Social Network Analysis and Data Visualization of Max Weber's Collected Letters

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Abstract: *Max Weber's Collected Works (Max Weber-Gesamtausgabe) in German were fully published in 2020. The volumes include 34713,471 letters written and sent by Max Weber between 1875 toand 1920. TheThese publications posepresent several challenges to Weber's scholarship due to the language barrier and the hundred yearcentury-long interval between Weber's demisedeath and the publicationrelease of his collected works. Against this backdrop, this article applies novel network analysis tools to explore the relationshiprelationships between Weber and his correspondents. With the complete collection of his letters now available to Weberian scholars, we have undertaken an innovative project that integrates data science into this field. To achieve this, we haveWe extracted metadata from Weber's Collected Works to construct network data. We employed, employing R and various R packages to applyfor network analysis and data visualization. Additionally, we also providedhave made the dataset and R scripts available online as open-access resources to facilitate reproducibility. As we employ onlyWhile our research relies solely on statistical analysis of Weber's letters without qualitative examination, the scope of our research could be considered limited. Nevertheless, we feel our researchwe believe it makes a meaningful contribution to Weberian studies. By academically exploring the Collected Letters, this study isrepresents a pioneering effort with significant implications, encouraging further research and scholarship in the field.*

Keywords: Max Weber; Social Network Analysis; *Max Weber-Gesamtausgabe*; Collected Letters; Data Visualization

1. Introduction

This paper analyzes collected letters by Max Weber published in German to examine his social and intellectual relationships and their impact. To achieve this, we employ statistical analysis and data visualization. Alongside Karl Marx (1818-1883) and Émile Durkheim (1858-1917), Max Weber (1864-1920) is regarded as one of the foundational sociologists whose work continues to have profound influence across multiple disciplines. However, despite Weber's academic significance, the publication of Weber's primary texts had long been problematic and inadequate [1].

The effort to compile and publish Weber's collected works began soon after his sudden passing in 1920. His widow, Marianne Weber, played a key role in assembling his scattered writings and lectures, culminating in the first collected works in eight volumes, including: Collected Paper and Economy and Society [2]. The Collected Papers consists of Collected political writings [3], Collected Writings on Methodology [4], Collected political Writings on Sociology of Religions [5], Collected Writings on Socio-economy [6] and Collected Writings on Sociology and Socio-politics [7].

Many of these early publications consisted of unfinished manuscripts compiled posthumously, making them difficult for contemporary public readership. Thus, it is difficult for the contemporary reader to understand the intellectual environment in which Weber had operated and interacted whilst he was alive.

Recognizing these challenges, the idea of publishing a new comprehensive edition of Weber's works in German, the *Max Weber-Gesamtausgabe* (hereafter MWG) was conceived by Horst Baier (1933-2017) in 1972. The MWG officially began that same year, with its first publication appearing in 1984 and the final volume completed in 2020. The MWG consists of hefty 54 volumes. The MWG is divided into three parts. Part I contains all known writings and lectures (*Schriften und Reden*) in 34 volumes and Part II contains *Weber's Letters* (*Briefe*) in 13 volumes. Finally, Part III includes various lecture courses and lecture manuscripts (*Vorlesungen und Vorlesungsnachschriften*) in seven volumes from his teaching at the universities of Freiburg in Breisgau, Heidelberg and Munich from 1894 to 1920 [8].

With the completion of Weber's new collected works, we argue that it is necessary to pay particular attention to *Weber's Letters*. When conducting scholarly research on an author, letters play a very important role in providing special insights that can be used as a crucial form of primary source. In Weber's case, the importance of his letters have been recognized. First, in 1984, the German Historical Institute held an academic conference where scholars of various nationalities examined Weber's relationship with other figures from a historical perspective. Wolfgang Mommsen (1930-2004) was a German historian who served as an important editor for the MWG project and served as director of the German Historical Institute. He stated that Weber's academic influence was greater after his death than during his lifetime due to the posthumous collection of his works. However, the fact that most of his works were published after his death caused challenges in Weberian studies due to the lack of historical contemporary intellectual context. Therefore, understanding Weber's work and its relationship and interactions with the intellectual and political movements of Weber's lifetime through his letters is essential [9]. Secondly, Richard Swedberg and Agevall (2016) emphasize that "Weber's letters are a rich and still largely unexploited source for a variety of topics - the development of his methodology, insights into his works, personal relationships, and much more" [10]. Thirdly, much of the earlier scholarship on Weber studies has relied on Marianne Weber's biography. However, aspects of Weber's private life such as his extra-marital romantic affairs remained largely concealed until Eduard Baumgarten (1898-1982) shared a collection of Weber's love letters with Karl Jaspers (1883-1969) [11]. Among these, a letter addressed to Mina Tobler (1880-1967), a Swiss pianist and one of Weber's known extramarital partners, provides insight into Weber's emotional and intimate experiences and psychological complexities as follows:

> Dear Tobel-child…The sky is shining, dear child, and the war will—someday—end. And others need do nothing more. For everything else is there, as strong and beautiful as ever, with a great longing that such beautiful times may soon, perhaps very soon, bloom again... I am completely alone, and see no one, neither male nor—what's worse!—female, of any significance to me [12].

Despite their significance, the study of Weber's German letters is an onerous task due to the passage of time and sheer volume of letters. Moreover, Weber's German prose is difficult to read and translate because of his verbose and idiosyncratic style of writing. Renowned German sociologist Dirk Kaesler even expressed his concern that Weber's texts are becoming increasingly inaccessible even to native German speakers. [13] Furthermore, as of the writing of this paper, none of Weber's letters have been translated into English, meaning their broader impact has been limited. It may take a considerable time before we witness the publications of these translated letters.

In response to these challenges, this paper seeks to facilitate engagement with Weber's letters by applying social network analysis (SNA) methodologies and data visualization techniques. Likewise with diaries, personal letters can sometimes be overly individualistic and be too much of a micro-perspective to interpret in a broader academic context. In this respect, computational tools can enable us to perform quantitative examinations of larger and complex datasets in order to reveal unknown pattern and insights [14].

Numerous studies on correspondence have examined scholarly networks in intellectual history. For instance, Binbas, from Iran, analyzed the intellectual networks, through letter exchange, between intellectuals in Iran and Central Asia in the 1450s [15]. In addition, Catherine Volk analyzed the political and intellectual landscape of the late Roman Republic, which was politically chaotic at the time, by studying the epistolary exchanges between Cicero and Caesar [16].

Another prominent example is the 'Republic of Letters', the study of an intellectual community that existed in Europe and the Americas from the 16th to the 18th centuries. The 'Republic of Letters' is a community in which intellectuals in Europe and the Americas used Latin as their academic language between the 16th and 18th centuries to conduct academic activities primarily through letters, which allowed them to

cross intellectual, cultural, and religious boundaries and also to overcome geographical barriers. Currently, thousands of letters related to their activities remain reserved and related research is in progress.

Scholars at Stanford University have used data from the Republic of Letters to conduct network analysis and data visualization: 'Mapping the Republic of Letters: Voltaire and the Enlightenment', which conducted of the exchange of letters in the Republic of Letters at Stanford University in the United States. This project analyzed social networks and created data visualization in three areas: correspondence networks', 'social networks', and 'knowledge networks' particularly focusing on the correspondence network of the French Enlightenment thinker Voltaire [17].

Franco Moretti, an Italian professor at Stanford University has further advanced this approach by applying quantitative and empirical analysis methods to literary texts and his research has had a great influence on literary studies and the digital humanities. In "Speculations on World Literature," published in 2000, he expressed the idea that it is physically impossible to read countless works in different languages and argued for finding a way to decode the text without reading it as an alternative to so-called 'close reading,' which is a method of reading individual texts seriously and deeply [18]. He proposed the methodology of 'Distant Reading' or 'Reading at a distance', which means going over a large range of texts from a distance. Subsequently, Moretti elaborated on the method of 'distant reading' using statistical analysis and computer technology in *Distant Reading* (2013). In the chapter 'Network theory, plot analysis', Moretti performed network analysis on characters in Shakespeare's *Hamlet* and the Chinese Qing Dynasty's novel *Dream of the Red Chamber* as an example of 'distant reading' to derive new meaning from literary works [19]. Moretti's methodology has been controversial, but his use of network analysis and the use of the 'distant-reading' method has significantly influenced the digital humanities.

This paper aims to lay the groundwork for future scholarship on Max Webers by addressing several notable gaps in existing research. First, prior studies have typically not made their source materials, particularly Weber's correspondence, accessible to the public in a digital format. In contrast, this project has digitized Weber's letters to make them accessible to the public. While the original content of these letters entered the public domain in 1990, seventy years after Weber's death in 1920, many published editions remain under copyright due to editorial contributions, such as annotations and introductions. Accordingly, this study has extracted the original text from Weber's letters from the edition and ensured only public domain content is shared, in order to make them freely available to the public.

Second, this research emphasizes reproducibility and transparency. All analytical procedures were conducted using open-source computing means and both the datasets and source code were publicly available online. This approach allows for easy and free reproduction, modification, and distribution, alongside other benefits such as reduced costs, lowering barriers to entry, increased flexibility and transparency.

Third, this study could be considered valuable as a pioneering attempt in applying new analytical and computational methods to Weber's original text. While the primary goal is not to necessarily generate new sociological theories or knowledge, the use of such digital text may help support, contextualize or even challenge existing interpretations of Weber's thought.

Finally, we have intentionally limited the scope of our research methods and range due to the extensive nature and thematic diversity of Weber's correspondence, which span multiple phases of his life. A more comprehensive content analysis is beyond the bounds of this initial paper. This work forms part of a broader five-year research initiative supported by the Korea Foundation Research which aims to conduct a more integrative investigation of the MWG utilizing such methods as content analysis based on natural language processing text mining and network analysis. Thus, we hope to produce deeper insights and implications of the content, structure and evolution of Weber's intellectual development in our further research.

The structure of this paper is as follows. First, we outline the background and theoretical foundation for adopting networks analysis by drawing on previous research. Next, we will describe our data collection process and methodologies in creating datasets, applying network analysis and data visualization. We then present our findings and implications, before we conclude our research with reflections on the broader significance of this study on Weberian scholarship.

2. Materials and Methods

2.1 Data collection

We have used the letters contained in the MWG II published by German academic publisher Mohr Siebeck, in 11 volumes with 9788 pages. The ten volumes of the MWG II contain 3472 letters written and sent by Max

Weber. They were produced from 1875 to 1920. We have employed ten volumes ranging from the MWG II 1 to MWG II10 to build datasets on the metadata. The MWG 11 includes supplements and registers. Details of the datasets are available on Table 1.

Table 1. Description of the MWG II

Volume	Period	Year of publication
1	1875-1886	2017
2	1887-1894	2015
3	1895-1902	2015
4	1903-1905	2015
5	1906-1908	1990
6	1909-1910	1994
7-1	1911-1912	1998
7-2	1911-1912	1998
8	1913-1914	2003
9	1915-1917	2008
10-1	1918-1920	2012
10-2	1918-1920	2012

After the preface, each volume of the MWG II has a chronological list of letters (*Chronologisches Verzeichnis der Briefe*) tabularized with columns like *Datum* (date), *Ort* (place), *Empfänger* (recipient), *Seite* (page index) as shown in Figure 1. In addition, the table has explanations on notations in German. We have included notation 'o. O.' (*ohne Ort*)' which means literally 'without place', which we have translated to 'place unknown' in our datasets.

Chronologisches Verzeichnis der Briefe			XV
Datum	*Ort*	*Empfänger*	*Seite*
11. August 1905	Heidelberg	Willy Hellpach	503
14. August 1905	Heidelberg	Willy Hellpach	506
16. August 1905 oder davor	o.O.	Willy Hellpach	507
16. August 1905 oder davor	Heidelberg	Paul Siebeck	508
16. August 1905	Heidelberg	Lujo Brentano	509
30. August 1905 oder danach	o.O.	Marianne Weber	510
1. September 1905	Heidelberg	Willy Hellpach	511
3. September 1905	Heidelberg	Emil Lask	513
3. September 1905	Heidelberg	Paul Siebeck	515
5. September 1905	Heidelberg	Willy Hellpach	518
5. September 1905	Heidelberg	Ignaz Jastrow	519
6. September 1905	o.O.	Franz Eulenburg	521
8. September 1905	o.O.	Franz Eulenburg	522

Figure 1. Chronological list of letters

We have constructed epistolary datasets on meta-data from the chronological list of letters from ten volumes of the MWG II to produce a tabularized data frame in the comma separated value (CSV) file format. We have translated variables in German: *Datum* to 'year', Ort to 'place', and *Empfänger* to 'recipient'. Moreover, we have converted date value of *Datum variable to year*. The data frame has 3478 observations and three categorical variables as shown in Table 2.

Table 2. Variables and description of the data frame

Variables	Description
year	Year of the letters is sent
place	Place where Max Weber sent letters
recipient	Recipient of the letters sent from Max Weber

Moreover, we have separated Weber's original letters from editorial works and annotations in the MWG volume to deal with copyright issues. We have reproduced the full text of his letters in the Microsoft Word format.

2.2 Methods

In an effort to ensure the reproducibility of our findings and to support further research and educational use, we employed social network analysis using the R programming language and a suite of third-party libraries. R is a widely adopted open-source language for statistical computing and data visualization, compatible on multiple platforms. Our analysis utilized the following R packages: *tidyverse, igraph, tidygraph*, and *ggraph*, which together facilitated the processing, analysis and visualization of complex network data. The resulting dataset comprises 509 nodes (corresponding to places) and 822 edges (corresponding to letter recipients), reflecting the structure and dynamics of Weber's epistolary network. The tidygraph and ggraph libraries were specifically used for data visualization. To promote transparency, we will make the complete epistolary dataset, full texts of Weber's original letters, and all associated R source code publicly available via Github.

3. Results

3.1 Statistical description

We created electronic maps to highlight the top-ten places where Weber sent letters, using Leaflet for R package as shown in Figure 2. Leaflet is an open-source JavaScript library for interactive maps. The Leaflet for R package is designed to create Leaflet maps from R easily [20]. The blue circles are mapped from data shown in Table 2 and the size of these circles represents the percentage of letters sent. Additionally, we have marked unknown locations in the North Sea outside Germany, situated between UK and Denmark.
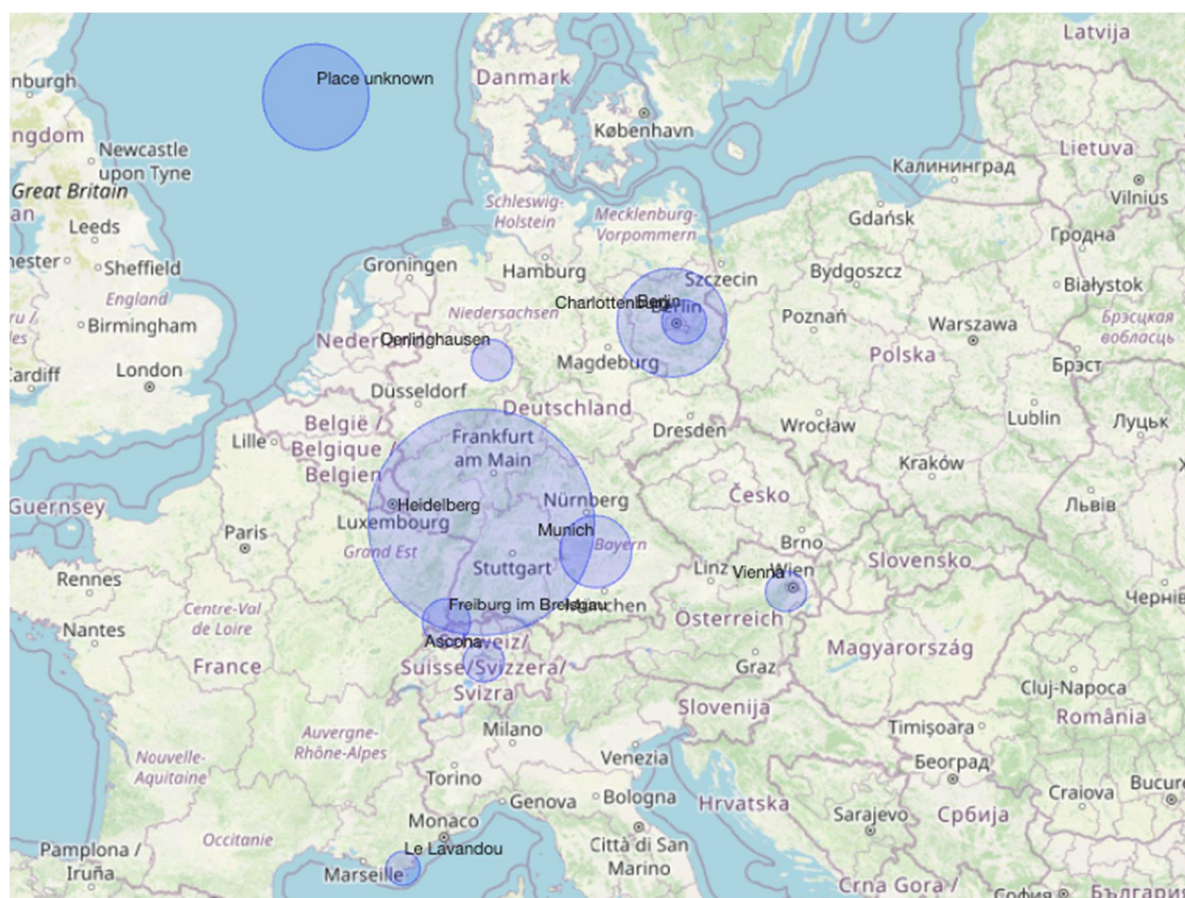

Figure 2. Top 10 places where Weber sent his letters

Heidelberg and Charlottenburg together account for nearly 60 percent of the locations where Weber sent letters, as shown in Table 3. Max Weber taught at five universities including University of Berlin, University of Freiburg, University of Heidelberg, University of Vienna, and Ludwig-Maximilians-Universität München. He spent much of his academic career in Heidelberg from 1882 to 1886 and 1896 to 1903. He started his academic journey by enrolling at the University of Heidelberg in 1882 and was later appointed there as a professor in national economy and finance in 1896. However, he resigned from his position at the University of Heidelberg due to health reasons in 1903 and then moved to Fallenstein House, a mansion on the Neckar River built by his grandfather in 1910.

Weber also spent time in Charlottenburg where he attended school from 1870 to 1882. He returned to Charlottenburg from Heidelberg in 1886 to work as a trainee lawyer until 1890. During this time, Weber was known to have immersed himself in the classical works of German writer Johann Wolfgang von Goethe (1749-1832) and German philosopher Immanuel Kant (1724-1). Weber's extensive reading in Charlottenburg played a profound role in developing his sociological theories on methodological approach.

Table 3. Top 10 places where Weber sent letters in descending order

Ranking	Place	Percentage	Frequency
1	Heidelberg	48.99	1704
2	Charlottenburg	10.23	356
3	Place unknown	7.84	273
4	Munich	5.20	181
5	Freiburg im Breisgau	2.50	87
6	Vienna	1.73	60
7	Ascona	1.67	58
8	Berlin	1.55	54
9	Oerlinghausen	1.55	54
10	Le Lavandou	1.29	45

Table 4 displays the Top 10 recipients of letters sent by Weber. It is interesting to note that three of his family are listed in the table including Marianne Weber, Helene Weber, and Alfred Weber (1868-1958). Marianne Weber was more than just Max Weber's wife as she played a crucial role in editing the first collected edition of his writings. She was also a sociologist and women's rights activist in her own right. She interacted with Weber intellectually via their correspondence. For instance, she attended lectures by prominent German neo-Kantian philosopher Heinrich Rickert (1833-1902). She sent a letter on Rickert to Weber and in response he engaged with her thoughts on Rickert in his own letters [21].

**Table 4.** Top 10 recipients of letters sent by Max Weber

Rank	Recipient	Percentage	Frequency
1	Marianne Weber	19.58	681
2	Paul Siebeck	11.44	398
3	Helene Weber	5.72	199
4	Mina Tobler	3.48	121
5	Robert Michels	3.39	118
6	Edgar Jaffé	2.33	81
7	Else Jaffé	2.07	72
8	Oskar Siebeck	2.01	70
9	Alfred Weber	1.98	69
10	Heinrich Rickert	1.87	65

Helene Weber (1844-1919) was Max Weber's mother and was a devout and ascetic Calvinist who engaged actively in the women's rights activist movement. In contrast, Weber's father, Max Weber Sr. (1836-1897) was "a man who enjoyed earthly pleasures" [22]. He was a renowned German lawyer, municipal official and National Liberal politician. He had a strained and often conflicting relationship with his wife and his son. The tensions between Weber's parents weighed heavily on his life. Over time, he became estranged from his father, siding with his mother. In 1897, Weber had a heated argument with his father over the latter's treatment of his mother. Weber accused him of subjecting Helen to patriarchal tyranny and demanded that she henceforth be allowed to visit him alone.

The dispute never being resolved, shortly afterwards Max Weber Sr. abruptly died. His death caused Max Weber to suffer from a nervous breakdown and he withdrew from teaching and spent time the next five years in a sanatorium. This strained relationship is reflected in the ranking — while his brother Alfred Weber appears ninth, his father is not notably absent.

Another key figure in Weber's correspondence was Paul Siebeck (1855-1920), a businessman for Mohr Siebeck Verlag, an academic publisher focused on the humanities and social sciences, based in Tübingen, Germany. He and his brother-in-law J. Gustav Kötzle (1840-1900), bought the publishing house J.C.B. Mohr in 1878 [23]. Mohr Siebeck later published the first and second collected editions of Weber's writings. Many of Weber's works were published posthumously, but these letters indicate that Weber was actively involved in publishing his work during his lifetime.

Finally, we turn to Mina Tobler and Else Jaffé (1874-1973) a German social scientist, both of whom appear in Table 4. Mina is believed to have influenced Weber's sociology of music [24]. Else Jaffé was married to Edgar Jaffé (1865–1921), a former student of Max Weber. Weber was known to have fallen in love with both Tobler and Jaffé [25]. Weber's extramarital entanglements were recently explored in a biography about him [26].
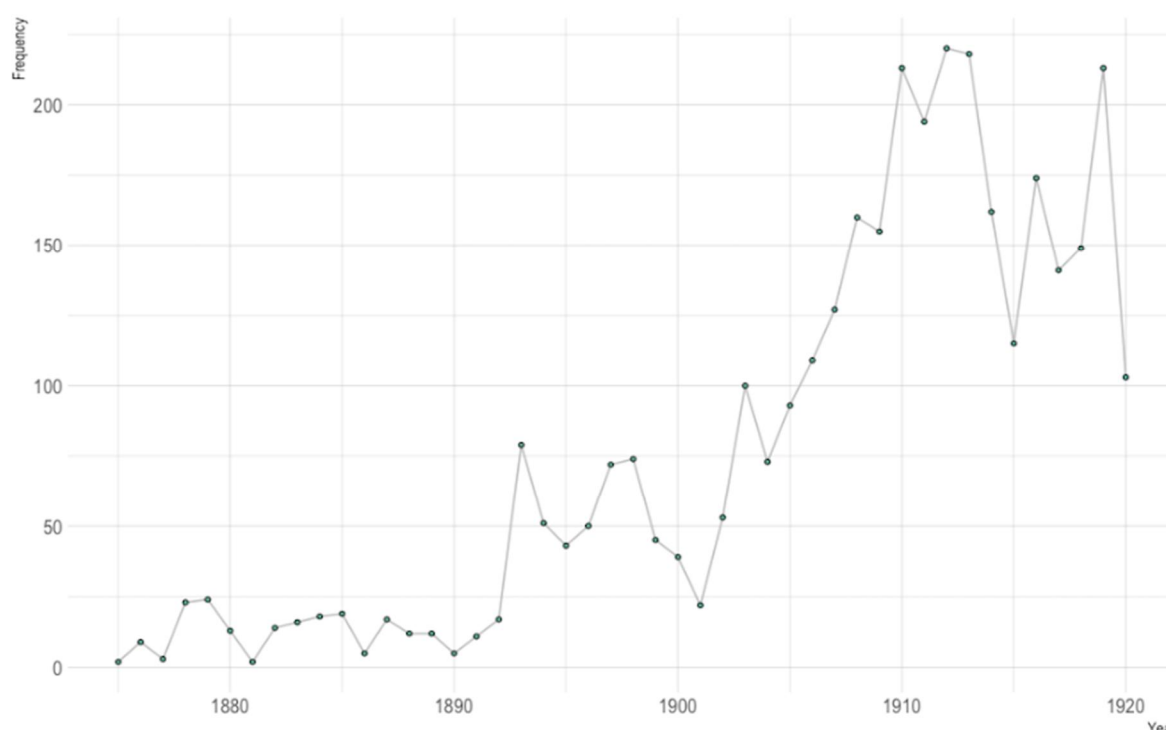
Figure 3. Frequency of letters sent by Weber from 1975 to 1920

Figure 3 shows the frequency of letters sent by Weber between 1875 to 1920.

We can see that his academic career milestones align with fluctuations in his correspondence. In 1889, Weber published his doctoral thesis, followed by his 1891 habilitation thesis, a postdoctoral qualification required in order to become a professor in German-speaking countries. In 1893, Weber began a relationship with his distant cousin Marianne Schnitger, whom he married later that year. This marriage provided Weber with financial independence, allowing the couple to move to Freiburg, leaving his parents behind. We can see his letter-writing activity increase from 1890 to 1893. As previously mentioned, Weber underwent a severe breakdown after his father's death in 1897, lasting to 1902. The letter-writing activity shows an oscillating pattern during that period. His letter-writing significantly increases from 1901 to 1913 before again oscillating between 1910 to 1920.

3.2 Social network analysis

Next, we turn to the results of the social network analysis, which is grounded in graph theory, a branch of discrete mathematics concerned with the study of nodes (vertices) and edges (links or connections). In this context, the term "graph" refers to a structure composed of nodes and edges. There is a key distinction between

'*undirected*' and '*directed*' graphs. Undirected graphs have edges with no inherent direction while directed graphs indicate a specific flow from one node to another.

Our analysis utilizes a *directed graph* structure, as all relationships in the dataset represent letters sent from Max Weber to various recipients. Due to the nature of the Max Weber Gesantausgabe (MWG II) dataset, which comprises only outgoing correspondence and doesn't include letters received by Weber. This one-sidedness imposes limitations on the scope of the analysis, particularly in assessing reciprocal relationships or the full dynamics of Weber's intellectual network. All edges in the network therefore represent unidirectional communication, flowing from Weber to individual recipients. Several key metrics were employed to characterize the structure and properties of the network, including centrality measures, density, diameter, clustering coefficient, and reciprocity.

Centrality was assessed through three primary indicators:

- Degree centrality, which quantifies the number of direct connections a node has. A high degree centrality suggests a recipient was frequently contacted by Weber and may have held significant importance in his correspondence network.
- Betweenness centrality, which identifies nodes that frequently appear on the shortest paths between other nodes, highlighting individuals who may have served as intermediaries or bridges in Weber's communication flow.
- Closeness centrality, which reflects how quickly a node can reach all other nodes in the network, suggesting the potential efficiency of communication or influence.

Additional measures include network density, which captures the proportion of actual edges relative to all possible edges in the network, and the clustering coefficient, which evaluates the tendency of nodes to form tightly connected groups. Furthermore, eigenvector centrality was used to assess the overall influence of a node by considering both its direct connections and the centrality of the nodes to which it is connected.

Finally, it is worth noting that the structure of the dataset is vertically extensive, comprising a relatively small number of variables but a large number of observations. This structure is suitable for social network analysis, as it allows for detailed modeling of connections, even with limited attribute data.

Given all of this, we have selected *degree centrality* as our primary network theory measure. *Degree centrality* is one of the simplest centrality metrics in network theory, measuring the number of connections a node has. A node's degree is a count of how many edges are linked. The out-degree centrality for directed graphs is defined by the following formula:

$$C_d^{out}(i) = \sum_{e \in \delta_i^{out}} w_l^L$$

where the out-degree centrality of a node *i* is defined as C_d^{out} and δi represents the set of outgoing links from node *i*, and w_l^L is the weight of each link *l* [27]. We used R and igraph package to compute degree centrality. Table 5 presents the degree centrality of the MWG II across periods from 1875 to 1920.

Table 5. The degree centrality of across periods from 1875-1920

Node	Value
Heidelberg	1700
Marianne Weber	681
Paul Siebeck	399
Charlottenburg	356
Place unknown	274
Helene Weber	199
Munich	182
Mina Tobler	121
Robert Michels	118
Freiburg im Breisgau	95

Table 5 displays the top ten-degree centralities of the MWG II ranging from 1975 to 1920. Four German cities Heidelberg, Charlottenburg, Munich, and Freiburg im Breisgau are shown in the list. As shown in the

statistical description, the locations where Weber spent most of his academic and legal career had high values of degree centrality.

Secondly, it is worth noting that three female recipients, Marianne Weber, Helene Weber, and Mina Tobler have high values of degree centrality in our analysis. This intriguing result suggests that Weber's relationships with three female correspondents warrant further research in Weberian studies for a more comprehensive understanding. Bologh's monograph examined Max Weber's work and thoughts from a feminist lens, where she argued that Weber's work advocated for a masculinist worldview [28]. However, we believe that analyzing Weber's correspondence with them could reveal deeper insights and his true attitudes toward gender from his personal interactions

Table 6. The degree centrality of across periods divided by 1875-1990, 1910-1910, and 1911-1920

1875-1900		1910-1910		1911-1920	
Nodes	**Value**	**Nodes**	**Value**	**Nodes**	**Value**
Charlottenburg	181	Heidelberg	638	Heidelberg	900
Heidelberg	162	Marianne Weber	304	Marianne Weber	301
Helene Weber	110	Paul Siebeck	126	Paul Siebeck	207
Freiburg im Breisgau	94	Place unknown	90	Munich	182
Marianne Weber	76	Robert Michels	76	Place unknown	162
Paul Siebeck	66	Helene Weber	42	Charlottenburg	150
Marianne Schnitger	50	Edgar Jaffé	42	Mina Tobler	121
Max Weber Senior	48	Lujo Brentano	37	Else Jaffé	71
Alfred Weber	37	Alfred Weber	31	Vienna	59
Berlin	32	Oskar Siebeck	31	Ascona	58

Table 6 presents the degree centrality of key correspondence across three time periods: 1875-1990, 1910-1910, and 1911-1920. We divided the MWG II dataset into these periods to allow for a more detailed analysis of Weber's communication patterns. In the 1875 to 1910 period, both Marianne Weber and Marianne Schnitger are listed with a degree centrality of 50. Since Marianne Schnitger was Marianne Weber's maiden name before her marriage to Max Weber, this indicates that she consistently held a prominent position in Weber's correspondence through his life. Hence, she is consistently ranked highly from 1875 to 1920 alongside nodes like Heidelberg, Paul Siebeck and Charlottenburg.

Interestingly, two male family members including Max Weber Senior, his father and Alfred Weber, his brother are listed in the period from 1875 to 1910. This suggests that Max Weber maintained correspondence with his father until the latter's death in 1879. However, his communication with his brother gradually declined in his later life, possibly indicating a shift in his social and intellectual network.

In the final period, Mina Tobler and Else Jaffé, who were romantically linked to Max Weber, appear prominently in the period from 1911-1920, alongside his wife. This suggests that Weber's correspondence with female scholars became more frequent in his later years rather than in his youth. Further research in this area could shed light on the significance of this pattern in Weber's personal and intellectual development.

4. Discussion

The analysis of Weber's collected letters revealed several notable patterns and characteristics. First, Weber's epistolary activity increased significantly in the later stages of his life, with fewer letters written during his youth. Second, his correspondence was geographically concentrated in Heidelberg and Charlottenburg—two locations that were central to both his academic career and personal life. Third, there was a marked surge in letter-writing activity beginning in the early 1900s, following his recovery from a nervous breakdown in 1898, a trend that continued into the 1910s.

These findings largely corroborate existing biographical accounts and well-known facts. It is already well established that Weber's correspondence peaked during his middle years, and that Heidelberg and Charlottenburg served as key geographic hubs in his intellectual and social networks. Furthermore, as expected,

his wife Marianne Weber appears as the most frequent recipient of his letters. As such, the present study may offer limited standalone scholarly novelty in terms of historical discovery.

Nonetheless, we believe this research makes meaningful contributions in several important ways. First, research is the pioneering application of computational methods to Weberian studies that quantifies Weber's epistolary activity through numerical and statistical methods, providing an empirical basis for analyzing trends in his correspondence. Second, by digitizing and making publicly accessible the full texts of Weber's original letters along with the corresponding datasets, this study lays the foundation for future research. We expect that this research will support more advanced studies that incorporate full-text content analysis, natural language processing and complex network analysis to yield deeper insights into Weber's intellectual development and social milieu.

At the time of writing, this study represents one of the first attempts within Weberian scholarship to apply quantitative methods to the MWG II dataset. By adopting a computational approach, we contribute a methodological framework for integrating digital humanities techniques into historical and sociological research. Furthermore, through the use of open-source software and publicly accessible data, this study emphasizes transparency and reproducibility, thereby offering a replicable model for future investigations in the field.

Despite these contributions, several limitations should be acknowledged. First, the present study does not include a qualitative content analysis of the letters, which would be essential for capturing the depth and nuance of Weber's intellectual development and personal relationships. Second, we did not employ natural language processing (NLP) techniques, primarily due to the substantial volume and complexity of the epistolary corpus, which exceeds the scope of a single paper. Future research will aim to incorporate NLP in order to identify linguistic patterns, thematic developments, and stylistic shifts across Weber's correspondence over time. More broadly, there exists a significant number of similarly extensive letter collections authored by major intellectual figures that have yet to be explored using computational methods. We hope that this study serves as a catalyst for further interdisciplinary research, helping to bridge the gap between traditional humanities scholarship and data-driven approaches.

5. Appendix: Data and Code Availabilty

We provide supplementary materials including data sets and R scripts GitHub. There are two folders at the link including datasets and R scripts. The dataset folder includes Weber's original letters extracted from MWG excluding the commentaries. The R scripts folder contains scripts used for this paper [29].

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