Networking for Historical Justice: The Application of Graph Database Management Systems to Network Analysis Projects and the Case Study of the Reparation Movement for Japanese Colonial and Wartime Atrocities

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ABSTRACT

Using the reparation movement for Japanese colonial and wartime atrocities as a case study, this paper explores the applicability of graph database management systems to network analysis research and teaching in the field of digital humanities. Since the late 1980s, Asian victims of Japanese colonial and wartime atrocities (such as the infamous "comfort women" system) began to sue the Japanese government and corporations with the help of local and Japanese lawyers and activists. This paper uses the plethora of publicly available court materials produced by the movement to study social networks in this transnational historical justice movement and illustrate how graph database management systems can upgrade traditional network analysis methodologies in digital humanities. By inputting the data about lawsuits and lawyers in the movement into graph database applications like Neo4j and GraphXR, the paper demonstrates the advantages of managing network data in graph database structure in terms of scalability, modifiability, intuitive visibility, query efficiency, and analysis potential over relational database structure, which is the mainstream in network analysis research.

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(1) CONTEXT AND MOTIVATION

(1.1) INTRODUCTION

Seventy-six years after the end of WWII in Asia, the problematics of the "postwar" (*sengo*) still haunt Japan today. While the term "postwar" often only represents a historical periodization lasting around a decade for most other countries, it remains highly political for Japan: politicians have been trying to declare the end of the "postwar" since the early 1950s (most famously in the 1956 Economic Whitepaper (経済企画庁 [Economic Planning Bureau of Japan], 1976)[1] that declared the end of the postwar but, nonetheless, drew public backlash); and scholars, even those outside Japan, still debate whether it has ended today (Gordon, 1993).[2] Contrary to such efforts to close off the "postwar," this condition of Japan has expanded transnationally. With the political and economic shifts in Asia accompanying the end of the Cold War,[3] Asian victims of Japan's colonial and wartime atrocities (most famously the military sexual slavery system of "comfort women" and massacres like the Nanjing Massacre), heretofore without a venue to articulate their sufferings, have begun to demand apologies and reparations from the Japanese government. With the help of both Japanese and compatriot activists, lawyers, and scholars, the victims[4] have launched over a hundred lawsuits against Japanese government organs and corporations.

This paper uses this transnational movement of "postwar reparation" (*sengo hoshō*), a massive movement that aims to confront the "postwar" of Japan and Asia, as a case study to examine the applicability of graph database management systems and their attached analytic tools to research and teaching that are related to network analysis and other digital humanities fields. As part of the ongoing project "A Graph Database of Reparation Lawsuits Against Japanese Colonial and Wartime Atrocities" (azurebamboo, 2021) that seeks to digitize relationships among lawsuits and participants in the reparation movement into a graph database, this paper examines how graph database approaches enabled by management systems like Neo4j, and analytic and visualization tools like GraphXR, can improve current network analysis research approaches, which heavily rely on relational database structure, and serve as foundations for expandable collaborative projects. This paper demonstrates this methodological intervention by performing network visualization and analysis on graphs extracted from this graph database of the reparation movement, focusing on the geospatial and temporal progression of the reparation movement through graphing the lawsuits and their origins as well as filing locations through space and time. Although the case study introduced in the paper is highly specific, the paper demonstrates that the methodology of graph database management and network visualization and analysis is readily generalizable.

(1.2) HISTORICAL BACKGROUND

Claims against the Japanese government for service and damage in the war (and by extension the empire's colonial endeavors), have always been a major component of the "postwar" problematics in Japan. Such claims were first put forth by those who served and suffered for the empire, especially by former Japanese soldiers and the bereaved of those killed in combat. Right after the end of the Allied Occupation of Japan in 1952, pressure groups that rallied behind this cause were able to quickly push the parliament to reinstate laws (which had been suspended during the Occupation) regarding benefits (then *onkyū*) for veterans, civilian military

1 The phrase became widely used as the symbol for efforts to close off the "postwar" and the ambiguous period Japan resides in after the war. For example, see 石井晋, "書評 青地正史著『もはや戦後ではない：経済白書の男・後藤譽之助』" 経営史学 = Japan Business History Review 51, no. 2 (September 2016): 89–92. [Ishii Susumu. "Review of *"It is Postwar No More:" The Man of the Economic Whitepapers, Goto Yunosuke*"]

2 This edited volume epitomizes this scholarly debate in the 1990s and serves as the foundation of later scholarship on the subject in Anglophone academia.

3 During the Cold War, the Japanese government sought to resolve the issues of reparation with the (usually authoritarian) governments under Pax Americana (such as South Korea and Taiwan), and later the People's Republic of China (which pivoted away from USSR to the United States), rather than with their people. This left open the possibilities for victims of these atrocities to directly demand reparations from the Japanese government after the end of the Cold War, but it also gave excuses for the Japanese government to dismiss these claims.

4 I use the term "victim" in this article not to diminish the agency of these people but to emphasize the legal denomination of these plaintiffs as victims of atrocities, which endows their testimonies with not only legal but also historical authority.

employees, and the bereaved families of those who died "serving the nation" (*okuni no tame*; for analysis of the civil activism and political undertakings that realized such claims against the state, see Seraphim, 2006). The reasoning was that regardless of the end result of the war (whether Japan was the victor or the vanquished), those who served the "public cause" deserved compensation from the state for their services. Parallel to this genre of claims were claims made by Japanese domestic victims of the war, first and foremost those who survived the atomic bombing. This demographic was the first to benefit from a new law granting state benefits (*teate*) to treat their physical, mental, and social complications. Over the course of three decades following the end of the war, these two genres of compensation claims gradually expanded in scope to include more constituents: over time, even war criminals (themselves if alive and their bereaved for those who had been executed) became eligible for veteran benefits (Seraphim, 2006; Pan, 2021, chapter 2). Other civilian victims, such as those who suffered from Allied air raids, also joined the *hibakusha* ("those who suffered from the atomic bomb") in receiving government benefits (Pan, 2021, chapter 4). However, for almost four decades, only those with Japanese nationality (*kokuseki*) were able to claim such compensations (*hoshō*) and reparations (*baishō*) from the government, reflecting the constitutionalist-nationalist limits of this regime for addressing the "postwar" (*sengo shori*) that guarantees *jinken* (lit. "human rights" today), but only for the *kokumin* ("national citizens").[5]

It was not until the 1970s that non-Japanese began to launch similar claims against the Japanese government. At the beginning, Korean *hibakusha*, both those who returned to Korea and those who continued to live in Japan, launched lawsuits to claim their place in the health benefit system created for Japanese *hibakusha* by the 1957 Act on Medical Care for Atomic Bomb Survivors.[6] Then came various lawsuits by other former colonial subjects (mostly Korean and Taiwanese) demanding compensation for their services (mainly in the military) and investments (such as military scrip) in war and colonial endeavors. With the help of Japanese and Korean activists, lawyers, and scholars, Koreans left behind on Sakhalin Island by their former empire also launched lawsuits against the Japanese government for reparations and political solutions to repatriate them. These lawsuits were sporadic during the late 1970s and throughout the 1980s, but they did begin to challenge the "postwar" compensation system that only privileged the Japanese *kokumin*.

These also paved the way for a surge of lawsuits since the late 1980s. The gradual expansion of the domestic "postwar" compensation system centering around *kokumin* also stimulated the production of oral history, which in many cases turned into political and legal testimonies. For example, heretofore silent victims of air raids on Japanese cities had to speak up and narrate their sufferings in order to claim their place in the compensation system. The outpouring of such testimony activism (*shōgen katsudō*) also expanded from the victims to the perpetrators of wartime and colonial endeavors, who mostly retired during the 1980s and thus had less at stake and more time to reflect on and articulate their past undertakings. Gruesome testimonies about atrocities such as the regular massacres of civilians in northern China and cannibalism in Papua New Guinea shocked the Japanese public, the majority of whom had never personally experienced the war, and prompted Japanese activists, lawyers, and scholars concerned with historical justice to actually conduct field work in these Asian countries to locate the victims and collect their testimonies. Thanks to economic development and integration, as well as the shift in the political climate in the region towards the end of the Cold War, victims and local civilian activists in many of these Asian countries also began undertaking a similar activism, and were ready to collaborate with their Japanese colleagues to tell their stories and launch their claims for apologies and reparations from the Japanese state. Such collaborations led to the plethora of transnational lawsuits that make up the reparation movement. To date, there have been 101 lawsuits filed in Japanese courts and 56 filed in South Korean courts. Hundreds of lawyers have fought these suits on behalf of plaintiffs who are victims of massacres across Asia, the biological weapons trials of the infamous Unit 731, the "comfort women" military sexual slavery system, forced labor by Japanese corporations and the military, and many more colonial and wartime

5 Pan 2021. More accurately, the term *jinken*, which was often used to discuss the state's responsibility towards those who suffered from the war and colonial endeavors, did not translate as "human rights" in these contexts before the 1970s.

6 For specific lawsuits, see Yamamoto, n.d. For Anglophone research on the movement, see Koga, 2016 and Hein, 2003.

atrocities. Thousands of activists and scholars have also supported this reparation movement. Although most of the lawsuits did not produce financial compensation and official apologies for the plaintiffs, they still succeeded in inscribing the plaintiffs' testimonies, which came to embody not only legal but also historical authority, into the public records of the Japanese state available for all to view. In this regard alone, the reparation movement is a significant step in achieving historical justice for Japan and Asia in general, and the archive of information the movement produced continue to boast potential for future activism. The data for this paper come from these lawsuits and the human agents that constitute this (still ongoing) transnational movement.

(2) METHOD: DATA COLLECTION AND COMPILATION

(2.1) DATA SOURCES

Since the movement centers on the "history problem" of the "postwar," its participants have been meticulous in excavating, preserving, and producing historical records on both the movement's objects (the atrocities) and their own activism.[7] Since the late 1980s, Japanese activist groups such as the "The Gathering for Carving the Remembrance and Commemoration of the War Victims of the Asia-Pacific Region in Our Hearts" (*Ajia taiheiyōchiiki no sensōgiseisha ni omoi wo hase, kokoro ni kizamu shūkai*) have dedicated themselves to the publication of primary accounts of Asian victims of Japanese colonial and wartime atrocities (Pan, 2021, p. 286). After publishing numerous serialized volumes on topics such as forced labor, the "comfort women," and various wartime massacres by the Japanese military, some activists from this group also compiled a handbook that summarized the lawsuits and issues in the reparation movement (<ハンドブック戦後補償>編集委員会 [Postwar Reparation Handbook Edition Committee], 1992; 戦後補償問題研究会 [Committee of Postwar Reparation Study], 1990). Individual activist groups focusing on specific issues also meticulously record their courses of actions, including litigations. For example, the support group for the lawsuit by victims of the biological weapons trials from southern China, mainly managed by lawyer Ichinose Keiichirō who spearheaded the litigations, details the course of the lawsuit on their website, which is a typical practice among reparation activists (*731*部隊細菌戦国家賠償請求訴訟 [The Lawsuit for Compensation for Unit 731 Germ Warfare], n.d.). These acts of recording the movement focus more on the production of testimonies by the victims.[8] For example, support group websites always privilege testimonies by the victims over other legal documents, even in the lawsuits sections. In contrast, the "Overview of Postwar Reparation Lawsuits" (*Nihon sengo hoshōsaiban sōran*) compiled by lawyer Yamamoto Seita, a seasoned lawyer who fought multiple lawsuits in the movement, takes the form of a chart that provides the barebones information of all the lawsuits in the movement (Yamamoto, n.d.). The information provided in the "Overview" for each lawsuit includes the title, summary, dates of filings and rulings, plaintiffs, defendants, plaintiffs' representatives (lawyers), and rulings. While expansive, the "Overview," which includes 101 lawsuits, is still not complete or exhaustive. For example, many entries are missing ruling or filing dates, and the lists of lawyers for the lawsuits are often incomplete.

Despite these limitations, this project uses the "Overview" as the foundation for the graph database[9] since it is the most comprehensive compilation of lawsuits in the movement and is based on both personal experiences and connections of movement participants and existing publications documenting the movement. The project then consults the websites of each lawsuit or cause, mass and social media reportage on the lawsuits, and personal interviews to supplement missing or inaccurate information. However, such supplementations are also

7 The data used in this paper can be accessed on GitHub at *https://github.com/azurebamboo/Graph-Database-for-Reparation-Lawsuits-against-Japan-for-Colonial-and-Wartime-Atrocities-*.

It is also deposited in the Harvard Dataverse at *https://doi.org/10.7910/DVN/CZ4PBO*.

8 Again, I use the term "victim" not to minimize the agency of these people in participating in the reparation movement (the prime goal of which is precisely to reclaim their agency vis-à-vis the Japanese state), but to refer to their role in the legal battles (*higaisha* by Japanese lawyers and activists) as the actors who produce testimonies that carry both legal and historical authority.

9 A graph database is a type of database that uses graph structures for semantic queries. Compared to a relational database (in network analysis, a simple example would be a set of node and edge tables), a graph database represents relationships (or edges) between nodes explicitly (instead of implicitly). See Section 3 for details.

often incomplete, which is why the project is an ongoing one that calls for collaboration. One example is the lawsuit launched by the bereaved families of Liu Lianren, who was a Chinese victim of forced labor by Japanese military and mining corporations. His family sued the Japanese government in 1996. Because lawsuits in the movement usually drag on for years and are fought all the way to the Supreme Court, lawyers attached to the suits are often subject to change over the years, and the "lawyers" section of the "Overview" often comes with the entry "Others." Liu's case continued until 2005, when it was dismissed by the Supreme Court of Japan. According to the "Overview," apart from lawyer Takahashi Toru, there have been 120 "other" lawyers on the case over the years (Yamamoto, n.d., Case 43). Accurate and exhaustive information can sometimes be found in the official Petitions or Rulings for lawsuits, which support groups often publish on their websites. Such documents can be found on the website for Liu's case, but even these official public documents do not contain the exhaustive list of the 120 lawyers, which means that only personal interviews would enable us to complete the list. However, the names of two of the other lawyers, Onodera Toshitaka and Oyama Hiroshi, who also worked on numerous other cases and are thus key nodes in the graph database, can be recovered from the documents (すおぺいネット[Suopei.net], n.d.). As a result, currently in the database, the node of Liu's lawsuit is connected to these three lawyers and the stand-in node of "Others." As a result, while the database can represent all the lawsuits in the movement, data for the lawyers, activists, and plaintiffs for some lawsuits are still missing. For this ongoing project, the next steps would thus be more personal interviews with participants of the movement and archival research of both court and other government materials and personal documents from the participants to further enrich the data.

(2.2) PRIVACY, PERSONAL SAFETY, AND OTHER ETHICAL CONCERNS

Lawyer Yamamoto Seita has a page called "Anonymous Treatment of Court Records and Other Materials" on his website that houses an "Overview" (訴訟記録などの資料の匿名処理について [About the Anonymity in Our Records], n.d.). "In light of the nature of the medium of the internet and the recent degradation of Japanese society," Yamamoto has decided to only include the family name of the plaintiffs in the lawsuits unless they have already willingly publicized their identities when giving testimonies. Although technically, the ruling and filing papers that carry the names of the lawyers are in the public domain (accessible from the websites of Japanese court systems if one is willing to look), I share the same concern with lawyer Yamamoto that including the full names of lawyers and activists in this graph database may jeopardize their privacy and even their safety given the widespread use of harassment and threats, both online and offline by ultra-right wing groups and individuals, against the plaintiffs, activists, lawyers, and scholars who participate in the movement. I thus consulted with lawyer Ichinose Keiichirō about the potential legal and political ramifications of creating such a database. Lawyer Ichinose (half-jokingly) concurred with Yamamoto's assessment that Japanese society has become "degraded" but acknowledged the "concern about deliberate attacks on this type of information."[10] Ichinose then advised me to follow Yamamoto's convention and include the full names of only the lawyers, and not publicize the full names of other movement participants unless explicit consent was acquired. As a result, for now, the database only contains the full names of the lawyers. To further expand the database, this project plans to formally reach out to activists and groups that have participated in the movement to obtain consent (or explicit declination) for the inclusion of their information in the database.

(3) RESULT AND DISCUSSION: THE APPLICATION OF GRAPH DATABASE MANAGEMENT SYSTEMS TO NETWORK ANALYSIS RESEARCH AND TEACHING

In the field of digital humanities, network analysis and visualization (Pan, 2020) are often achieved with open-source software designed for and geared towards academic research. The most beginner-friendly tool is Palladio, a product of an NEH Implementation grant and that

10 Again, I use the term "victim" not to minimize the agency of these people in participating in the reparation movement (the prime goal of which is precisely to reclaim their agency vis-à-vis the Japanese state), but to refer to their role in the legal battles (*higaisha* by Japanese lawyers and activists) as the actors who produce testimonies that carry both legal and historical authority.

can visualize simple graphs with edge table inputs (Palladio App, n.d.). Gephi, one of the most frequently used instruments in the field, comes with a more powerful toolkit for visualization options and statistical analysis (*Gephi.org*, n.d.). The rapidly growing field of social network analysis, especially for research done on social media, has spurred the development of a wide range of tools, such as Netlytic and SocioViz, that are designed for such purposes. For advanced users, packages and integrations in the statistical computing environment R and programing language Python, such as igraph, can enable more complex analysis, although knowledge about these programming and query languages is usually required. While a plethora of tools for visualization and analysis for network research exists, most studies in the field use simple edge lists, a type of relational database structure, as their basic data structure. Few studies in digital humanities have focused on graph database creation and management as a foundation for continuing research and teaching based on network analysis and visualization. Compared to relational databases, which implicitly represent the relationships (or edges) between nodes (or entities) in a network, graph databases treat relationships as first class citizens that can have labels and properties, and thus represents them directly as objects. For example, when combined together, the "node table" and the "edge table" that the software Gephi usually requires constitute a relational database. Programs like Gephi can use the "Id" column ("primary key" in database terminology) to generate the edges (or relationships) when relevant values are referenced in the "edge table" in the "Source" and "Target" columns. In contrast, a graph database eliminates this extra layer of implicit referencing ("indexing" in traditional relational databases, which becomes resource expensive when data volumes and queries increase) (Lazarevic, 2021). ***Figure 1*** illustrates this difference. This has significant implications for network analysis in digital humanities research and teaching. Most directly, this property graph model in a graph database expands the dimension of information the edges can convey in a network. In relational databases, edges usually only convey directions and at most labels (categories), but they can carry easily expandable and modifiable properties in graph databases. This means that for long term projects such as this one (which, because of the current incompleteness of the source data, calls for continuing addition of data), graph database allows for more possibilities in terms of efficient and versatile querying and expansion. For example, while one would have to change several rows or even key tables in a relational database if new nodes need to be added into existing relationships or relationships need to be modified, one could simply annotate and change single entities in a graph database to achieve the same effect. Since the data collection of this project is still ongoing, this project adopts a graph database model and uses a graph database management system to house the data.

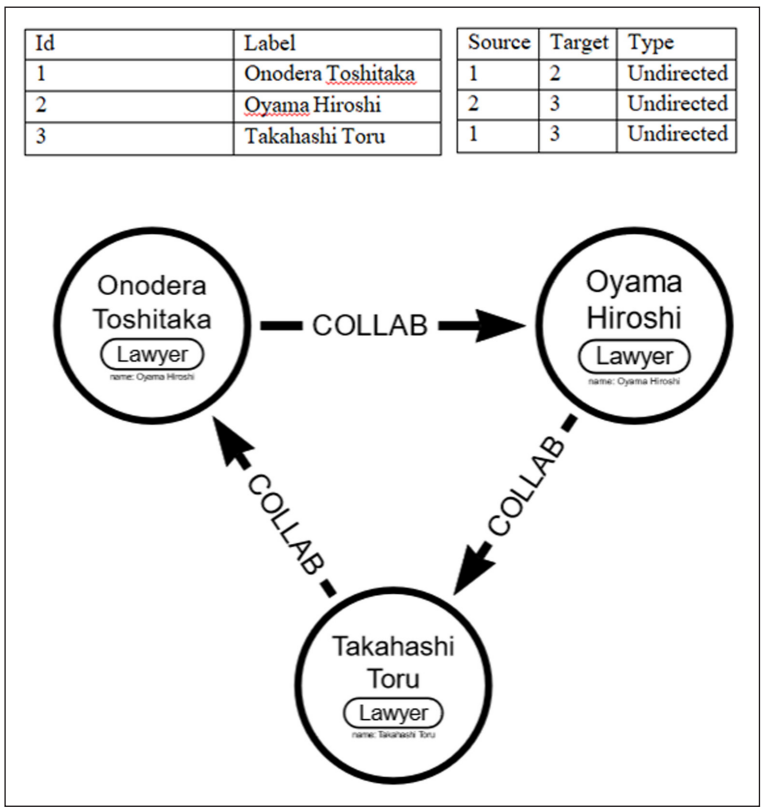

Figure 1 An Example of a Relational Database versus a Graph Database Structure. On the top, the node table on the left and the edge table on the right represent that the three lawyers are connected to each other when combined together in a relational database. In contrast, the graph database structure on the bottom directly represents the nodes and edges (with properties).

Another reason why this project uses a graph database structure is the property graph's strengths of representing edges (or relationships). In a property graph, edges (or relationships) in the database can have not only directions, but also properties and labels. For example, while representing a lawsuit that was filed and received rulings from a number of courts at different times and with different results (which are properties of the edges or relationships) can be complicated and even unattainable in a relational database, one can easily add simple "FILED_TO" and "RULED" edges (which are first class citizens in the graph database) with expandable properties like "date" and "result" in a graph database. The creation of a graph database can be realized in open-source versions of software geared towards commercial use, such as GraphQL and Neo4j. This project utilizes Neo4j and its query language Cypher to build and manage the database. Neo4j is a graph database management system developed by Neo4j, Inc., and this project utilizes its GPL3-licensed open-source "Community Edition," which is free to the public (Neo4j Inc., n.d.). Neo4j is also available in an "Enterprise Edition" under a closed-source Commercial license and is used mainly commercially in fields like Fraud Detection, Supply Chain Management, and Identity and Access Management. Due to its versatile functions and a myriad of add-ons, Neo4j is very suitable for network analysis research in digital humanities. In fact, this project is not the first digital humanities initiative to utilize Neo4j. Most related to the subject of this project, the Graphing POW Camp Mistreatment in Wartime Japan portion of the War Crimes Documentation Initiative (WCDI) at the University of Hawai'i at Mānoa also uses Neo4j and the query language Cypher to "illuminate the connections and relationships among seemingly discrete war crimes trials that the Allied authorities held in Asia and the Pacific following the end of World War II" (War Crimes Documentation Initiative, n.d.). In addition, historian Javier Cha also uses Neo4j to study the network of *Yangban* aristocracy in medieval Korea (Cha, 2019, 2021/2022). All such previous scholarship chose the graph database structure and the Neo4j platform partly because of their strengths in data expandability and relationship representation, the same reasons why this project chose these methods, which will be discussed later in the paper.

In Neo4j and other graph database management systems, the database is organized according to a schema, namely, what the nodes are and how they are connected (by what relationships with what properties). For example, the WCDI graph database uses a POLE (Persons, Objects, Locations, Events) principle to guide the development of its schema, in which "Person" nodes, which are affiliated with "Location," are victims or perpetrators of "Crime" who are charged in "Trial," among other relationships (War Crimes Documentation Initiative, 2021). The graph database for this project uses a primary schema that can be modified when the data are processed in other tools such as GraphXR (Kineviz Inc., n.d., discussed later).[11] The primary schema consists of the node classes "Lawsuit," "Court," "Lawyer," and "Defendant." In the primary schema, plaintiffs are recorded as properties of the "Lawsuit," and geographical coordinates are properties of the "Court," which can be mapped using visualization tools like GraphXR. The schema is the foundation of a graph database, and thus its modeling entails significant interpretation of the data. However, since the schema can be modified through extractions of properties from both nodes and relationships in GraphXR without affecting the database itself, the structure of the primary schema here has more flexibility.[12] In terms of the relationships, "Lawsuit" is fought "AGAINST" "Defendant," and is "FILED_TO" the "Court," which "RULED" on the case; "Lawsuit" is also "FOUGHT" by "Lawyer," who "COLLAB" with each other. ***Figure 2*** illustrates this schema along with some other metrics of the database (such as number of nodes and relationships).

11 For example, in some analyses with tools like GraphXR, "Lawsuit" nodes are eliminated and deprecated as a property of the "COLLAB" relationship between "Lawyer" to facilitate the execution of a community detection algorithm on "Lawyer."

12 For example, one might question why "Lawsuit," a type of event, is a node here instead of set of properties or relationships. In fact, in GraphXR, one can easily produce both of such forms in different network manipulations. This can be achieved using the Transform functions in GraphXR (*How To GraphXR*, n.d.).

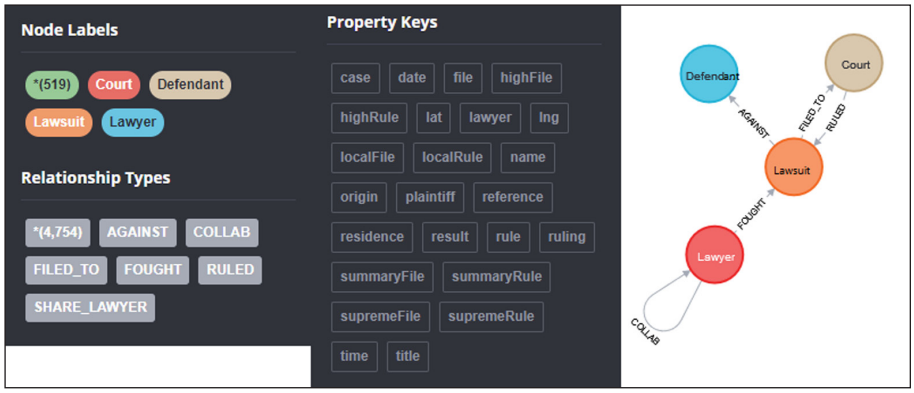

Figure 2 Schema and Data Summary of the Graph Database.

Creating the graph database in Neo4j comes with several strengths. First, one can easily query the database with the Cypher language for different combinations of information needed from the database. For example, if one wants a table for the title and the first filing date of all the lawsuits originating from mainland China, one can simply write the query shown in ***Figure 3*** (namely, matching nodes with the value "Chinese" as their property "origin" and returning the info needed) and export a table (as CSV or in another format) from either the Neo4j Sandbox (a free browser version of Neo4j), Neo4j Desktop, or other free Neo4j software. Second, the graph database is freely modifiable and expandable. As a relatively small database (currently with 519 nodes and 4270 relationships) whose sources are mainly gathered as sporadic leads instead of automatically generated data, the expansion of the database will most probably be done through human input and will contain possible human errors. With Neo4j, one can easily add new nodes, relationships, and properties (including those connecting to existing nodes), modify them, and examine possible errors with Cypher query codes. Thirdly, the Neo4j browser (the querying interface in the Neo4j software) also comes with simple data visualization tools; if one wants to quickly visualize and examine parts of the database, one can do so with a simple line of query as shown in ***Figure 4***.

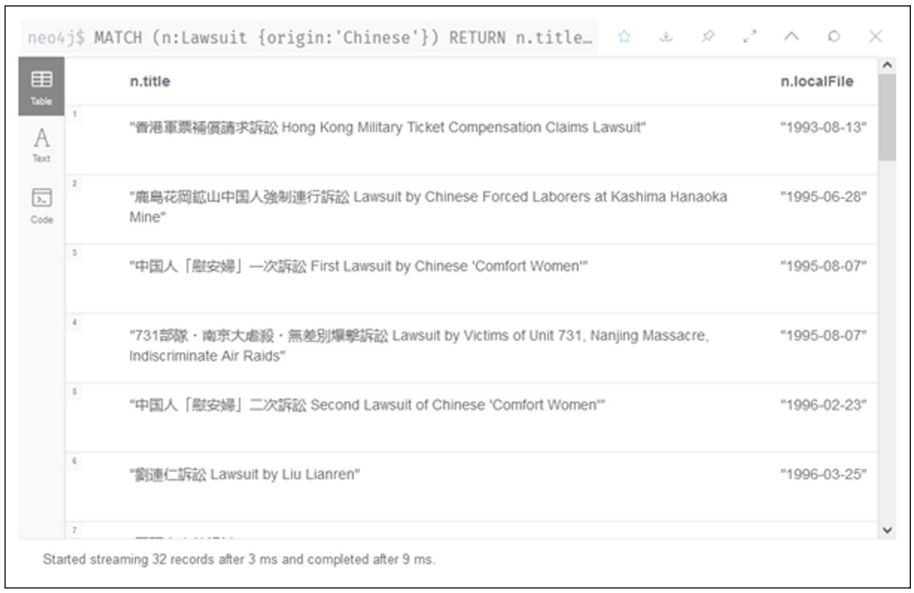

Figure 3 Query Result in the Neo4j Browser of Lawsuits by Chinese Plaintiffs and Their Filing Dates at Local Courts.

With these features, we can tabulate some obvious statistics for the movement. For example, we can easily export all 259 filings and rulings in the movement by extracting such information from the properties of the "Lawsuit" nodes and "FILED_TO" and "RULED" relationships, and we can see that the majority (200) of the filings were dismissed in different forms, and only 21 filings (only 2 of which were at Supreme Court) were completely upheld.[13] ***Figure 5*** is a summary of such results. This merely confirms the general wisdom that the litigation activism in the reparation movement served more to give the plaintiffs a platform to articulate their own

13 There are a variety of terms for dismissing a filing in Japanese courts, including 棄却 (*kikyaku*), 却下 (*kyakka*), and 取下 (*torisage*). They have nuanced (but important, depending on the context) legal differences, but for the plaintiffs, they were all essentially "dismissals" of their cases by the Japanese courts.

experiences as legal (as well as historical and personal) testimonies, rather than to substantially achieve financial remittances. However, putting information about the movement in a graph database makes exporting, tabulating, and visualizing such general observations (through simple querying) scalable and modifiable, and thus easy to achieve. In the following sections, this paper will examine other capabilities of the graph database on top of these functions.

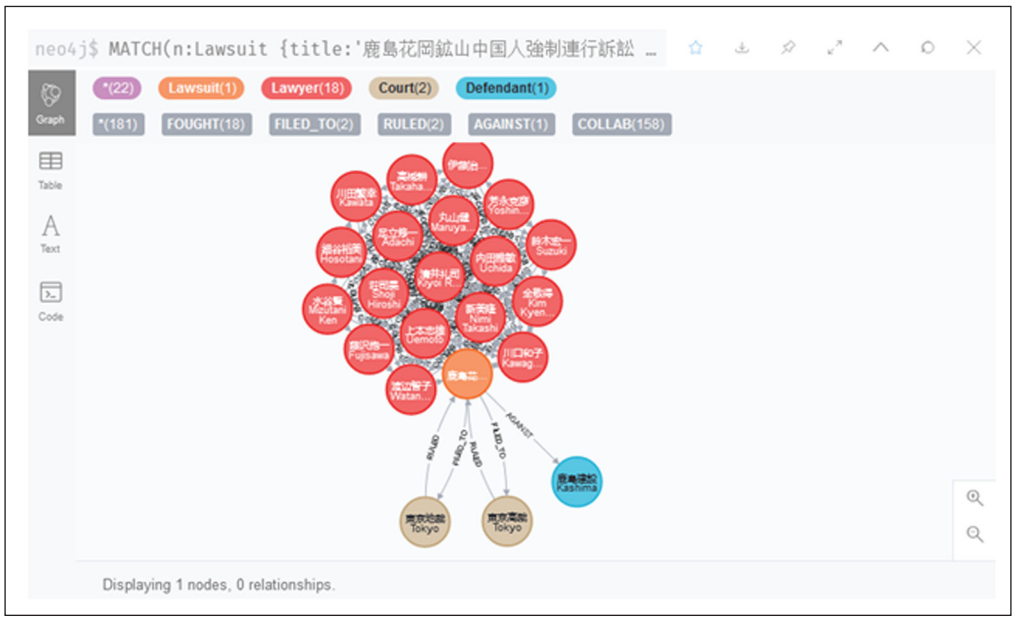

Figure 4 Simple Visualization of One Lawsuit and Connected Nodes in Neo4j Browser.

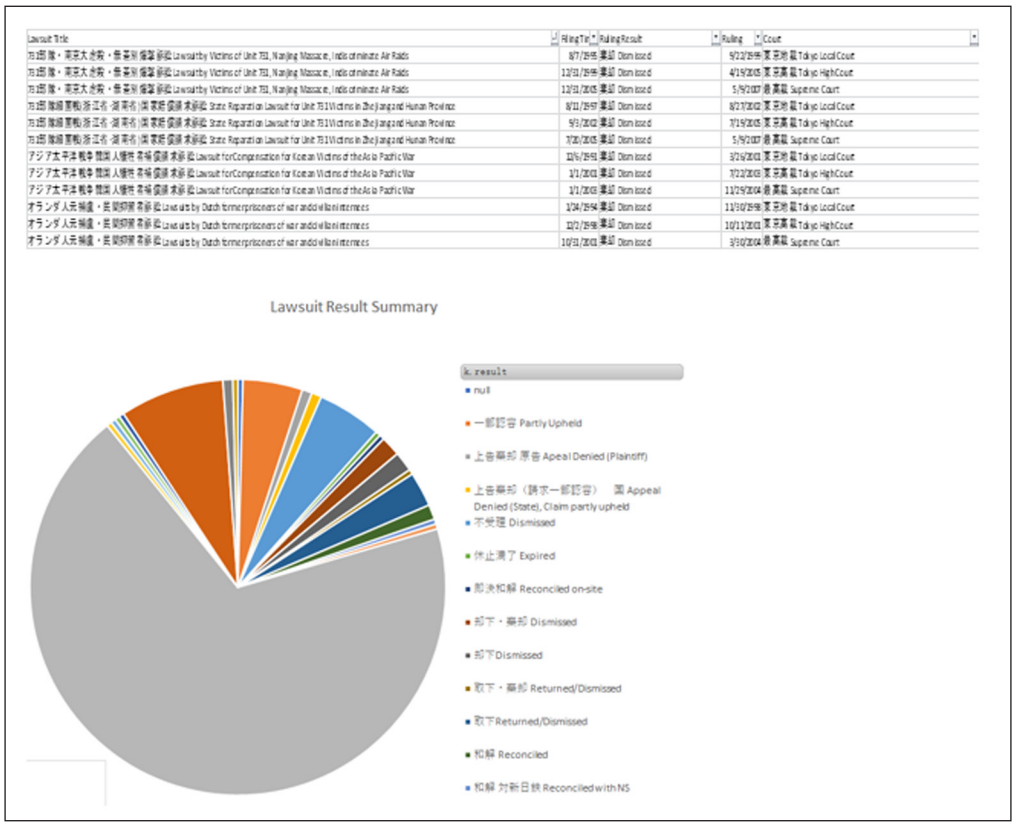

Figure 5 Excerpt and Pie Chart from the Lawsuit Filings Tabulation Exported from the Database.

(4) APPLICATIONS: VISUALIZATION AND TEACHING POTENTIALS: A GEO-SPATIAL ANALYSIS OF THE PROGRESSION OF THE REPARATION MOVEMENT

A large and significant advantage of network analysis in digital humanities teaching and research is the techniques to visualize and intuitively present complex relationships among entities that traditional text descriptions simply cannot convey. Putting the data of the reparation movement

into a graph database greatly strengthens this forte of network analysis. The management system of Neo4j is equipped with a wide variety of Graph Apps for such purposes, and one of them, GraphXR, is particularly suited for presenting our data. In itself, GraphXR is a browser-based visual analytics platform compatible with a variety of database systems including Neo4j, for which its mother company Kineviz built the native Graph App (Kineviz Inc., n.d.). Like Neo4j, it also has a free open-source "Explorer" version that allows users to store up to three projects with less than 1000 nodes, which is perfect for our database at this stage. Another advantage of GraphXR over other visual analytics tools is that it can visualize networks in both 2D and 3D space and is compatible with VR devices, which opens up a wide variety of teaching and research possibilities. In this section, I will discuss two examples of visual presentation with our graph database in GraphXR, before going, in the next section, into the visual analytics that use the centrality and community detection algorithms in GraphXR and Neo4j.

As mentioned, data can be loaded into GraphXR in different ways. When connected to a Neo4j database, nodes and relationships can be pulled onto the scene using either the search function or with Cypher or other kinds of query codes.[14] Hence, we can choose to load only part of the database. The first visualization example consists of a time-lapse playback of the lawsuits filed over time and the filing and ruling courts. To achieve this, we can use the cypher code to only load the "Lawsuit" nodes and "Court" nodes. Using the "Layout," "Filter," and "Map" functions of GraphXR, we can create a video-like time-lapse view of the lawsuits by their filing and ruling dates, in which we arrange the "Lawsuit" nodes into a circle for visibility, filter by the ruling and filing dates properties recorded in the database, and pin the "Court" nodes onto the map using their latitude and longitude properties recorded in the database. In the actual GraphXR interface, one can zoom into the view and double-click on specific nodes to examine detailed information. ***Figure 6*** is a snapshot of this view, with the blue edges being the "FILED_TO" relationships and the red ones the "RULED" relationships. One can use the link in the caption to access the time-lapse view in a shareable GraphXR instance.

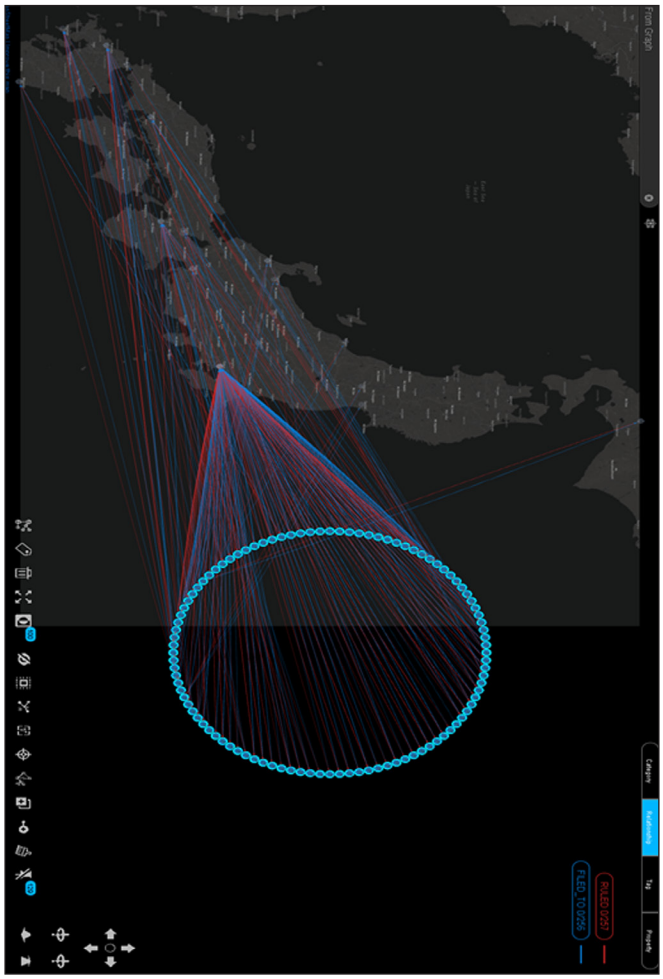

Figure 6 End-Point Snapshot of Time-lapse of Lawsuits Filed in Japanese Courts from 1970s to 2010s: A time-lapse view can be accessed at *https://graphxr.kineviz.com/share/610cd4dd7218aa003c1fcfb0/lawsuit/6114a2507218aa003c268e32* (with the "Filter" function on the left of the GraphXR interface).

14 For a tutorial to GraphXR, see: (*How To GraphXR*, n.d.).

To take this visualization a step further, one can also create new nodes representing the locale of origin of the plaintiffs in the lawsuits and overlay them onto this view (***Figure 7***). This can be achieved by extracting the "origin" property of the "Lawsuit" nodes into another category of nodes using the "Transform" function in GraphXR and adding geographic coordinate properties to them. To enhance visibility, one can also tilt the map and arrange the nodes in 3D space and delete or hide the "Court" nodes. The time-lapses intuitively demonstrate that although Taiwanese and *zainichi* (people of Korean origin residing in Japan) plaintiffs launched the first several lawsuits in the 1970s (which were mainly about their unequal treatment by the Japanese government compared to their Japanese counterparts who served the empire in similar roles), lawsuits from South Korea and mainland China quickly became the majority beginning in the late 1980s. Most of these suits originated in the Tokyo Local Court, especially those against the Japanese state (*kuni*) as the defendant, indicating Tokyo as the central stage for the national and international political aspects of litigation activism in the movement. A significant minority of the lawsuits were filed in locales where the atrocity on trial occurred (such as sites of forced labor). These were often supported by local networks of lawyers and activists who were not as connected with those based in Tokyo, and this will be discussed in later sections. Although queries in Neo4j can also reveal these findings, being able to directly visualize and observe them definitely carries great value in itself, especially for teaching and presentation.

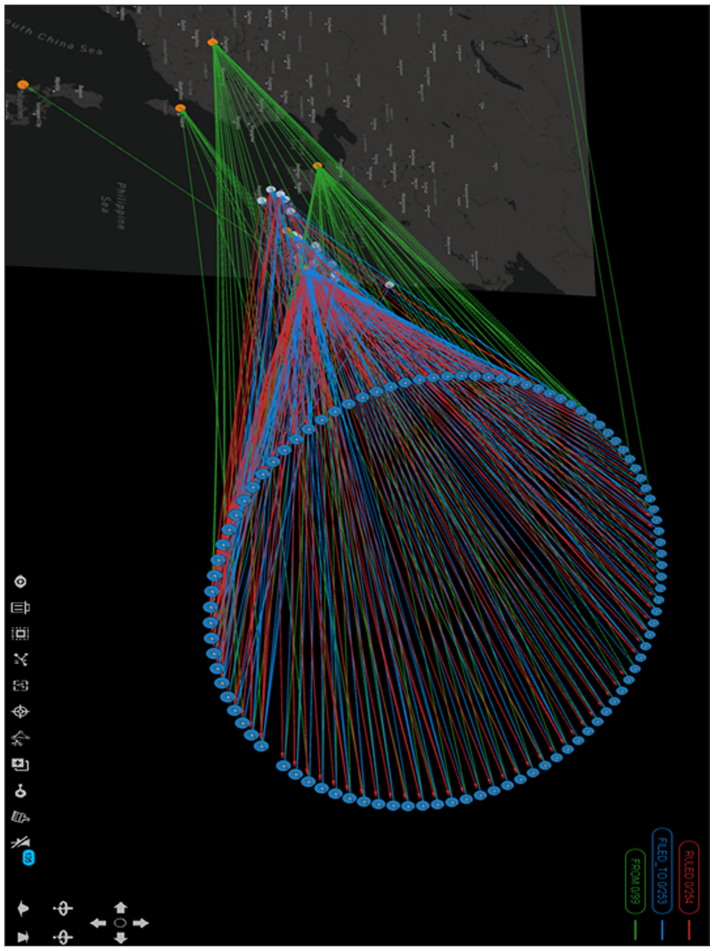

Figure 7 End-Point Snapshot of Time-Lapse of Lawsuits by Origin of the Plaintiffs Visualized in 2D and 3D Space: A time-lapse view can be accessed at *https://graphxr.kineviz.com/share/610cd4dd7218aa003c1fcfb0/lawsuit/615def8e782c180052a81724*.

CONCLUSION

Using the reparation movement for Japanese colonial and wartime atrocities as a case study, this paper has demonstrated the applicability of graph database management systems in the research and teaching of network analysis and other cultural analytics fields. Compared to using a relational database structure, which is currently utilized by most network analysis research, graph databases using the property graph model, such as those used by Neo4j, can accommodate more layers of expandable network data and more efficiently and versatilely query them for analysis by treating not only nodes but also edges in the database as first class citizens with easily modifiable properties. Storing data about the reparation movement thus

enables a variety of approaches to visualize and analyze the movement. For example, in addition to being able to export all the iterations of information in relational data forms (as different kinds of edge and node lists, for example), the graph database of the reparation movement can also achieve time-series and geospatial visualizations and analyses of nodes and edges. This paper uses the tool GraphXR to create time-lapse views of where the lawsuits came from, were filed, and were ruled on throughout the last four decades. From such visualizations, one can intuitively observe how the reparation movement has grown dramatically since the late 1980s and how countries like China and South Korea have come to the forefront of the movement. This technique with GraphXR can also be used for any other graph and relational database with time stamp properties on nodes or edges, greatly broadening the horizon for pedagogy and research with network data.[15] As mentioned above, the data size of this project is still comparatively small and incomplete at the moment, so the next steps would be a) continuing to amass source data and make addition and modification to the current database, and b) conducting statistical analysis, such as centrality and closeness tests with nodes, with data in the database, to better understand networks in the reparation movement.

ADDITIONAL FILE

The additional file for this article can be found as follows:

- **Pan, Keyao.** (2022). "Networking for Historical Justice: The Application of Graph Database Management Systems to Network Analysis Projects and the Case Study of the Reparation Movement for Japanese Colonial and Wartime Atrocities", *https://doi.org/10.7910/DVN/CZ4PBO*, Harvard Dataverse, V1, UNF:6:p8zAD6owOCDZT0iIU8lR5w== [fileUNF].

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COMPETING INTERESTS

The author has no competing interests to declare.

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