estimate the original richness of the text tradition.[36] They found that the cultural ecosystems of islands (Icelandic and Irish) showed lower loss rates in comparison to the continental manuscript heritage.[37]

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31 For a recent publicaton, see Rapp *et al.*, *New Light on Old Manuscripts*. For further information, visit sinaipalimpsests.org (accessed on 17 June 2022).

32 See also Hasse and Büttner, Notes on anonymous twelfth-century translations.

33 Kestemont *et al.*, Forgotten books, 765-769.

34 Survivorship bias occurs, for example, when the incomplete survival of cultural heritage and the study of a fraction of historic documents leads to incorrect conclusions about the actual artefacts produced in historic societies.

35 Chao, Non-parametric estimation, 265-270.

36 For details, see the formula provided by Chao, Non-parametric estimation, 265-270, and Kestemont *et al.*, Forgotten books, 765-769.

37 See also Table 1 »Point estimates of survival ratios in six traditions«, in Kestemont *et al.*, Forgotten books, 769.

Since social networks with fewer connections seemed to realise a more even distribution of manuscript copies per work, the copies were less susceptible to external forces, the authors argued. This highly unique and insightful approach may prove to be important in advancing manuscript studies and promotes, yet again, the advantages of interdisciplinary studies. It is my impression, however, supposing the assumptions of the model hold true for literary and not just biological ecosystems, that this approach can, at best, only provide a general rate of survival of manuscripts in a literary tradition without taking into account the factors mentioned above that disparately affect specific works or genres, as the formula is based on the random appearance of species (or manuscripts) assuming a linear development in the increase or decrease of cultural heritage. But in essence, transmission itself is inherently uneven. Although Esch warned against ahistorical quantitative models, stressing the importance of thoughtful application, the aforementioned approach can be powerful when employed cautiously, taking into account additional historical factors that may have influenced the transmission of manuscripts.

An interesting approach which considers the historical development of a manuscript tradition was presented in December 2022 by Camps and Randon-Furling, who observed resemblances between evolutionary biology and the transmission of manuscripts, prompting them to apply a stochastic model to texts.[38] In doing so, they argue, »[h]ow much was lost or preserved from all works of the past [...] can be described in terms of genetic drift and natural selection«.[39] Instead of working with statistical estimates alone, the researchers thus considered the philological model of a *stemma codicum*, treating it like the biological model of a phylogenetic tree. Where the stemma establishes – based on textual variants found in existing manuscript copies – which common ancestors of a text (i.e., manuscript copies) must have existed, the phylogenetic tree is similarly used to reconstruct the links between existing and extinct species. This approach features a crucial advantage over the Chao1 method in that it can not only calculate the probability of a tree (a work) being lost, but that it can also, for example, grasp the loss of full »branches«, whose existence can be postulated by determining the textual variants that prevail over others and thus reduce textual diversity in a manuscript tradition. The paper then presents some results obtained with a suggested stochastic model for the transmission of European manuscripts and, in consequence, is able to refine the results in Kestemont *et al*.

While we have seen that increasing attention is being paid to lost literature in a number of projects led by medievalists, and systematic attempts are being made to account for lost European manuscripts,[40] the histories of Near and Middle Eastern literature have for the most part received attention through individual case studies on specific works and are thus largely based on discoveries of text fragments. In the following we address the potential that bio-bibliographical reference works hold as an important source for the systematic study of lost Arabic texts.

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38 Camps and Randon-Furling, Lost manuscripts.

39 Camps and Randon-Furling, Lost manuscripts.

40 See furthermore the project »Books Known Only by Title: Exploring the Gendered Structures of First Millennium Imagined Libraries« at the Centre for Advanced Study of the Norwegian Academy of Sciences and Letters.

Reasons to Study Networks of Lost Texts

To acquire a better understanding of the likelihood of transmission (*Überlieferungs-Chance*) we consider manuscripts as carriers of texts that circulate in communities where life cycles of codices end, and the texts are transferred on new manuscripts (or not). This scenario is reflected in networks that continue to revolve around the texts; networks comprised of readers, owners, scribes, and so on.

Effects influencing the survival or disappearance of the works in this kind of network were mentioned above, but we can also claim that there is one factor that probably plays the most important role when it comes to the survival of a text: its dissemination at a relatively early stage. Whenever the dissemination of a text can be traced in several communities in different cultures and regions, it is far less likely that single factors such as an outbreak of fire in a library, war in a specific region and so on, will cause the disappearance of a work. It could be argued that the better disseminated a text, the longer its lifespan might be (or have been), and the more likely we are to find its traces in other sources that were produced around the time that the text in question was being circulated.

This is where networks become a crucial tool. While we know relatively little about lost texts, we still have many valuable resources at hand that allow us to reconstruct where and by whom a text was read (or who claims not to have read a certain text). Collecting information on books in fact comes down to a collection of information on provenance – information on past ownership, custody, and location. Such a reconstructed network around any literary work will never be complete, but it may assist a researcher in gaining insight into the minimum circulation of a text before its disappearance.

For single instances it is possible to collect and evaluate such information manually. With vast source material such as entire manuscript collections or bio-bibliographical reference works, however, digital prosopography can provide useful tools for a better and more detailed understanding of lost manuscript traditions.

Bibliographies and Their Limitations

Historical works, especially biographies (including autobiographies) and bibliographical treatises are not extant in numbers that rival those of the copies of works on theology.[41] As a result, researchers are often constrained to depend on valuable insights into these works from the accounts of a small number of well-known historical biographers, such as Ibn al-Nadīm (d. c. 384/994), Ibn al-Qifṭī (d. 646/1248), Ibn Abī Uṣaybiʿa (d. 668/1269 or 1270), and Bar Hebraeus (d. 685/1286). It is important to realise that when we talk about apparently lost titles mentioned in these biographical works, we are talking about already famous works, texts, and authors, well known enough to make it into one or another historical bio-bibliography. These are titles and figures which were intended to be remembered, and their inclusion in a bio-bibliographical book was further based on the compiler's preferences – meaning that possibly thousands of other works never made it into such a compilation.

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41 Bourgain and Light, *Bestsellers*, 9. Ibn Abī Uṣaybiʿa quotes the autobiographies of Ḥunayn ibn Isḥāq, Ibn Haytham, ʿAlī ibn Riḍwān (lost), and ʿAbd al-Laṭīf al-Baghdādī (lost), as also highlighted by Sánchez, Written sources, 89.

Despite this issue of the bibliographers' selection and preference of some authors over others, bibliographical works can provide a basic understanding about books that were lost in the following centuries. However, caution should also be exercised with regard to the titles that later biographers have unreservedly taken over from earlier bio-bibliographical works. Stefan Leder has pointed out that the discrepancy between extant literature and that listed in al-Nadīm's *Fihrist* is especially large for early works, up to the third/ninth century. On the one hand, this may mean that the mention of certain works in later bibliographies is no guarantee of their existence at the time of the composition of the reference work; on the other hand, there are reasons to hold reservations about the correctness of the information and thus about the existence of the early works mentioned in the *Fihrist*.[42]

Meticulous research enabled Ibn Abī Uṣaybiʿa in his *History of Physicians* (*ʿUyūn al-anbāʾ fī ṭabaqāt al-aṭibbāʾ*) to provide detailed bibliographic information on authors writing on medical topics, exceeding the number of works listed by Ibn al-Nadīm and Ibn al-Qifṭī.[43] It makes thus sense to choose Ibn Abī Uṣaybiʿa over the earlier biographers when working with networks, even if he noticeably omitted individual titles in some biographies, possibly because he could not confirm their existence. There is no doubt that Ibn Abī Uṣaybiʿa's detailed and multifaceted history offers a unique insight into the social networks which evolved around more than 450 famous scholars and the almost 4,000 works they wrote. Ibn Abī Uṣaybiʿa mentions scribes and collectors of books, scholars who studied together, and those who refuted each other's works.

A brief look at the individual chapters of the *History of Physicians* further allows us to grasp how comprehensive the information was that Ibn Abī Uṣaybiʿa gathered from his informants and libraries he visited. Since our focus lies on authors and works of the early Arabograph world, we concentrate here on chapters which deal with physicians spanning from the Early Abbasid period to Ibn Abī Uṣaybiʿa's lifetime.

Ibn Abī Uṣaybiʿa was born in Damascus, where he lived for many years; hence it is not surprising that he was able to list 60 physicians along with more than 600 works from Syria. Working in the Nāṣirī Hospital in Cairo certainly also made it easy for him to collect biographical data on Egyptian physicians.

But Table 1 also shows that Ibn Abī Uṣaybiʿa had heard of 88 renowned physicians who settled in the Maghreb, while only very little was known about the works these physicians produced (on average he cannot list more than two works per capita). On the other hand, he knows of relatively few physicians from Persia but can list about 25 works written by each Persian scholar. Even though some scholars may have written extensively while others produced few treatises during their lifetime, these numbers are mainly a reminder of the fact that we observe literary text production through the lenses of Ibn Abī Uṣaybiʿa who heavily relied on the bibliographical work of Ṣāʿid al-Andalusī (d. 462/1070).[44] We are consequently limited to the information he collected through his own personal networks and the books that were accessible in thirteenth-century Syria and Egypt.

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42   See Leder, Grenzen der Rekonstruktion, 22-23.

43   See Ibn al-Nadīm, *Kitāb al-Fihrist*, ed. Flügel, or the more recent edition published by the Al-Furqān Islamic Heritage Foundation: Ibn al-Nadīm, *al-Fihrist*, ed. Sayyid; Ibn al-Qifṭī, *Taʾrīḥ al-khukamāʾ*, ed. Lippert.

44   See al-Andalusī, *Kitāb ṭabaqāt al-ʾumam*, Spanish trans. Llavero Ruiz and Lorca *et. al.*

Table 1: The chapters of Ibn Abī Uṣaybiʿa's History of Physicians *that list physicians from the Early Abbasid period or later, together with the number of biographies and titles of works in each chapter.*

Chapter	Number of biographies	Number of titles
8. Syriac Physicians of the Early Abbasid Period	39	230
9. Physicians Who Translated Works on Medicine and Other Subjects from Greek into Arabic, and Their Patrons[45]	49	---
10. Iraqi Physicians and the Physicians of al-Jazīrah and Diyār Bakr	83	793
11. Physicians in the Lands of the Persians (*bilād al-ʿajam*)	24	594
12. Physicians of India	6	25
13. Physicians Who Were Prominent in the Western Lands and Settled there	88	200
14. Famous Physicians amongst Those in Egypt	58	408
15. Famous Syrian Physicians	60	619

Digital Prosopography and Texts – How to Shed Light on Presumably Lost Works

Digital editions of reference works are useful in many ways, especially if they are published under a Creative Commons licence that allows their re-use. The »Communities of Knowledge« project applied encoding processes and linking of entities to a digital edition of Ibn Abī Uṣaybiʿa's *History of Physicians*, produced by Emilie Savage-Smith, Simon Swain, and Geert Jan van Gelder as *A Literary History of Medicine*.[46] We aimed to create a dataset that would allow for the observation of individual scholars from different viewpoints within the framework of the historical reference work. A user could then visualise and study individual networks of a specific target group, based on desired parameters.

This required a shift from the narrative descriptions of a bio-bibliographical collection to structured, machine-readable data.[47] I will roughly describe the process that was used in order to later allow for the evaluation of the dissemination of a literary work.[48] The team of »Communities of Knowledge« used the source text in TEI-XML (Text Encoding Initiative Extensible Markup Language) format and its indices to produce a dataset that constitutes the basis for network visualisation and analyses. All necessary entities (names, works, places) were tagged in this process and received stable URIs as identifiers. Additionally, so-called »factoids« with a specific focus on relations between individuals (and in this case also between individuals and works) received stable URIs.

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45 In this chapter, Ibn Abī Uṣaybiʿa primarily assesses the quality of the translation performances and provides only very few titles. Therefore, it is unnecessary to present the number of works here.

46 Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al*. For the edition of the Arabic text, see vols. 2-1 and 2-2, for the annotated English translation, see 3-1, 3-2, 3-3. Please note that the transliteration applied by the editors differs slightly from our own and was not changed in the quotes and tables provided throughout this paper. We are grateful to Prof. Savage-Smith for the information she provided during the early stages of the project.

47 See Schwartz *et al.*, Modeling a born-digital factoid prosopography, §4.

48 For a more detailed description of this process, see Gibson and Schmahl, Communities of knowledge, in this volume (doi.org/10.1553/medievalworlds_no18_2023s$$$).

In a factoid-based approach, it is possible to encode a researcher's interpretation of a primary source. Here we benefit from standards established by Daniel Schwartz, Nathan Gibson, and Katayoun Torabi.[49]

The term factoid was applied by a group of researchers at King's College,[50] who pioneered prosopography in a relational database. »Factoids capture assertions made in primary source texts and not necessarily confirmed truths about the past. The factoid approach to prosopography thus captures the scholar's interpretation of what a historical source asserts about persons.«[51] In this manner it is possible to encode more complex pieces of information, which the researcher may put into a relational database, creating a nexus of relationships between the pieces.[52] In general, we encoded three kinds of factoids:

- Person factoids (using the TEI »person« element) encode a variety of information related to an individual like ethnicity, education, gender, or birth dates. Encoding this kind of data as factoid is most useful whenever a simple tag does not suffice and an interpretation by the researcher is desired. This may, for example, apply to the instance in which ʿAlī ibn Riḍwān's date of birth (or a possible timespan) can only be retrieved from the planetary constellation given for the time of his birth.[53]
- Event factoids (using the TEI »event« element) capture relevant events in the source text which may later be displayed in a timeline or juxtaposed with other events.
- Relationship factoids (using the »relation« element) can encode many kinds of relations between people (and, in our approach, between people and works).

While early approaches to digital prosopography focused on a relational database for modelling prosopographical factoids, the »Communities of Knowledge« project (drawing from the project »Syriac Persons, Events, and Relations – SPEAR«[54]) implements a TEI model for prosopographical factoids. To give a practical application, we go back to our example from the introduction:

> When al-Mubashshir ibn Fātik died, may God have mercy upon him, his wife, accompanied by her slave girls, betook herself to his library. She was resentful of the books because of the time he spent with them, all the while neglecting her. While lamenting him, she and the servant girls threw the books into a big pool of water in the courtyard.[55]

If we wish to trace the dynamics of a social networks and want to encode the relationship between Ibn Fātik and his wife expressed in this quotation, a non-mutual relationship factoid with an @active and a @passive participant, we choose the @ref attribute »enmity-for«, in the taxonomy we have defined in collaboration with Syriaca.org. The fully encoded factoid according to our standards is:

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49 See Schwartz *et al.*, Modeling a born-digital factoid prosopography, §4.

50 Centre for Computing in the Humanities, now Department of Digital Humanities.

51 Schwartz *et al.*, Modeling a born-digital factoid prosopography, §5.

52 For recent studies and the technical development of the factoid approach, see Bradley, A prosopography as Linked Open Data, and Pasin and Bradley, Factoid-based prosopography and computer ontologies.

53 For this example, see Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al.*, §14.25.1.

54 syriaca.org/spear/index.html (accessed on 25 February 2023).

55 Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbā* , ed. and trans. Savage-Smith *et al.*, §14.23.2.

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            <rs ref="https://usaybia.net/person/2553">Ibn Fātik's influential wife</rs>
            together with her female slaves damaged the books of
            <persName ref="https://usaybia.net/person/1589">Ibn Fātik</persName>.
          </desc>
        </relation>
    </listRelation>
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    </bibl>
</ab>
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Figure 1: An example factoid with @ref attribute »enmity-for« encoded in TEI.

By employing this approach, the historian's interpretations of a narrative source are transformed into machine-readable assertions. It is important to note that these assertions may occasionally conflict with one another and should be regarded as research tools rather than definitive research outcomes. The information can then be stored in a well-organised spreadsheet or database. Additionally, the open-source web application Srophé, which powers both Syriaca.org and Usaybia.net, facilitates the generation of RDF (Resource Description Framework) from TEI to make it more friendly to semantic web applications.[56] In our particular case, we exported the information as a TSV (tab-separated values) document using XSL (Extensible Stylesheet Language).[57] We limited our taxonomy creation and factoid encoding to aspects relevant to specific research questions, such as the circulation of books. When the focus is shifted from individual scholars of a network to texts and manuscripts produced within this network, we can trace the minimum circulation of well-known works as well as lost books with respect to temporal, regional, or culturally shaped viewpoints and carefully suggest which closely collaborating scholars might have been aware of a certain work. Factoid-based encodings can (depending on the time invested) only be conducted for a limited part of the source text, but can be visualised against the backdrop of the persons, places, and works tagged throughout chapters 8-15 of the text. If desired, the networks can easily be extended with the addition of encoded factoids from other sources such as further bio-bibliographical works like those of Ibn al-Nadīm or Ibn al-Qiftī.

The Potential of Bio-Bibliographies
Lists of Works – Grasping the Lost and the Extant
The first suggested potential way of using data that emerges from machine-readable reference works is to inventory lost texts, but this unfortunately still lies out of reach for researchers at the moment. Since bio-bibliographical works often comprise structured lists of works, the obviously great potential they offer is to deliver an overview about works which, to the best of our knowledge, existed at a certain point in history. Comparing these titles to an overview of existing works would take historians a big step forward in better understanding the loss of treatises in the transmission process. However, this is quite difficult to achieve, for several reasons: (1) while general encyclopaedias on Arabic literature exist,[58] we are well aware of the fact that these are incomplete and should be updated by surveying as many manuscript catalogues as possible; (2) both the data extracted from bio-bibliographical reference works and an overview of existing Arabic literature need to be machine-readable and the data need to be compatible; (3) the titles of works mentioned in the reference work have to be matched with the corresponding titles in the dataset of existing works, that is, the data need to be normalised, requiring some manual adjustment by researchers.

The objective of identifying lost works in bio-bibliographical reference works may appear farfetched at first glance, but future databases could bring us considerably closer to a better understanding of the loss of literature. One of the main research outputs of Bibliotheca Arabica,[59] for example, is a digital database, *Khizana*,[60] which integrates modern catalogue data, as well as historical catalogues and collections of manuscript notes. The platform aims to combine a curated compilation of bio-bibliographical sources and Linked Data collections. This could make it significantly easier for future projects endeavouring to identify exactly those works which appear in the bibliographies of Ibn al-Nadīm, Ibn al-Qifṭī, or Ibn Abī Uṣaybiʿa but are absent from even the most important and most comprehensive manuscript catalogues.

Readers and Owners of Manuscripts
While Ibn Abī Uṣaybiʿa was writing his *History of Physicians*, he visited a large number of private as well as institutional libraries, and at times he even indicated when he came across individual manuscripts in the handwriting of a specific scholar or scribe. His reports on his meticulous search for titles and works can hence also serve as a valuable attestation for important manuscripts or even autographs that were still extant in the thirteenth century.

I encoded these relations as »reader-of-handwriting-of« factoids, which encompasses a broader scope than would have been possible by using more restricted vocabulary, such as »reader-of-autograph«. An example of this can be seen in the following factoid:

58　Such as Brockelmann, *Geschichte der arabischen Litteratur*, and Sezgin, *Geschichte des arabischen Schrifttums*.

59　»Bibliotheca Arabica – Towards a New History of Arabic Literature«, based at the Saxon Academy of Sciences and Humanities in Leipzig (Germany) is a long-term research project dedicated to the history of Arabic literature with a focus on manuscript studies. On this project, see Brinkmann and Löhr, Bibliotheca Arabica, 197-206.

60　*Khizana*, accessed on 9 June 2023: khizana.saw-leipzig.de.

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      <desc>
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        <persName ref="https://usaybia.net/person/1136">Abū l-Faraj ibn al-Ṭayyib</persName>'s
        commentary <rs ref="https://usaybia.net/work/2620">Tafsīr K. Aghlawqun li-Jālīnūs</rs>
        which was authorised in his own handwriting in the
        <placeName ref="https://usaybia.net/place/8">ʿAḍudī Hospital in Baghdad</placeName> on
        <choice>
          <reg>
            <date when="1010-04-28" calendar="#julian">28 April 1010</date>
          </reg>
          <orig>
            <date when="0400-09-11" calendar="#hijri">11 Ramaḍān in the year 400</date>
          </orig>
        </choice>.
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            active="https://usaybia.net/person/926" passive="https://usaybia.net/person/1136"/>
        </listRelation>
      </desc>
    </event>
  </listEvent>
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  </bibl>
</ab>
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Figure 2: Factoid encoding a »reader-of-handwriting-of« relation including a date element.

We learn that Ibn Abī Uṣaybiʿa claims to have seen manuscripts in the handwriting of 30 scholars, most of whom lived in eleventh- to twelfth-century Egypt and Syria. In some instances, he was able to access copies which date back to the tenth or even the ninth century, which makes Ibn Abī Uṣaybiʿa an important witness of the early manuscript traditions. He copied, for instance, from Khalaf al-Ṭūlūnī's (fl. 302/914) autograph[61] and saw the original version of al-Fārābī's (d. 338/950) *Kitāb al-qiyās al-ṣaghīr*. Ibn Abī Uṣaybiʿa even claims to have seen several books in the handwriting of Ḥunayn ibn Isḥāq (d. 260/873):

> I – Ibn Abī Uṣaybiʿah – add here that Ḥunayn's secretary was a man by the name of al-Azraq. I have seen many of the works of Galen and other authors in his handwriting, some of them with annotations in Greek in Ḥunayn's handwriting, and those books bore the seal of al-Maʾmūn.[62]

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61 The autograph has the title K. *al-nihājah wa-l-kifāyah fī tarkīb al-ʿaynayn wa-khilqatihimā wa-ʿilājihimā wa-adwiyatihimā*; Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al.*, §15.1.5 (no. 14).

62 Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith et al., §8.29.6. Note that as a translation for the Arabic word *ʿalāma*, »seal« is likely wrong; this may rather have been a standardised signature. Seals are only transmitted from later periods. I am grateful to Boris Liebrenz for his opinion on this matter.

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        <persName ref="https://usaybia.net/person/926">Ibn Abī Uṣaybiʿa</persName> saw
        manuscripts with Greek annotations in the handwriting of <persName
        ref="https://usaybia.net/person/899">Ḥunayn ibn Isḥāq</persName>. These books also
        had a seal of caliph <persName ref="https://usaybia.net/person/1497">al-Maʾmūn</persName>.
      </desc>
    </relation>
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  </bibl>
</ab>
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Figure 3: A »reader-of-handwriting-of« factoid encoding the relationship between Ibn Abī Uṣaybiʿa and manuscripts annotated by Ḥunayn ibn Isḥāq.

Yaḥyā ibn ʿAdī (d. 363 / 974) reports that al-Maʾmūn (r. 198-213 / 813-833) paid Ḥunayn for his translations in gold and by weight. From Ibn Abī Uṣaybiʿa, who transmits Ḥunayn's auto-biography, we learn that the scholar would on other occasions translate free of charge even for his adversaries to prove his good will, whereas previously he had received a purse of silver dirhams equal in weight to the translated work. This apparently compelled him to produce thick and heavy codices, which Ibn Abī Uṣaybiʿa could apparently purchase:

> I have found large numbers of these works, and have purchased a good many of them. They are written in *muwallad* Kūfic script in the handwriting of al-Azraq, Ḥunayn's secretary. The letters are written very large, with broad strokes, and the lines are wide-ly spaced. The paper is very heavy, being three or four times as thick as the paper manufactured nowadays, while the sheets are trimmed to about one third the size of a sheet of Baghdādī paper. Ḥunayn had his works published in that fashion to make them bulkier and increase their weight, inasmuch as he was paid weight for weight in silver dirhams. It is thus clear that he used that particular type of paper deliberately.[63]

Interestingly, a manuscript preserved in the University Library of Tehran[64] transmits a col-ophon for Ḥunayn ibn Isḥāq's *Ādāb al-falāsifa* which attributes the copy to Ḥunayn him-self and dates it Dhū al-Ḥijja 249 / January-February 864. The large and widely spaced Kufic script on thick oriental paper clearly fit the criteria described by Ibn Abī Uṣaybiʿa. However, recent radiocarbon dating of the manuscript suggests an origin between 1526 and 1796 and confirms earlier suspicions of palaeographers.[65] The Tehrān codex was not copied by Ḥunayn, but clearly imitates his original style and was thus inspired by the tales or was truly copied from an autograph.

Overall, we can compile a list of manuscripts and works in the handwriting of several scholars which were read by Ibn Abī Uṣaybiʿa and thus still extant in thirteenth-century Damascus; see Table 2.

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63   Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al.*, §8.29.2.

64   MS Tehran, Kitābkhāna-yi markazi-i Dānishgāh-i Tehrān, 2165.

65   Aghaei *et al.*, Radiocarbon dating of manuscripts, 6-7 and 12.

Table 2: Well-known scholars whose handwriting Ibn Abī Uṣaybiʿa claimed to have seen in manuscripts, together with the work in question (where he indicated this).[66]

Author/Scribe	Work*
Muwaffaq al-Dīn ʿAbd al-Laṭīf ibn Yūsuf al-Baghdādī (usaybia.net/person/32)	
Abū l-Faḍl ibn ʿAbd al-Karīm al-Muhandis (usaybia.net/person/153)	Galen's Sixteen Books
Abū l-Khaṭṭāb (usaybia.net/person/254)	
Abū Sahl al-Masīḥī (usaybia.net/person/334)	*K. iẓhār ḥikmat allāh taʿālā fī khalq al-insān* (ID: Work 3728)
ʿAlī ibn Sulaymān (usaybia.net/person/480)	*K. al-amthilah wa-l-tajārib wa-l-akhbār wa-l-nukat wa-l-khawāṣṣ al-ṭibbiyyah* (ID: Work 1663)
ʿAlī ibn Sulaymān (usaybia.net/person/480)	*K. al-taʿālīq al-falsafiyyah* (ID: Work 1664)
al-Azraq (usaybia.net/person/600)	
al-Badīʿ ʿAbd al-Razzāq ibn Aḥmad ibn al-Khiḍr al-ʿĀmirī (usaybia.net/person/603)	
al-Bayyāsī, Amīn al-Dīn Abū Zakariyyā Yaḥyā ibn Ismāʿīl al-Andalusī (usaybia.net/person/642)	
Bulmuẓaffar ibn Muʿarrif (usaybia.net/person/659)	a commentary of Alexander on Aristotle's *Generation and Corruption*
Fakhr al-Dīn al-Rāzī (usaybia.net/person/762)	
al-Fārābī, Abū Naṣr (usaybia.net/person/765)	*K. al-qiyās al-ṣaghīr* (ID: Work 985)
al-Ḥasan ibn al-ʿAbbās (usaybia.net/person/846)	
Ḥunayn ibn Isḥāq (usaybia.net/person/899)	*R. fīmā aṣābahū min al-miḥan wa-l-shadāʾid* (ID: Work 3046)
Ibn Abī Ṣādiq al-Nīsābūrī (usaybia.net/person/923)	*S. kitāb manāfiʿ al-aʿḍāʾ li-Jālīnūs* (ID: Work 3952)

66 Usaybia.net URIs for works (e.g., usaybia.net/work/1664) are preliminary and based on the items mentioned in Ibn Abī Uṣaybiʿa's lists (see Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al.*), – they do not resolve to a web page and could be revised in the course of further work. Therefore, we have indicated IDs rather than URIs here.

Ibn al-ʿAynzarbī (usaybia.net/person/939)	
Ibn Jazlah (usaybia.net/person/1012)	
Ibn al-Muṭrān (usaybia.net/person/1070)	
Ibn al-Naḥḥās, Muwaffaq al-Dīn Hibat Allāh Abū l-Qāsim ibn ʿAbd al-Wahhāb ibn Muḥammad ibn ʿAlī al-Kātib (usaybia.net/person/1075)	
Abū l-Faraj ibn al-Ṭayyib (usaybia.net/person/1136)	*Tafsīr K. Aghlawqun li-Jālīnūs* (ID: Work 2620)
Abū l-Faraj ibn al-Ṭayyib (usaybia.net/person/1136)	*M. amlāhā fī jawāb mā suʾila ʿanhu min ibṭāl al-iʿtiqād fī l-ajzāʾ allatī lā tanqasim* (ID: Work 2643)
Ibn al-Tilmīdh (usaybia.net/person/1140)	
Jamāl al-Dīn (Ibn al-Jammālah) (usaybia.net/person/1314)	*Al-M. al-Nāṣiriyyah fī ḥifẓ al-umūr al-ṣiḥḥiyyah* (ID: Work 1142)
al-Jilyānī (usaybia.net/person/1339)	
Abū ʿAlī al-Ḥasan ibn ʿAlī ibn Ibrāhīm al-Juwaynī al-Kātib (usaybia.net/person/1355)	
Khalaf al-Ṭūlūnī (usaybia.net/person/1378)	*K. al-nihājah wa-l-kifāyah fī tarkīb al-ʿaynayn wa-khilqatihimā wa-ʿilājihimā wa-adwiyatihimā* (ID: Work 5001)
Muhadhdhab al-Dīn ibn al-Naqqāsh (usaybia.net/person/1596)	*K. bustān al-aṭibbāʾ wa-rawḍat al-alibbāʾ* (ID: Work 1141)
Muḥammad ibn Aḥmad ibn Ṣāliḥ al-ʿAbdī (usaybia.net/person/1612)	
Ṣadaqah ibn Manjā ibn Ṣadaqah al-Sāmirī (usaybia.net/person/1943)	
Saʿīd ibn Hibat Allāh ibn al-Ḥusayn (usaybia.net/person/1969)	*K. al-Talkhīṣ al-Niẓāmī* (ID: Work 2768)
Yūsuf ibn Hibat Allāh ibn Muslim (usaybia.net/person/2336)	

Networks of Lost Works and Their Sources

Depending on the prominence of a lost text and on how rich in detail a reference work is, the digital factoid approach makes it possible to trace the dissemination of works or even to reconstruct who contributed to a treatise that has not been transmitted.

We will illustrate this by using the example of Yūsuf ibn Ibrāhīm ibn al-Dāya's (d. between 263/876 and 270/884) lost *History of Physicians*. In historical accounts, Ibn al-Dāya is overshadowed by his son, the previously mentioned author of the Pseudo-Ptolemaic *Centiloquium*, Abū Jaʿfar (also known as Ibn al-Dāya). His now lost *History of Physicians*, however, was used by Ibn Ḥawqal (d. after 978) and Ibn al-Qiftī, as well as by Ibn Abī Uṣaybiʿa. In an article, Jelle Bruning has shown that Ibn Abī Uṣaybiʿa did not only rely on the earlier biographers when he cited this work but apparently had access himself to a copy of the lost history.[67] His quotes are in several cases more extensive than those by Ibn Ḥawqal; Ibn al-Qiftī on the other hand appears to paraphrase the original work at times. Ibn Abī Uṣaybiʿa may hence be acknowledged as the most reliable source for Ibn al-Dāya's *History of Physicians*. However, at this point we are interested not in editing or collecting the numerous text fragments, which are certainly interesting, but in looking at the informants that Ibn al-Dāya approached when he compiled his treatise.

In his work, Ibn Abī Uṣaybiʿa is systematic in the way in which he quotes his sources. Oral informants are usually introduced by *qāla*, while he refers to literary sources by *ḥaddatha*.[68] This not only relates to Ibn Abī Uṣaybiʿa's own history, but also to Ibn al-Dāya, whom he usually quotes in the following manner:

حدث أبو جعفر أحمد بن يوسف بن إبراهيم قال حدثني أبي قال حدثني عيسى ابن حكم الدمشقي المتطبب
قال حدثني أبيٍ عن أبيه قال ولي الموسم في أيام معاوية بن أبي سفيان يزيد بن معاوية فوجهني أبوه معه متطبباً له.

I have the following story from Abū Jaʿfar Aḥmad ibn Yūsuf ibn Ibrāhīm, who had heard the account from his father, who in turn had heard it from the physician ʿĪsā ibn Ḥakam al-Dimashqī, who had heard it from his father, who had heard it from his father. »In the caliphate of Muʿāwiyah ibn Abī Sufyān,« ʿĪsā's grandfather said, »the caliph's son Yazīd was responsible for leading the *ḥajj*-caravan, and on one occasion his father sent me along as Yazīd's personal physician.«[69]

We can consequently retrieve substantial networks through which Ibn al-Dāya received his biographical information. The personal contacts which contributed to Ibn al-Dāya's lost treatise are introduced by *qāla* and can hence be encoded by applying SPEAR vocabulary and non-mutual »oral-informant-to« factoids. This yields on the one hand, a list of at least 17 direct oral informants to Ibn al-Dāya (*see Table 3*), and, on the other hand, a much bigger

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67   See Rosenthal, Ibn al-Dāya, and Bruning, Yūsuf b. Ibrāhīm b. al-Dāya, 97-120.

68   Bruning, Yūsuf b. Ibrāhīm b. al-Dāya, 106.

69   Ibn Abī Uṣaybiʿa, *ʿUyūn al-anbāʾ*, ed. and trans. Savage-Smith *et al.*, §7.6.

social network that spans from one oral informant to another. We may notice that the direct oral sources found for Ibn al-Dāya include more personal contacts than those listed by Yāqūt al-Rūmī (d. 626/1229).[70] However, some informants mentioned by Yāqūt al-Rūmī such as Ibrāhīm ibn al-Mahdī's mother Ḥakam Shakla are not mentioned in Ibn Abī Uṣaybiʿa's accounts.[71]

Table 3: List of direct informants for Ibn al-Dāya's lost treatise as retrieved from Ibn Abī Uṣaybiʿa's History of Physicians.

Usaybia.net URI	*Informant*
usaybia.net/person/1337	Jibrīl ibn Bukhtīshūʿ
usaybia.net/person/1240	ʿĪsā ibn Ḥakam
usaybia.net/person/2355	Zakariyyā ibn al-Ṭayfūrī
usaybia.net/person/1675	Mūsā ibn Isrāʾīl
usaybia.net/person/595	Ayyūb ibn al-Ḥakam al-Baṣr
usaybia.net/person/1194	Ibrāhīm ibn Fazārūn
usaybia.net/person/2326	Yūḥannā ibn Māsawayh
usaybia.net/person/227	Abū l-ʿIbar Ṭarad
usaybia.net/person/2064	Aḥmad ibn Hārūn al-Sharābī
usaybia.net/person/1186	Ibrāhīm ibn ʿAlī
usaybia.net/person/838	Hārūn ibn Sulaymān ibn al-Manṣūr
usaybia.net/person/1567	Mīkhāʾīl ibn Māsawayh
usaybia.net/person/1199	Abū Isḥāq Ibrāhīm ibn al-Mahdī
usaybia.net/person/2191	al-Ṭayfūrī
usaybia.net/person/1199	Ibrāhīm ibn al-Mahdī
usaybia.net/person/2147	Sulaymān, a eunuch from Khorasan
usaybia.net/person/1276	Ismāʿīl ibn Abī Sahl ibn Nawbakht

We can extend this information with other factoids which we have also modelled for relevant parts of Ibn Abī Uṣaybiʿa bio-bibliography (e.g., »associate-of«, »colleague-of«, »patron-of«, etc.) and further specify personal relationships that lie behind an »oral-informant-to« connection. The network can then be visualised using a visualisation tool such as Cytoscape, as is done in Figure 4, where we have also highlighted Ibn al-Dāya's direct oral informants.[72] To deliver a clearer picture we have excluded in this figure the linear relations between unnamed informants (e.g., »heard it from his father who had heard it from his father«).

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70 Yāqūt al-Rūmī, *Irshad al-arib ila maʿrifat al-adib,* 2, ed. Margoliouth, 157, as also noted by Bruning.

71 Bruning adds eight people to Yāqūt's list of the informants on whose authority Ibn al-Dāya transmitted anecdotes. However, even Bruning (Yūsuf b. Ibrāhīm b. al-Dāya, 106) misses four of the oral contributors mentioned by Ibn Abī Uṣaybiʿa, which illustrates the advantages of digital factoid modelling over manual searches.

72 Cytoscape Consortium, Cytoscape: Network Data Integration, Analysis, and Visualization in a Box, accessed on 9 June 2023: cytoscape.org/.
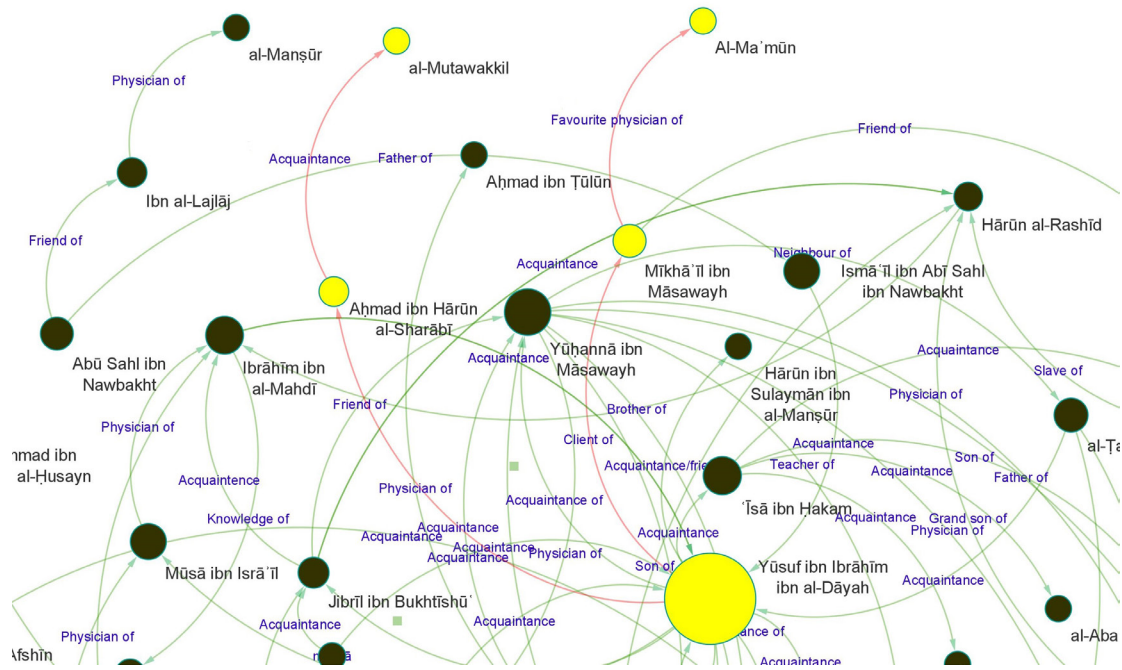
Figure 4: Bird's eye view of the network of Ibn al-Dāya's informants who contributed to his lost History of Physicians *(node size based on betweenness centrality, continuous mapping; first neighbouring nodes to Ibn al-Dāya are selected).*

This graph reflects the minimum-network of personal connections Ibn al-Dāya maintained and shows further how close his social links to the caliphs were. Not only was Ibn al-Dāya considered a foster brother of al-Muʿtaṣim (r. 218/833-227/842),[73] there is also only a single intermediate step in the personal connection between Ibn al-Dāya and al-Mutawakkil, which is through Aḥmad ibn Hārūn al-Sharābī. Moreover, Ibn al-Dāya's relationship with Mīkhāʾīl ibn Māsawayh, the brother of Yūḥannā ibn Māsawayh (d. 243/857), who holds an important position in the network, proves a close connection to al-Maʾmūn.

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73   Bruning, Yūsuf b. Ibrāhīm b. al-Dāya, 98.

Figure 5: Close reading of Ibn al-Dāya's social network focusing on his connections to the caliphs.

Conclusion

The wider the dissemination of a literary work at a relatively early stage in its history, the higher its chance of survival. As has been noted by Arnold Esch, the survival of a work is subject to two separate processes: the overall randomness of transmission and the factors affecting the likelihood of a specific work's transmission. At the beginning of this paper, we discussed a number of factors that contribute to the likelihood of transmission. For our purposes, we are not interested in a scenario in which manuscripts are preserved in an enclosed environment (such as a genizah or a qubba). We focused instead on a second scenario, where manuscripts circulate in a community, which allows us to examine networks of owners and readers of a work, or even contributors to a certain treatise.

Historical reference works hold a high potential for the study of lost literary heritage. In the future, it may be possible to systematically compare lists of works in bio-bibliographical histories to data retrieved from manuscript catalogues and thus get a basic understanding of works that have disappeared over the centuries from the shelves. Establishing networks of readers and owners of lost manuscripts and works mentioned in reference works can further serve as a useful tool in analysing the social environment in which specific treatises were read and studied. We showed that Ibn Abī Uṣaybiʿa had access to at least 30 manuscripts written by prominent scholars and their scribes, and among those books were apparently also autographs of al-Fārābī and Ḥunayn ibn Isḥāq. Furthermore, it may even be possible to trace the sources used for producing selected lost works. Ibn Abī Uṣaybiʿa's reference work, for example, contains enough information to draft a vast social network of oral informants on whose authority Ibn al-Dāya transmitted the anecdotes in his now lost *History of Physicians.*

To use such a reference work in a systematic manner, persons, places, and other relevant entities need to be tagged. We encoded our interpretation of the text in the form of digital factoids that were relevant for our study, such as »reader-of-handwriting-of«. Applying digital prosopography and modelling factoids in a customised TEI schema (SPEAR) in general offers great potential for investigating bio-bibliographical reference works.[74] For this paper, we applied factoid prosopography to draft networks of lost texts and manuscripts, allowing us to model a minimum network of personal informants that contributed to Yūsuf ibn Ibrāhīm ibn al-Dāya's now lost *History of Physicians*.

In the small but hopefully growing field of research on lost literary heritage, the Arabograph world is underrepresented. Using machine-readable assertions from bio-bibliographical reference works as a starting point, this article seeks to raise awareness about lost Arabic works and advocates for systematic approaches that go beyond studying selected fragments of individual works.

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74 See also Gibson and Schmahl, Communities of knowledge, in this volume (doi.org/10.1553/medievalworlds_no18_2023s196).

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