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Pedagogy and the Digital Humanities: Undergraduate Exploration into the Transmitters of Early Islamic Law

The present volume has attempted to shed light on how the various methods and approaches emerging under the umbrella of the digital humanities hold great promise for graduate students, faculty, and independent researchers in Islamic studies. This essay goes a step further by arguing that digital humanities projects also hold great promise for instructors of Islamic studies in the undergraduate classroom. Although faculty who teach in other areas of the undergraduate humanities curriculum have been incorporating such projects into their syllabi for years, instructors of Islamic studies have, until now, been slow to follow suit. Although there may be several factors that explain this state of affairs, the principal obstacle for undergraduates in the North American context is plain to see: the paucity of sources in English. While this impediment remains a constraint for all but a rare few undergraduates who have a reading knowledge of an Islamicate language, the recent publication of a number of English translations of key Islamic texts has begun to open the door for digital humanities projects in the undergraduate context.

The present chapter documents one such project on the transmitters of early Islamic law, undertaken by twelve undergraduates of mixed years in an introductory-level survey on the origins of Islamic civilization at Washington and Lee University's Department of History.[1] Students in the course combined the traditional tools of historical inquiry with computational tools to explore, picture, and develop new insights into the political, social, and cultural history of the transmission of early Islamic law. Practically, this meant students undertook close readings of primary sources and critical reviews of secondary literature while also mining data, creating a database, and using online visualization software.

The source for the study was an English translation of ʿAbd al-Ḥayy al-Laknawī's (d. 1886–7) biographical dictionary of the transmitters of one of the earliest canonical sources of Islamic law, the *Muwaṭṭaʾ* (*The Well-Trodden Path*), a collection of more than 1700 reports (*ḥadīth*s) attributed to Muhammad, his companions, and the pious transmitters of the following generation.[2] These reports address almost every area of Islamic law, including purity, divorce, offenses, and so on. Biographical dictionaries like al-Laknawī's belong to a genre of writing that emerged in the classical period of Islamic civilization and detailed the lives of these transmitters, in part to allow élite audiences to evaluate the trustworthiness of each transmitter and, by extension, the authenticity of the *ḥadīth*. The compiler of this collection, Mālik ibn Anas (d. 795), narrated each of these reports by a chain of oral transmission to their sources, typically three or four degrees between him and Muhammad, Muhammad's companions, or those who followed them by a generation. As a consequence, Laknawī's biographical dictionary offers biographies of approximately 500 transmitters from the first two Islamic centuries. The entries in this work often include transmitters' death dates and locations of residence or migration, so that *ḥadīth* critics could evaluate whether each chain of transmission was historically plausible. Entries also indicate transmitters' gender and frequently their tribal lineage. Additionally, but with less frequency, some entries reported whether the transmitter was known to have converted to Islam, what their occupation was, and whether they were a partisan (*shīʿa*) of ʿAlī, a companion of the Prophet, a member of the generation that followed the companions, or were descended from a client (*mawlā,* a non-Arab Muslim dependent on an Arab patron). Lastly, entries would sometimes preserve remarks of praise or doubt concerning transmitters' trustworthiness.

The project was intended to show students how to do historical research 'from farm to table' and unfolded in four broad phases: planning, collection, cleanup, and visualization. After I consulted with colleagues and a team of university librarians to plan the project, students worked as a single group to extract data from Laknawī's biographical dictionary and enter it into a master-database they created. They formed several small groups to clean up the data they collected by standardizing transliterations and place names, converting dates from *hijrī* to Gregorian, and so on. Lastly, they worked as individuals to visualize and analyze patterns in the data, placing their findings in the context of the broader

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2 See the appendix of Mālik ibn Anas and Muhammad ibn al-Ḥasan al-Shaybānī, *The Muwaṭṭaʾ of Imam Muḥammad*, trans. Abdassamad Clarke (London: Turāth Publishing, 2004), 471–571. The translation was based on ʿAbd al-Ḥayy al-Laknawī, *al-Taʿlīq al-mumajjad li-Muwaṭṭaʾ al-Imām Muḥammad*, ed. Taqī al-Dīn al-Nadwī (Damascus: Dār al-Qalam, 1991).

topics surveyed in the course, such as the transformations brought about by the early Islamic conquests and evolutions in the transmission of Islamic religious and legal authority.

Is Laknawī's biographical dictionary reliable as a historical source? This was a question I posed to the students, and one that created an important teaching moment regarding the practice of history and historiography. After some debate, students were able to justify the merit of the project without fully settling the question of reliability: even if the point were granted that Laknawī's dictionary did not preserve the precise number of transmitters who were women, converts, partisans, companions, clients, and so on, it did preserve a precise number of transmitters who were reported by scholarly authorities to have been women, converts, partisans, companions, clients, and so on. To this end, students would often remind one another that their data did not represent 'converts' or 'partisans', but 'transmitters reported to be converts' or 'transmitters reported to be partisans'. Nevertheless, the outcome still shed light on the construction of authority in early Islamic law.

Since the project was semester-long, the workloads for both the students and the instructor were very manageable. For most the term, the project felt as if it were running itself, often enriching but never intruding on the broader survey course. Students made a little progress each week, either on data collection, cleanup, or visualization, but still had time to do the assigned readings and write a mid-semester and a final paper. Having support from the university librarians was crucial in keeping the workload manageable for the instructor, and any instructor would be wise to make sure there is knowledgeable technical assistance in place before embarking on such a project.

1. Before Class: Planning the Project

Before students were able to collect data from Laknawī's dictionary, I worked with a team of four librarians to brainstorm what tools would be most appropriate for the project. Initially I had proposed that students use a shared spreadsheet (such as the Sheets application available through Google Drive) to enter the data. In that case, the preparation phase would have simply involved labeling the columns to indicate what information we wanted—name, death date, gender, and a range of other items—and students would have entered the appropriate information directly into the table. This plan could have worked, but it seemed to me that confusion might arise if a number of students were editing the document simultaneously. The librarians and I were also concerned that typographical errors might be more likely to be introduced into the spreadsheet if

the database grew unwieldy in size. Our priority was to enable students to devote their focus to reading and analyzing the primary sources, not managing these kinds of technical difficulties.

Brandon Bucy, a senior academic technologist at Washington and Lee, proposed an alternative that avoided those problems. Using a simple HTML design program, Brandon suggested we build an online form in which students could enter the data as if they were answering an online questionnaire. Among other questions, the form could ask: What is the transmitter's full name? What gender is the transmitter? What location of residence was the transmitter associated with? To help streamline the data, each question either had multiple-choice radio buttons or a textfield for a short answer, with examples modeling the desired format of the answer. In some cases, if students did not know the answer to a specific question, they were instructed either to leave the box blank or type 'unknown'.

The data collected using the form could be easily exported into a spreadsheet for students to manipulate later. Since students had to sign in with their university username and password in order to access the form, the other added benefit was that the form would automatically tag entries with the name of the student who submitted it, which was useful for evaluation and grading.

Although the form promised a far easier data entry system for students, it was not without its own kinks. For one, I insisted that the form be able to accept diacritics and special characters (for *hamza* and *ʿayn*), which the form did not accept in its default setting. Brandon solved this problem by enabling the form to accept a Unicode font. Nevertheless, a worry remained: The form could now record diacritics, but would students who had little experience using diacritics be able to input them from their personal computers? To anticipate these problems, we provided links to a tutorial on how to input diacritics on a Macintosh or PC. We also provided the relevant diacritics and special characters at the top of the questionnaire, so that students could work at any computer and simply copy and paste any character they needed.

2. The First Six Weeks: Creating a Master Database

By the second week of class, as students were embarking on their survey of early Islamic history, they were each assigned six to eight pages out of the approximately 100-page dictionary that cataloged the approximately 500 transmitters

of the *Muwaṭṭaʾ* in alphabetical order. Since the length of each entry varied from a few lines to a page, dividing the source up by pages rather than entries or letters of the alphabet distributed the labor of data collection and data entry most fairly. By the end of each week, students were expected to submit a form for about two pages of transmitters, with the goal of finishing their section of the dictionary by week six of the course. Students used the form to record the transmitter's name, gender, and, when provided, death date, alternate death dates, tribe or clan, occupation, and known locations of residences. Students were also asked to collect other identity markers associated with them. With 'yes' or 'no' radio buttons, students were asked to record whether Laknawī indicated whether the transmitter was a companion, a follower, a partisan of ʿAlī, a member or descendent of the *anṣār,* a *mawlā*, or a convert. If they answered 'yes' to the convert question, a one-line textfield allowed students to note the former religion with which that transmitter was known to have been associated. At the end of each entry, students had the opportunity to add any other notes, qualifications, or remarks they thought might be worth recording in the database.

Some class time was required to help train students to collect and enter data correctly. I provided an in-class overview of the basic rationales behind transliteration—the significance of *hamza* and ʿ*ayn*, the difference between *h* and *ḥ*—as well as common markers of gender, such as ibn/Abū, bint/Umm, and common patterns in Arab *nisba*s. This conversation, while sparked by the digital humanities project, helped to unlock broader themes in the conception of genealogy in classical Arabic culture and taught beginning students how to better understand the names in the scholarly literature and historical sources they were encountering in other parts of the class. Students were asked to try collecting and entering data from one or two 'pilot' entries as homework, so that any difficulties could be clarified during our next class meeting.

One minor problem with the form, which could have been easily rectified but was not, was that students could not confirm that the data they had entered was correct. Technically, there was a way they could search the data they themselves had entered, but this was a relatively cumbersome process. A confirmation page prior to finally submitting the data would have likely reduced typographical errors and other data misfires that would later need to be addressed during the clean-up phase.

Participation in the creation of the database was worth ten percent of their overall grade. Students were told they would be evaluated on their accuracy, attention to detail, and participation. If students produced more than ten accurate and detailed entries per week, they stood to gain extra credit. I randomly sampled students' entries for the purposes of quality control and evaluation.

The data collection and entry phase proceeded with greater-than-expected efficiency. Several students finished well before week six. Although some waited until week four or week five to accelerate their data collection and entry, all twelve students finished on time, and the master database was completed by the end of week six.

Throughout this phase, students would frequently come to class with peculiar and entertaining anecdotes and stories about the biographies of the transmitters they had studied that week. They would just as frequently connect a historical place (such as Kūfā) or a historical figure (such as ʿUmar II) with the same location or person they had encountered through the digital humanities project. In retrospect, these connections could have been made even more explicit, perhaps with a dedicated five-to-ten-minute discussion of an entry each class or each week. After all, these conversations were precious opportunities to connect the primary research students were performing with the secondary historical literature they were surveying.

3. Weeks Six to Ten: Drafting Visualizations and Cleaning Up the Database

After the midterm exam and a short fall term break, I met with Jeff Barry, an associate university librarian at Washington and Lee, to discuss the visualization tools that would work best to achieve the goals of the project. We were looking for something both practical and appealing to students of history. We had corresponded previously to consider the advantages and disadvantages of using the built-in graphing features offered by Microsoft Excel. On the one hand, it was a commonly accessible program, and one which students would no doubt be able to use in other contexts or settings beyond the humanities classroom. On the other hand, Excel had been designed to visualize certain kinds of quantitative data, but was limited in displaying the patterns in networks and relationships across time and space that this data called forth. Inspired, in part, by the "Mapping the Republic of Letters" project at Stanford University,[3] Jeff and I decided to forgo Excel in favor of two on-line visualization tools that held greater promise in visualizing networks, timelines, and maps: Palladio, designed by a

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3 See http://republicofletters.stanford.edu, last accessed January 10, 2015.

research lab called Humanities + Design at Stanford University; and RAW, designed by the DensityDesign research lab in Milan, Italy.[4]

Importing the master database into Palladio and RAW was very quick—a simple drag-and-drop or cut-and-paste was all that was needed—but an unforeseen problem immediately presented itself: the data badly needed to be 'cleaned up'. The form, we naively believed, had been designed in a way that would require only minor corrections on particular entries. In fact, there were a large number of cleanup tasks to perform on our database before we would be able to use it.

Jeff attempted to clean up some of the data himself (for example, by standardizing spellings for Medina, Medinah, and Madīnah), but we soon realized that cleaning up the data entailed much more than this. Following our discussion, it occurred to us that it would not only be more efficient to have students work in groups to perform the cleanup, but students could also use the cleanup to learn how to weigh advantages and disadvantages when standardizing certain areas of the database that they would later analyze for their individual projects. Incorporating a data-cleanup activity into the assignment also taught students a critical lesson that we ourselves had overlooked: cleanup was an essential part of any data-collection and data-mining project.

Rather than breaking the students up into groups and arbitrarily assigning cleanup tasks, I took time from one of our first class meetings after the fall break to have students import the raw data into Palladio and RAW, experiment with visualizing the data, and think through for themselves what in our data needed to be cleaned up. Jeff came to our class to introduce the web applications to the students, demonstrate some examples, clarify any questions, and make himself available in the future should students have technical questions. By experimenting and visualizing certain patterns and correlations in the data, students not only began to acclimate themselves to the idiosyncrasies of Palladio and RAW, but they saw right away where the shortcomings in the data were. For example, Palladio's map function did not work with our raw data, since cities had been identified by their historical names rather than by latitudinal and longitudinal coordinates. Students saw for themselves that a cleanup would require them to create a new column in the spreadsheet and add the relevant latitudinal and longitudinal coordinates.

Two other minor issues caught students' attention. First, our data had recorded dates according to the Islamic calendar, but some students thought it

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4 For Palladio, see http://palladio.designhumanities.org/; for RAW, see http://raw.densitydesign.org/, last accessed January 10, 2015.

would be useful to add a column that presented dates according to the Gregorian calendar. Second, the data collected on occupations had multiple transliterations for *qāḍī* and *faqīh* (judge and jurist) and sometimes listed multiple occupations for the same transmitter, such as ʿ*ālim* (scholar) and *ḥāfiẓ* (Quran scholar). It was later suggested that, because the column containing reported occupations was so small (forty data points or less), the cleanup group might consolidate particular occupations into larger occupational classes, such as political, scholarly, military, mercantile/artisanal, and miscellaneous.

The stickiest issue involved the column that contained data on tribes and clans. Laknawī's original entries sometimes indicated that transmitters were affiliated with multiple tribes. In these cases, students had entered both tribes in the same column. Likewise, in cases where Laknawī indicated information on both tribe and clan, students included both identity markers in the same column. This was a design flaw in the online form, which did not include multiple textboxes for students to enter tribe, alternate tribe, and clan. This was in addition to the fact that students were already struggling to discern whether the *nisba* was indicating a tribe, a clan, a place name, an occupation, or all of the above. The resulting data was so confusing that many students in the class thought it might be better to leave our tribe/clan column for future generations of students to clarify and analyze. A small group of students, however, inspired to explore tribal and clan identity markers, wanted to take on the challenge of cleaning up the data.

After attempting to construct a draft of their visualization by working through the data with RAW and Palladio for a week, we met again and discussed what cleanup groups were necessary. Students proposed four cleanup groups: dating, place names, occupations, and tribe/clans. Since some of the cleanup groups were more demanding than others, students organized themselves into cleanup committees of two, three, or four. From that class meeting onwards, each cleanup committee would report to me any progress they made or obstacles they faced during the cleanup.

The group focusing on tribe and clan faced the toughest challenge. This small group agreed to return to Laknawī's dictionary, hone their skills at distinguishing tribes from clans, and then reenter data about tribes and clans in different columns. In order to accomplish their task, students sought a reference list in English of Arabian tribes of the first two Islamic centuries, which is the period most germane to the transmitters in Laknawī's biographical dictionary. Students initially attempted to use a list of Arab tribes compiled on Wikipedia, but found the wiki-list to be a jumble of inconsistent transliterations, clans, regions, and

time periods.[5] After some consultation with me, students chose to rely on the table of contents of Werner Caskel's German translation and analysis of Ibn al-Kalbī's *Jamharat al-Nasab*.[6] This table, while not comprehensive, contained the names of the key Arabian tribes from the period, divided by those with origins in the North and the South of the Arabian Peninsula. Once students learned to convert Caskel's German transliteration into one with which they were more familiar, they were able to clean up the column in the spreadsheet to provide reliable and useful data on tribes and clans.

4. Weeks Eleven and Twelve: Editing, Revising, and Presenting Final Drafts

During weeks ten and eleven, students crafted and workshopped drafts of their visualizations. They were instructed to present one, two, or at most three slides that visualized the data they collected on the transmitters of the *Muwaṭṭaʾ*. If they intended to present more than one slide, the slides were expected to be thematically connected or suggest a useful comparison or contrast. They were also allowed to choose to use two or three different tools to visualize the same data, if the two tools demonstrated a useful comparison or contrast (for example, a RAW alluvial graph and a Palladio map of the same variables).

In one class exercise, students grouped into pairs to assess one another's drafts in terms of originality, clarity, accuracy, and overall effectiveness. They offered sources and suggestions with which to improve their analyses. Every five to ten minutes they switched pairs, and in doing so, they got to preview, provide, and receive feedback on one another's digital humanities projects. Students paired with me during this time as well, so that I could offer my own advice and suggestions.

In the final week, students were expected to present their final digital humanities projects and field questions from the audience. Typically this was divided up into three to five minutes of presentation and five to seven minutes of discussion. During the presentation, as well as in the final written project, students were expected to briefly address what historical factors they thought best explained the patterns in the data they found as well as any corroborating

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5 See "Tribes of Arabia," Wikipedia, last accessed January 10, 2015, http://en.wikipedia.org/wiki/Tribes_of_Arabia.

6 See Werner Caskel, Ǧamharat an-nasab : das genealogische Werk des Hišam Ibn Muḥammad al-Kalbī, vol. 2/2 (Leiden : E. J. Brill, 1966), *i.*

evidence in other historical sources. They were told to clearly indicate any inconsistencies in the data or the visualization and to footnote any sources used to collect or explain the data. Students listened to questions and feedback from their peers and then from me. They were able to take that feedback to revise their final projects before they handed them in at the end of the final week. The visualization, written analysis, and presentation was worth 25 percent of their final grade.

5. Sample Projects, Findings, and New Avenues

The first example is an alluvial graph, generated with RAW, created by Jake Barr, a junior at Washington and Lee.[7] Jake sought to compare the number of women and men who were reported to have been companions or followers in Laknawī's biographical dictionary. This was a simple but effective way of tracking the changing status of women's authority in the transmission of ḥadīth across the first two generations following the rise of Islam. While RAW was colorful, user-friendly, and good for displaying broad patterns in the data, it did not generate a title or the number of transmitters, which Jake had to manually add using another word- or image-processing program. Moreover, the alluvial graph, while an excellent tool for experimentation and stumbling across unexpected findings in the master database, can be counter-intuitive to read for those unfamiliar with it. The alluvial graph is not the only graph that RAW generates, and it is possible that another kind of graph could have more clearly communicated Jake's point. In future iterations of the course, students will receive greater direction on how to choose an appropriate graph for their findings during the editing and revision phase.

Read from left to right, Jake's graph shows that while men outnumbered women overall (a ratio of 174:25), women's authority as transmitters of ḥadīth dropped precipitously from the generation of the companions of Muhammad (a ratio of 81:21) to the generation that followed (a ratio of 93:3). Jake speculated that the professionalization of ḥadīth transmission during this period may have played a role in diminishing women's participation, a hypothesis that has been confirmed by recent work in the field with larger sample sizes.[8] By collecting this data and then visualizing it, Jake was able to demonstrate a nuanced point:

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7 Jake Barr, "Visualization" (presentation at Washington and Lee University, Lexington, VA, December 12, 2014).
8 See Asma Sayeed, *Women and the Transmission of Religious Knowledge in Islam* (Cambridge: Cambridge University Press, 2013), 63–107.
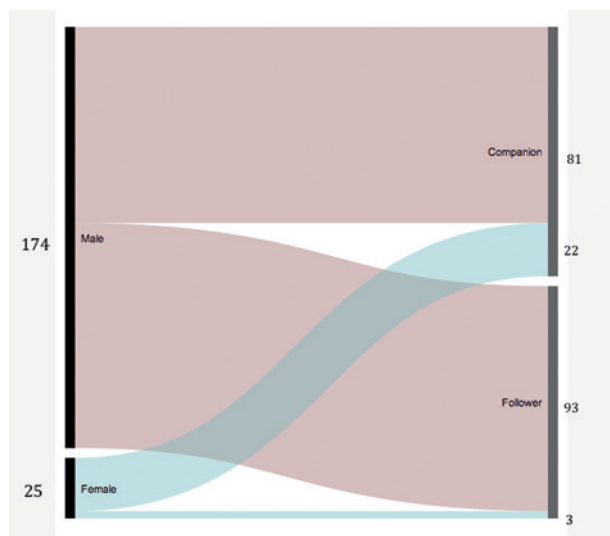
Figure 10.1. The Distribution of Male and Female Transmitters Among the Companions and the Followers. Created by Jacob Barr. RAW Alluvial graph of male and female transmitters who were reported to be companions or followers in Laknawī's biographical dictionary of the *Muwaṭṭaʾ*. The left side shows the total number of male and female transmitters. The right side of the graph shows how male and female transmitters are distributed among companions and followers.

women's participation, while quantitatively less than men from the outset, was dynamic across time.

Our second example comes from Amanda Dixon, a senior and a history major at Washington and Lee.[9] Amanda was also interested in women who were followers, but she added another variable: place. Amanda used Palladio to generate a graph of followers that displayed connections between the gender of the follower and the places with which they were associated.

In the graph above, Amanda created two nodes in dark grey: male and female transmitters who were followers. The size of the node reflects the relative size of the sample, which is why the node symbolizing male followers is larger than the one for female followers. Next, she commanded Palladio to link places associated with those followers in subnodes, shaded light grey. Amanda observed that male followers were routinely associated with Medina as well as pla-

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9 Amanda Dixon, "Gender and Location in the Companions and Followers" (presentation at Washington and Lee University, Lexington, VA, December 12, 2014).
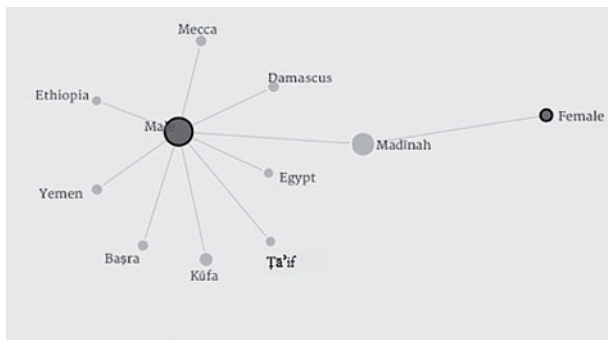
Figure 10.2. Male and Female Transmitters of the Follower's Generation and Their Places.
Created by Amanda Dixon. Palladio network graph displaying female and male transmitters who were reported to be "followers" in Laknawī's biographical dictionary of the *Muwaṭṭaʾ*, linked to places with which they were associated.

ces in territories newly captured by the Muslim conquests of Sassania and Byzantium. Meanwhile, female followers who transmitted *ḥadīth* were only known to have been associated with a single place—Medina. During the generation of the followers, then, Medina was the only city that linked both men and women in the transmission of authoritative *ḥadīth*, at least with respect to the transmitters of Mālik's *Muwaṭṭaʾ*. Amanda's visualization confirms what recent scholarship has shed light on in larger sample sizes: women's decline in the participation of *ḥadīth* transmission during the era of the followers correlated with social and legal restrictions on women's travel and mobility across the nascent Islamic world.[10]

Our third example was created by Rowan Farrell, a freshman in her very first semester at Washington and Lee.[11] Rowan made use of Palladio's timeline tool to look at the trends in the distribution of transmitters' reported occupations across time.

Rowan had a very small sample size to work with: under forty transmitters in Laknawī's biographical dictionary were reported to have had occupations. Nevertheless, Rowan's visualization suggests some intriguing trends that may provide an avenue of research for future scholars. For one, the most recent death date for transmitters of the *Muwaṭṭaʾ* who were reported to have held political

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10 Sayeed, *Women and the Transmission of Religious Knowledge in Islam*, 101 – 7.
11 Rowan Farrell, "Final Data Analysis" (presentation at Washington and Lee University, Lexington, VA, December 12, 2014).
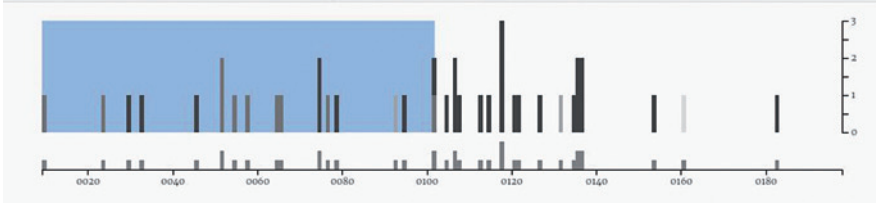
Figure 10.3. The Distribution of Transmitters from Laknawī's Biographical Dictionary with Reported Occupations from 0 – 185 AH. Created by Rowan Farrell. The darkest grey bars indicate transmitters holding scholarly positions (*qāḍī, faqīh, 'ālim*, etc.). The medium grey bars indicate transmitters who were reported to have held political or administrative positions. The period in which *ḥadīth* transmitters who were reported to have held political or administrative positions lived is further highlighted by the blue or dark grey swath on the left (0 – 100 AH). The lightest lines represent three transmitters, all of whom were reported to have been merchants, two of whom were reported to have served as soldiers and servants.

or administrative positions is 100 AH, after which point we begin to see the largest clusters of death dates for transmitters who were identified with a scholarly title, such as a jurist (*faqīh*) or a Quran memorizer (*ḥāfiẓ*). Rowan hypothesized that the decline of political authorities as *ḥadīth* transmitters and the rise of scholarly authorities correlates with changing attitudes brought about by macro-political shifts from the era of the 'rightly guided' to the nascent Umayyad dynasty. It is one thing to read about the dynamic relationship between political authority and religious authority in a textbook survey of Islamic history, but it is quite another thing to discover and visualize these patterns firsthand in the data, precisely as Rowan did.

Our last example was created by Alice Kilduff, another student in her first semester of college.[12] Alice's project was more challenging, since it involved tribal and clan affiliations. At its heart, however, her project was an attempt to answer a simple question: With which tribes were *mawlā*s who transmitted *ḥadīth* in the *Muwaṭṭa'* affiliated? Alice used RAW to create a Circular Dendrogram to visualize the data.<figr=4>

Alice worked hard with the tribal and clan cleanup subcommittee, so she was familiar with the promises and perils of the data on tribes and their clans. The sample size was relatively small, as students had only been able to identify about a fifth of Laknawī's 500+ transmitters' tribal affiliations. Many clans had been left unidentified. There were also some transmitters whose tribal

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12 Alice Kilduff, "Māwla Status and Tribal Identification Among *Muwatta* Transmitters" (presentation at Washington and Lee University, Lexington, VA, December 12, 2014).

Figure 10.4. *Māwla* Status and Tribal/Clan Identification Among *Muwaṭṭaʾ* Transmitters. Created by Alice Kilduff. The first nodes closest to the center represent reported tribes. Secondary nodes, if included, represent any known clans or sub-tribes. The outer nodes represent whether the transmitter was reported to be or to be descended from a non-Arab Muslim client of an Arab tribe, called a mawl. Any blank nodes indicate transmitters whose affiliation has yet to be identified.

affiliation was unknown who were identified as *mawlā*. In the end, Alice found that four prominent tribes had patronized *mawlā*s who transmitted or had descendants who transmitted *ḥadīth* in the *Muwaṭṭaʾ*: the Quraysh, the Hamdān, the Asad, and the Ḥimyar. The Quraysh were the most reported tribal affiliation overall, so it is not surprising to find *mawlā*s and descendants of *mawlā*s among their ranks. Future research may venture an educated guess as to why *mawlā*-transmitters emerged from the Hamdān, the Asad, and the Ḥimyar, rather than other tribes. Nevertheless, Alice's visualization shows how much Laknawī's bio-

graphical dictionary has to teach us about the role of status and tribe in the con-
struction early Islamic religious authority.

6. Future goals

In my upper-level course on Islamic law, I once asked students to use Laknawī's
biographical dictionary in translation to evaluate the scholarly genealogy of a
ḥadīth of their choosing from the *Muwaṭṭaʾ*. Did the death dates appear plausible
to them? What was the relative trustworthiness of each transmitter reported to
be? Did that *ḥadīth* appear to travel from place to place, or did it stay in Medina
throughout its life? The project helped bring alive an aspect of the text students
often glossed over—the chain of transmission (*isnād*)—and they wondered
whether a larger-scale project could offer insights into networks of transmitters
and Mālik's compilatory choices. Such a project could ask even bigger questions:
What was the frequency of repeated chains of transmission? Who were the most
frequently referenced transmitters of the *Muwaṭṭaʾ?* How often did Mālik use pro-
phetic reports versus companion reports? What was the average, median, or
modal gap in death dates between transmitters? Were certain areas of the law
a site of activity for female transmitters? Were certain chapters in the
Muwaṭṭaʾ the domain of transmitters with affiliations to a certain place, tribe,
or occupation? And yet, how could we answer these questions without poring
over the *Muwaṭṭaʾ* from cover to cover and collecting data on each chain of trans-
mission? Entering data on each transmitter this way would be too tedious, we
thought, as many transmitters made repeated appearances.

    As I wolfed down a *quattro stagioni* at Crozet's famous pizzeria in Charlottes-
ville, I explained this problem to Aaron Goldman, a friend, colleague, and com-
putational biologist at Oberlin College. Aaron was used to running a computa-
tional genomics lab with undergraduates and offered a simple suggestion to
make the project manageable. "All you need to do is create a master database,"
he saidbetween bites. Once a database was created, he imagined, students could
go on to perform a larger project, copying and pasting the transmitter's informa-
tion for each link in the chain they were recording.

    A year later, we now have the basic scaffolding of this master database. Fu-
ture iterations of this course will continue to clean up the database accordingly,
build upon it, and repurpose it to investigate some of those bigger questions I
outlined above. Future students will be able to study an individual chapter in
the *Muwaṭṭaʾ*, such as the chapter on "Marriage," record its *ḥadīth*s' chains of
transmission, and then investigate any patterns that emerge in the links between
these chains, including, but not limited to, the following:

- Variation in the gaps in death dates between links in the chain
- Apparent 'movement' within chains of transmission, from transmitters in one location to transmitters in another location
- Apparent 'movement' within chains of transmission, from transmitters of one tribe to transmitters from another tribe
- Variation in the length of chains of transmission
- Frequency of repeated chains of transmission
- Frequency of repeated transmitters
- Frequency of chains with female transmitters
- Frequency of chains with transmitters who are identified as *mawlā, shīʿa, anṣār,* or convert
- Frequency of chains with transmitters who are identified with scholarly or political occupations
- Frequency of prophetic reports versus companion reports

Once students have collected this kind of data on the chapter on "Marriage," they can then begin to collect data on other chapters, such as "Divorce" or "Prayer," and then compare and contrast chapters with one another. Future projects will also make use of mapping software to track the movement of *ḥadīth* across geographical space or networks of transmitters.

Another area of Laknawī's biographical dictionary that remains to be collected and explored in our database is the matter of trustworthiness. In many entries, Laknawī makes mention of the transmitter's trustworthiness, often by quoting another authority who thought favorably or unfavorably of the transmitter. While this may tell us more about what words of praise or doubt Laknawī chose to include in the dictionary than what Mālik's own choices were in compiling the *Muwaṭṭaʾ*, that data would have much to teach scholars about how often transmitters of the *Muwaṭṭaʾ* were praised and what keywords were used most frequently in their evaluation. We could then take that data to the chains of transmission in the chapters of the *Muwaṭṭaʾ* itself and investigate, for example, whether there is any correlation between the most frequently praised transmitters and other variables, such as tribe, gender, occupation, or frequency of citation.

Digital humanities projects in Islamic studies hold great promise for undergraduate teaching. In some ways, the study of *ḥadīth*, rich with biographical data and networked chains of transmission, is ideally suited for it. As more *ḥadīth* collections like the *Muwaṭṭaʾ* and its appended biographical dictionary are translated into English, more and more data collection and visualization projects will become available to and manageable by undergraduate scholars in Islamic studies. Our hope is that this database of the transmitters of the *Muwaṭṭaʾ*, created by

these students and others, may someday be freely available for other scholars and the general public to interface with online. In doing so, broader audiences may discover their own insights into the complex intersections of social life and religious authority that these texts contain.

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