Researching North Korean Historiography with Digital Humanities Methodologies

Intae RYU and Jong-wook HONG

Abstract

The purpose of this article is to attempt to combine North Korean humanities research with digital humanities methods, using the North Korean Humanities Data Archive (NKHDA) project as an example, and to report on a newly constructed semantic data processing model. Although NKHDA targeted the entire scope of North Korean humanities, it mainly focused on the field of historiography, which has a relatively large accumulation of scholarly information. This article focuses on North Korean historiography to discuss the following three points. Firstly, the theoretical and technical background of the NKHDA is summarized. Secondly, the trial-and-error process of constructing NKHDA is described. Thirdly, the process of creating a new model of semantic data processing by combining wiki documentation and triple data/ visualization is described. A new model was made possible by embedding triple data lists and network graphs into wiki pages and developing a data entry tool for triple data generation. Also described is the NKHDA's use as an educational platform for the digital humanities.

Keywords: North Korean historiography, digital humanities, NKHDA (North Korean Humanities Data Archive), semantic data processing, triple data, network graph, wiki database

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Introduction

The Institute of Humanities at Seoul National University (SNU IOH) undertook the North Korean Humanities Data Archive (NKHDA) project for three years from 2020–2022.[1] The aim of this article is to introduce an attempt to combine North Korean humanities research with digital humanities methodologies using the example of the NKHDA project, and to share the details on the newly constructed semantic data processing model that was one of the outcomes of the NKHDA project.

The implementation of the NKHDA project was driven by two needs.[2] First, the importance of the study of North Korean humanities for understanding and critiquing North Korean society. According to the SNU IPUS (Institute for Peace and Unification Studies at Seoul National University) "Unification Consciousness Survey" (2021), 29.4 percent of South Koreans think unification is not necessary, the highest percentage since the survey began in 2007. In addition, the public's acceptance of North Korean defectors is declining and negative perceptions of North Korea are increasing due to media influence.[3]

The results of the survey demonstrated that South Koreans' lack of understanding of North Korean society and the widening gap between the two Koreas was a key concern.[4] This general lack of understanding is not surprising given that most information about North Korea provided by South Korean academics and the media is focused on political and economic

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1. In this article, the Democratic People's Republic of Korea is referred to as North Korea, following the conventions of academia and society.

2. Institution for Peace and Unification Studies, Seoul National University, "Research Report on Creating NKHDA (2022)," accessed November 11, 2023, https://ipus.snu.ac.kr/wp-content/uploads/2023/03/17.-2022-통일평화기반구축사업-결과보고서_인문학연구원홍종욱.pdf.

3. Institution for Peace and Unification Studies Seoul National University, "Tongil uisik josa" (Unification Consciousness Survey [2021]), 30, 156, accessed November 11, 2023, https://ipus.snu.ac.kr/wp-content/uploads/2021/04/2021-통일의식조사-내지-0311-1.pdf.

4. Institution for Peace and Unification Studies Seoul National University, "Tongil uisik josa" (Unification Consciousness Survey [2021]), 88–95, accessed November 11, 2023, https://ipus.snu.ac.kr/wp-content/uploads/2021/04/2021-통일의식조사-내지-0311-1.pdf.

issues. Indeed, even the survey focused on North Korea's nuclear program and military provocations. As such, it may be argued that in order to overcome the differences and unfounded hatred between the two Koreas, it is necessary to gain a better understanding of the culture of North Korean society, as well as what is considered to be common sense. Accessing and analyzing the humanistic knowledge accumulated within North Korea, such as in the fields of history and literature, represents an important first step for understanding and criticizing North Korea in a more constructive way.

Second, the engagement between academia and civil society must take place in a digital environment. Computer technology and the Web environment have transformed humanities research. The 2009 Digital Humanities Manifesto 2.0 in the United States formally called for challenges and changes to traditional ways of thinking and doing research in the humanities (Jeong-uk Hong 2015).[5] The practice of the humanities in a digital environment has been further promoted in the context of the contactless research and education brought about by COVID-19.

Literary humanities scholars and digital humanities scholars have collaborated in research on the digital turn in North Korean humanities. The NKHDA is an interim product that explores ways of undertaking humanities research and educaton in ways appropriate for the digital environment.

The NKHDA was previously examined in two papers published in Korean. Hong Jong-wook et al. (2021) introduced the first phase of data construction, while Ryu et al. (2023) summarized how digital humanities education is possible with a data archive.

By summarizing the ideology and practice of building the NKHDA, as well as by addressing its achievements and limitations, this article explores the implications and possibilities of using digital technologies to study North Korean historiography. It reflects on the three-year project with reference to the findings of the previous two articles mentioned above. The NKHDA

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5. The Digital Humanities Manifesto 2.0, accessed November 19, 2023, https://www.humanitiesblast.com/manifesto/Manifesto_V2.pdf; http://manifesto.humanities.ucla.edu/2009/05/29/the-digital-humanities-manifesto-20.

targeted all of North Korean humanities, but focused on the field of historiography, where the accumulation of scholarly information is relatively large. In order to present a concrete and clear argument, this article focuses on North Korean historiography and deals with the following three topics.

Firstly, we summarize the theoretical and technical background of the NKHDA. The information accumulated by historical research on North Korea, which has mainly been carried out by South Korean researchers, and the aspects of North Korean scholarship that have come to be revealed through these endeavors, have called for the need to adopt digital humanities methodologies. NKHDA has adopted semantic data processing, the qualitative methods of digital humanities, to construct a wiki database and to compile the triple data.

Secondly, we examine the process of building NKHDA, to include the trials and errors of this process. The construction of NKHDA was pursued in three directions: creating triple data, network graph implementation based on the triple data, and wiki document creation. Although data processing is a hot topic in both analog and digital humanities, it is a specialized field with no general rules as of yet. Therefore, discussing the specific work process will have important implications for future research on North Korean historiography and the digital humanities.

Thirdly, we describe the process of combining wiki documents and triple data/visualization to create a new model of semantic data processing. The new model was made possible by embedding triple data lists and network graphs into wiki pages, and developing a data entry tool for triple data generation. We also address the application of the new model NKHDA as an educational platform for digital humanities.

Theoretical and Technical Background of NKHDA

Research on North Korean Historiography in the South

With the end of the Cold War and the beginning of democratization, research on North Korean historiography began in earnest in South Korean

society. These studies sought to overcome the academic divide between North and South Korea by introducing the achievements of North Korean historiography (Y. W. Chung et al. 1989; Ahn and Doh 1990). Subsequently, reflective analyses criticizing modern historiography itself also appeared (D. H. Chung 2001; North Korean Historiography Research Group of the Korean History Society 2003).

If the task of modern historiography is to demonstrate the ideology of the nation through historical materials, it can be said that Korean Marxist historiography was a branch of modern historiography. Juche historiography, which emphasizes nationalism, can also be regarded as an extreme form of modern historiography (Jong-wook Hong 2019, 2022). This provides a logical basis for identifying North Korean historiography as a modern discipline worthy of analysis.

The National Institute of Korean History (NIKH) has compiled eight volumes of the series "Monographs on North and South Korean Historiography," which go beyond the study of individual topics to look at North Korean historiography as a whole. The series also includes a project to systematize North Korean historiography itself by cataloging historical materials and research (NIKH 2001, 2002a, 2002b). This has laid the groundwork for the creation of a database in a digital environment.

There has also been progress in research aimed at situating North Korean historiography in the context of global historiography. There is a preconceived notion that North Korean scholarship is isolated. However, North Korean scholarship was part of a network of modern scholarship that originated in Europe. The continuity of colonial scholarship in the diachronic sense and the influence of global scholarship, especially socialist knowledge, in the synchronic sense should not be overlooked.

Paik Nam-un, a leading Marxist historian of colonial Korea (1910–1945), published *Joseon sahoe gyeongjesa* (Socio-Economic History of Korea) in 1933. In this work, Paik criticized the Asiatic mode of production and argued that slavery existed in ancient Korean society, as it did in Greece and Rome (Jong-wook Hong 2014). Other Marxist historians criticized Paik for ignoring Korean and Asian specificities. Kim Gwang-jin, for example, argued that slavery did not exist in Korean history and that the Asiatic mode

of production persisted until the Joseon dynasty (Jong-wook Hong 2021a).

In North Korean academia, the slavery debate began in 1955. The debate began with Do Yu-ho's criticism of Kim Gwang-jin's claim that Korean history went directly from a primitive communist system to a feudal system without slavery. It was a replay of the debate between Paik Nam-un and Kim Gwang-jin of the 1930s. The debate boiled down to defining Gojoseon as a slave system and the Three Kingdoms period as a feudal system. As Paik had argued earlier, the universality of world history was confirmed in Korean history (Jong-wook Hong 2021a).

In its early years, North Korea was eager to absorb the culture of its socialist suzerain, the Soviet Union, as symbolized by the slogan "Learn from the Soviet Union!" In 1948, the North Korean Committee for the Compilation of Korean History (Joseon ryeoksa pyeonchan wiwonhoe) launched the journal *Ryeoksa jemunje* (Questions of History), the title of which was taken from the journal *Voprosy istorii* (Questions of History) of the Institute of History of the USSR Academy of Sciences (Wada 1976, 10). North Korean journals, including *Ryeoksa jemunje*, and from 1955, *Ryeoksa gwahak* (Historical Science), devoted considerable space to translations of and introductions to Soviet historiography.

Since the 1930s, Soviet historiography had sought to write a national history based on Russian nationalism against the colonialist views of German and other Western historians. The ideology and methods of Soviet historiography were aligned with the goal of North Korean historiography to present a developmental account of Korean history under an anti-colonialist banner (Jong-wook Hong 2020). North Korean historiography shared the core ideology of modern historiography: the development of the nation.

In August 1960, the 25th International Congress of Orientalists was held in Moscow. At this conference, a Korean section was organized for the first time, with six scholars from North Korea, including Kim Seok-hyeong, Park Si-hyeong and Do Yu-ho. Since the 1980s, Park Si-hyeong, Kim Seok-hyeong, and others had traveled to Japan and China to explain the achievements of North Korean historiography and to engage in debates with Japanese and Chinese scholars (Jong-wook Hong 2023). By interacting with

the global academic community, North Korean scholars sought to situate Korean history within global history.

On the other hand, the nature of North Korean historiography as a state ideology is also important. North Korean historiography is a centralized, state-directed system. If Kim Il Sung University was the center of higher education, the Academy of Sciences was the center of research. In 1947, the Provisional People's Committee of North Korea established the Committee for the Compilation of Korean History with Lee Cheong-won as its chairman. With the formal establishment of the North Korean state in 1948, the Committee strengthened its organization with Paik Nam-un as chairman. With the establishment of the Academy of Sciences in December 1952, the Committee for the Compilation of Korean History was reorganized as the Institute of History (Ryeoksa yeonguso), and in 1964 it was separated into the Academy of Social Sciences with other humanities and social sciences institutes (Y. Kim 2005, 99–100).

In the 1960s, the heyday of North Korean historiography, various debates were held on the social formation of the Three Kingdoms and Gojoseon, the periodization of modern history, and the character of the national bourgeoisie. These debates were held under the guidance of the Institute of History and were concluded according to a set format. The series of debates was described as a process of "criticism and self-criticism" that followed the Soviet academic practice of "*diskussiya*." In this process, the side that was criticized and defeated subordinated its views to those of the community and engaged in self-criticism (Kojevnikov 2000).

The state-directed academic system also influenced the archiving of historical materials. North Korean academia is heavily influenced by its political milieu, including the idolization of Kim Il-sung and the purging of dissent. The fabrications in Kim Il-sung's writings are well known, and scholars are wary of them (P. Kim 1993). Kim Il-sung's writings can be used only through the careful archiving of chronological texts.

The first chairman of the Committee for the Compilation of Korean History and editor-in-chief of *Ryeoksa gwahak*, Lee Cheong-won, was purged in 1957. The 1958 publication of *Discussions on the Social and Economic Formations of the Three Kingdoms Period* (edited by the Institute

of History of the Academy of Sciences) cited the work of Paik Nam-un, Park Si-hyeong and others as an important precedent, but one of the books listed in the order of publication was covered with a sheet of paper. When the back of the page was illuminated with a light, it was found to be Lee's book. Other volumes of the same book in different libraries were similarly covered with paper. These are the signs of a purge (Jong-wook Hong 2021b).

The DPR Korea Media (KPM), a digital database affiliated with the North Korean government, provides article lists and texts from major newspapers and magazines (*Tongil News* 2006). KPM is a very useful archive. However, it should be used with caution, as the data and research compiled by the North Korean government and academia may be politically motivated.

South Korean archiving and research on North Korean humanities is also limited by the Cold War. For example, KPM is inaccessible in South Korea due to government Internet censorship. In the 1990s, a South Korean reprint of *Ryeoksa gwahak* was produced with some articles about Kim Il-sung removed to avoid punishment under the National Security Law. Without knowing this, researchers who rely on the reprinted version of *Ryeoksa gwahak* will obtain a false picture of history.

As the collection and accumulation of information on North Korean historiography has progressed, the foundation for a digital database has been laid. New research on North Korean historiography has revealed a hierarchical, state-directed academic system that is both diachronically and synchronically connected to the global community. There is a need for digital humanities methodologies that can capture the characteristics of North Korean historiography.

Qualitative Methods in Digital Humanities

When one thinks of the digital humanities, quantitative methods such as *big data* and *data mining* come to mind. By collecting and analyzing large amounts of data in a digital environment, it is possible to discover arguments that are difficult to capture in an analog environment.

On the other hand, there are also qualitative methods that describe

humanities knowledge and information on the digital web as if it were written on paper in an analog environment. While quantitative methods use digital technologies to create content for papers and books, qualitative methods build digital archives and create web documents instead of papers and books. NKHDA has adopted the qualitative methodology of the digital humanities: semantic data processing and wiki databases.

(1) Semantic Data Processing

Semantic data processing aims to organize diverse knowledge and information in a consistent format, while representing the semantic relationships between them as much as possible (H. Kim et al. 2016, 147–162). For semantic data processing, an ontology must be designed according to the characteristics of the domain. Thomas A. Gruber and W. N. Borst defined an ontology as "an explicit formal specification of a shared conceptualization" (Gruber 1993, 1; Borst 1997, 12).

Humanities knowledge and information is collected as subject-predicate-object (S-P-O) data according to the designed ontology. Triple data is in the form of sentences based on syntax, so it is suitable for capturing cultural meaning. Graph DB can be implemented using RDF-based linked open data (LOD) or structured data such as CSV, and the processed data can be visually represented using JavaScript libraries.

A prominent example of ontology-based triple (S-P-O) data description (technology), or semantic data processing, is Enslaved.[6] Enslaved is a digital archive that gathers in one place the scholarly results of 16 historical projects studying the slave trade from the 15th century to the early 20th century. You can search for people, events, places, and materials related to the slave trade based on a variety of conditions, and you can download data in RDF/XML, Turtle, and RDF/JSON formats (J. Kim et al. 2021).

Examples in Korea include the National Institute of Korean History's Korean History LOD[7] and the National Library of Korea's National

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6. Enslaved, accessed November 12, 2023, https://enslaved.org/.
7. National Institute of Korean History, Korean History LOD, accessed November 12, 2023,

Bibliography LOD.[8] However, apart from the academic services of these government agencies, ontologies are not used in the field of humanities research. This is due to a lack of experience and understanding of the qualitative method of data compilation in digital humanities.

(2) Wiki Database

How will writing, a fundamental part of the humanities, change with the digital turn?

In the late 1980s, media scholar Vladimir Flusser contrasted analog and digital forms of communication, which he called "lines" and "networks," respectively. He explained that in an analog environment, the writer functions as a provider of fixed information and the reader is able to understand exactly what the writer means, while in a digital environment, the writer is a transmitter of unfinished meaning and the reader forms a network in his or her own unique context (Flusser 2015).

In the mid-1990s, the critic Jeong Gwa-ri understood that if a manuscript written with a pen emphasizes context and coherence because of its stubbornly linear nature, a manuscript written with a computer, which facilitates the nonlinear movement of revision, emphasizes the autonomy and interconnectedness of each fragment of text, thus moving from contextual writing to combinatorial writing (Jeong 1998, 177). Since the 2000s, the writing environment has changed even more rapidly with the proliferation of the Web and the advancement of artificial intelligence (AI) technology.

What is the state of writing in the humanities today? Despite the introduction of digital technologies, one gets the impression that analog writing has been strengthened, at least in written form. In particular, the end result of writing in the humanities is still expressed on paper. Most academic papers are distributed as PDFs. It is a contradictory situation that digital

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http://lod.koreanhistory.or.kr/.

8. National Library of Korea, National Library of Korea LOD, accessed November 12, 2023, https://lod.nl.go.kr/home/index.jsp.

writing is stuck in analog form and then shared on digital devices.

This contradiction has become more pronounced with the rise of networked knowledge, which is difficult to represent analogously because it is created on the Web. Humanities writing has long been complemented by tables and photographs, but if the humanities cannot embrace time-series infographics and video, it will be difficult for humanities writing to be recognized.

Wiki can be an alternative. The text-editing capabilities of wiki inherit analog writing, with its chapters and sections, footnotes, and tables, but the digital web environment offers the possibility of non-linear reading through infinite hyperlinks. It can also use a variety of augmented media such as electronic maps and timelines. Wiki text logically and visually reconciles the completeness of the written word with the openness of the network.

Wiki is a software engine that compiles information in a simple markup language, a database that organizes and aggregates the compiled information, and a website that can share all of this with a large number of users on the Web (J. Kim et al. 2021). The most prominent example of wiki-based information editing and knowledge distribution is Wikipedia.[9]

NKHDA has adopted MediaWiki, the most widely used of several wiki software packages. MediaWiki manages generated information by storing it in a relational database (RDB). In addition, it is possible to write data in a web standard format based on XML format and effectively manipulate it using programming languages such as Python (J. Kim et al. 2021, 376).

Creating the NKHDA: Trial and Error

Constructing the Knowledge Graph

(1) Describing Triple (S-P-O) Data

Of the two stems of the NKHDA project, the triple data description and the

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9. Wikipedia, accessed November 13, 2023, https://www.wikipedia.org/.

wiki database construction, we began with the former. In order to create the Triple Data, we needed to design an ontology that would allow us to outline the entire data. Once the overall data structure is understood, it is possible to build a wiki database that reflects the schema.

The construction of NKHDA began with a list of journal articles. The article list contains information such as author, translator, article, journal volume, publication date, and publisher. By organizing the relationship between this information, it is possible to understand the entire North Korean humanities community, including the research topics of scholars and their changes, and the state of academic institutions such as universities and research institutes. We designed a data model, or ontology, based on the information contained in the article lists of *Ryeoksa jemunje* (Committee for the Compilation of Korean History, 1948–1950) and *Ryeoksa gwahak* (Institute of History of the Academy of Sciences, 1955–), which are the representative journals of North Korean historiography.

The ontology consists of the following elements: class, instance, property (data properties), and relation (object properties). Classes are categories of objects, and instances are entities, individual elements that make up a category. Properties define characteristics of classes and instances, and relations define semantic relationships between classes and instances. According to the ontology, complex humanities knowledge and information are articulated in a triple data format.

By referring to the ontology of the previous semantic data processing, we were able to define the scope of class and instance and the semantic relationship between them to a certain extent. However, in order to design a precise ontology suitable for the domain of North Korean humanities, it was necessary to set clear boundaries for each class and strictly define the semantic relationships between classes (instances). After starting to build the sample data, researchers from different disciplines designed the ontology while reconciling their differences through discussions.

For example, we created the "institution" class to cover educational institutions such as universities and research institutions such as the Academy of Sciences, but we did not create a separate class for academic societies or research organizations, considering the characteristics of North

Figure 1. Discussions for designing the NKHDM

Source: Authors.

Korean academia, where the private sector is almost nonexistent. However, in the process of collecting information on the educational backgrounds and careers of North Korean humanities scholars, it became necessary to categorize the Chintan Society (Jindan hakhoe 震檀學會) and student associations in which they participated during the colonial period. In the end, the "group" class was created separately from the "institution" class in order to express the continuity between colonial academia and North Korean academia (Jong-wook Hong et al. 2021).

In the case of the North Korean academy, especially from the early days of the founding of the country until the 1960s, the practice of systematically holding academic debates led by the Academy of Sciences and concluding them with a summary was faithfully followed. In order to capture this characteristic of North Korean academia, where debates have a clear structure, beginning and end, we created the classes of "controversy" and "argument." The designed ontology was named North Korea Humanities Data Model (NKHDM) and was published on the NKHDA website.[10]

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10. North Korea Humanities Data Model, accessed November 13, 2023, http://dh.aks. ac.kr/~nkh/wiki/index.php/NKH_Data_Model.

From October to December 2020, the NKHDA project team organized a digital humanities workshop hosted by the SNU Institute of Asian Studies. With the aim of "mapping the relationship network of modern Korean intellectuals," 19 university faculty members and graduate students majoring in Korean modern literature, Korean modern history, Chinese modern literature, and digital humanities participated in the workshop to organize life information and data of modern Korean intellectuals. In the workshop, they designed an ontology covering various fields of humanities such as literature, history, and philosophy, and then implemented a knowledge graph by building triple (S-P-O) data (Jang et al. 2021, 82).[11] This experience was an important reference for the advancement of NKHDM.

With the data model outlined, we used Google Sheets as a collaborative

Figure 2. Example of Google spreadsheet for building data in the early stage of the project[12]

Source: Authors.

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11. The results of the project were compiled into the Archive of Intellectuals in Modern Korea, accessed November 13, 2023, http://dh.aks.ac.kr/imk/.

12. Google spreadsheet for building data (https://docs.google.com/spreadsheets/d/10k2YOpcVqc-lI43y05wbXe-gftHeMYSDATLXmHz_AOM/edit?usp=sharing).

workspace to enter the initial data. We created a form where each class and instance could be entered according to its relation and property, fitting into rows and columns across multiple sheets in Google Sheets. Since the ontology was not finalized and the rules for entering data values were not detailed, we held several review meetings during the data entry process. Any errors or corrections found were reflected in the spreadsheet, and the NKHDM was frequently updated in sync with the spreadsheet.

Data entry began with the articulation of the article lists of *Ryeoksa jemunje* and *Ryeoksa gwahak*, according to the ontology. The target journals were expanded to include *Joseon gogo yeongu* (Korean Archaeological Research) and *Joseon munhak* (Korean Literature). In addition, we worked to accumulate information on people, documents, and institutions contained in previous articles and books by creating triple data.

While data in the natural and social sciences are more or less structured with numbers, data in the humanities are mostly structured with semantic relationships. As a result, processing humanities data takes much time and effort, as researchers have to go through and reprocess the data item by item.

(2) Implementing Network Graphs

Triple (S-P-O) data, which reveals relationships between instances in the form of subject-predicate-object, requires the implementation of a knowledge graph. To visualize the data accumulated in Google Sheets, the first approach considered was to install the graph database on a web server. This approach already proved its effectiveness in the Jiam Diary Data Archive, a representative achievement of semantic data processing in Korea (Ryu 2019).[13]

Currently, one of the most widely used graph databases is Neo4j.[14] Instead of outputting data in the form of a network graph as it is, Neo4j takes the form of revealing results that fit a pre-designed query. Therefore,

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13. Jiam ilgi (Jiam Diary Data Archive), accessed November 13, 2023, http://www.jiamdiary. info/.
14. Neo4j[TM], accessed November 13, 2023, https://neo4j.com/.
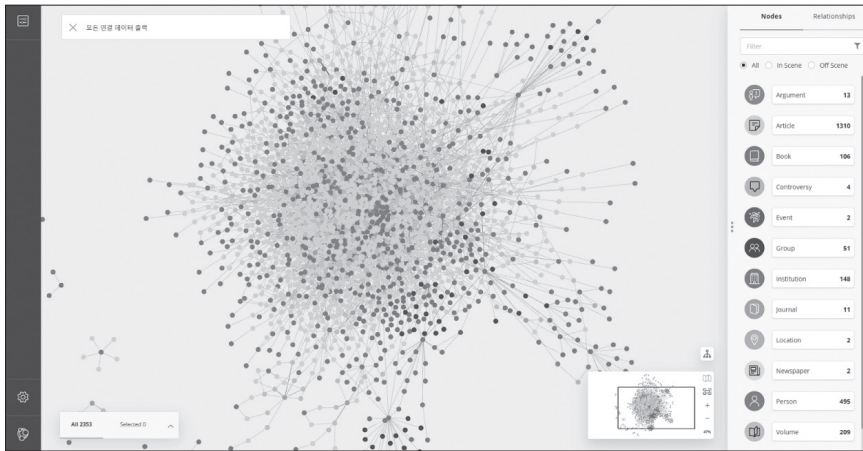
Figure 3. Example of North Korean humanities knowledge network by Bloom in Graph DB Neo4j

Source: Authors.

we had several discussions to find a valid query that encompassed the North Korean humanities. Figure 3 is an experimental graph visualization on Neo4j using sample data.

However, the method of visualizing data by installing a graph database on a web server was not adopted. This is because it was difficult to determine comprehensive and valid queries in the early stages of the research due to the nature of the target subject, North Korean humanities, which is not limited to a single subject such as the Jiam Diary, but extends to different areas and different times.

We decided to postpone the use of Neo4j as a long-term project and chose to visualize the data from the backend database in the browser using JavaScript libraries. JavaScript libraries for network graph output include D3.js' Force-directed graph,[15] Sigma.js,[16] and Vis.js Network.[17] Based on Vis.

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15. D3.js Force-directed graph, accessed November 13, 2023, https://observablehq.com/@d3/force-directed-graph/2.
16. Sigma.js, accessed November 13, 2023, https://www.sigmajs.org/.
17. Vis.js Network, accessed November 13, 2023, https://visjs.github.io/vis-network/docs-kr/network/.

js Network, the Digital Humanities Research Institute at the Academy of Korean Studies has developed a program called Semantic Database Visualization[18] that interfaces with RDB (SQL) and releases it as open source.

NKHDA has adopted Semantic Database Visualization. In NKHDA's network graph, various instances such as journal, volume, article, person, and institution are set as individual nodes, and semantic relationships between nodes are expressed as edges.

Figure 4 presents the network graph based on the paper "Was There Really No Slavery in the History of Korean History? Concerning the Denial
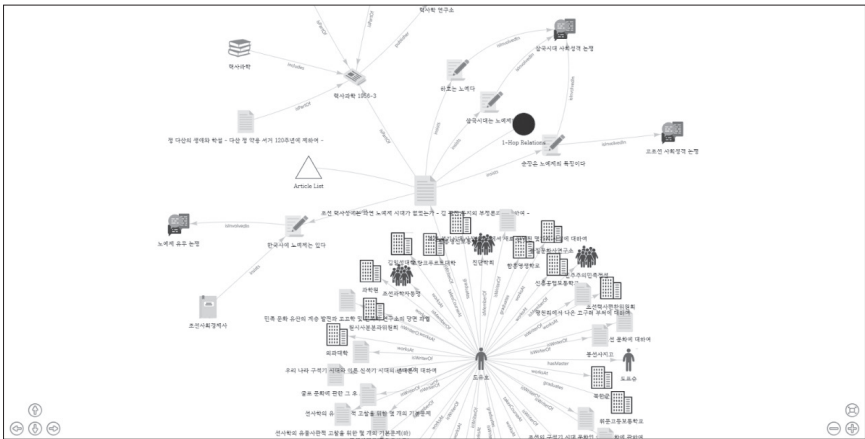
Figure 4. Example of North Korean Humanities Network graph output provided by NKHDA: Do Yu-ho's article[19]

Source: Authors.

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18. Semantic Database Visualization, developed by the Digital Humanities Research Institute in the Academy of Korean Studies, accessed November 13, 2023, http://dh.aks.ac.kr/Edu/wiki/index.php/Semantic_Database_Visualization.

19. http://dh.aks.ac.kr/~jisun/cgi-bin/Story02.py?db=s_jisun&project=NKH2&key=조선_력사상에는_과연_노예제_시대가_없었는가_-_김_광진_동지의_부정론과_관련하여_-, accessed November 13, 2023.

Theory of Comrade Kim Gwang-jin" by Do Yu-ho. In the upper left corner you can see that this paper was published in the 1955-3 issue of *Ryeoksa gwahak*. The other papers published in 1955-3 are also shown. In the lower right corner you can see that the author of this paper is Do Yu-ho. You can also see other articles written by Do, as well as the institutions and groups he belonged to. We can see an infinitely expanding network of semantic relationships that are not limited to a matrix table.

On the left and right sides of the paper, arguments such as "slavery exists in Korean history" and "sacrificial burial is a characteristic of slavery" are connected. Each argument is also related to the "slavery controversy" and the "Gojoseon social formation controversy." In the previous section, it was emphasized that "controversy" and "argument" were designed as classes in the ontology. The data design, which captures the characteristics of North Korean historiography, is also represented as a network graph.

One of the important issues in the study of the ancient period in North Korean historiography is slavery. If you click on the "slavery controversy" item in the network graph, you can see that the controversy consists of two opposing arguments: "slavery exists in Korean history" and "slavery does not exist in Korean history." Figure 5 shows the structure of the network, including books and articles that support both arguments.

If you click on "slavery exists in Korean history," the argument that constitutes the "slavery controversy," you can see that this argument was made in the articles by Paik Nam-un and Do Yu-ho. Similarly, the opposing argument, "slavery does not exist in Korean history," is argued in several articles by Kim Gwang-jin. We can see that Paik Nam-un and Do Yu-ho were on the same side of the debate countering Kim Gwang-jin.

In addition to "slavery does not exist in Korean history," Kim Gwang-jin's various articles also asserted arguments such as "*haho* is a serf," "the Three Kingdoms period was a feudal system," and "sacrificial burial is not a characteristic of slavery." These arguments all constitute the "Three Kingdoms period social formation controversy," and the argument that "sacrificial burial is not a characteristic of slavery" also constitutes the "Gojoseon period social formation controversy."

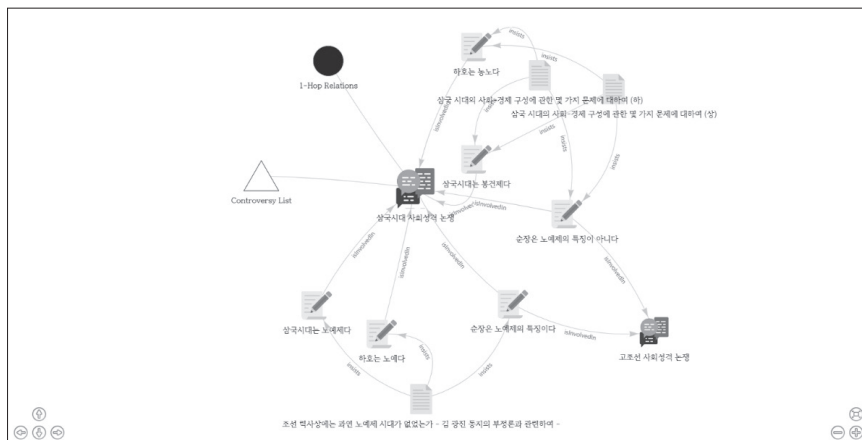If you click on the "Three Kingdoms period social formation
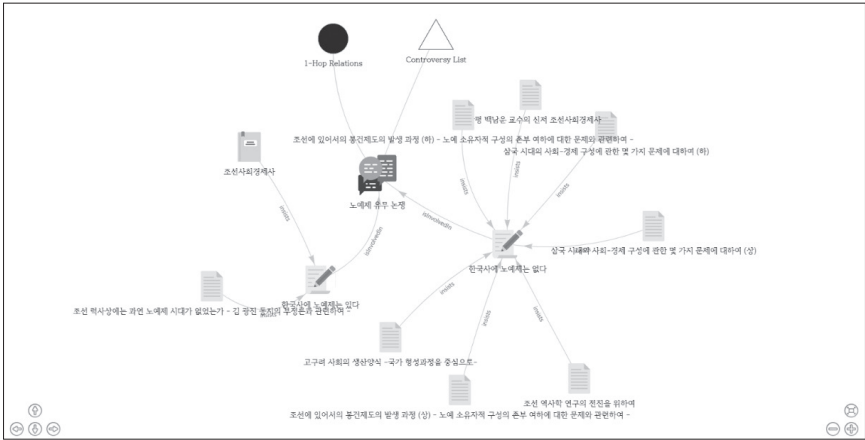
Figure 5. Example of North Korean Humanities Network graph output provided by NKHDA: The slavery controversy[20]

Source: Authors.

controversy," you can see that the controversy consists of three pairs of opposing arguments: "*haho* is a serf" versus "*haho* is a slave," "Three Kingdoms period was a feudal system" versus "Three Kingdoms period was a slavery system," and "sacrificial burial is not a characteristic of slavery" versus "sacrificial burial is a characteristic of slavery," as shown in the Figure 6. In each pair, the former is argued by Kim Gwang-jin and the latter by Do Yu-ho. In the "Three Kingdoms period social formation controversy," Kim Gwang-jin argues that the Three Kingdoms period was a feudal system because *haho* was a serf, whereas Do Yu-ho argues that the Three Kingdoms period was a slave system because *haho* was a slave. Kim Gwang-jin and Do Yu-ho were at odds not only in the "slavery controversy" but also in the "Three Kingdoms period social formation controversy."

The "Three Kingdoms period social formation controversy" is often understood as a controversy over slavery or feudalism, but behind the scenes

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20. http://dh.aks.ac.kr/~jisun/cgi-bin/Story02.py?db=s_jisun&project=NKH2&key=노예제_유무_논쟁, accessed November 13, 2023.

Figure 6. Example of North Korean Humanities Network graph output provided by NKHDA: Three Kingdoms period social construct controversy[21]

Source: Authors.

there was a "slavery controversy" over the existence of slavery in Korean history. This can be seen in Figure 6, which shows the confrontation between Do Yu-ho, who claims that the Three Kingdoms period was a slavery system, and Kim Gwang-jin, who claims that the Three Kingdoms period was a feudal system and that slavery does not exist in Korean history. In addition, the fact that the "Three Kingdoms period social formation controversy" is connected to the "Gojoseon period social formation controversy" is also revealed through nodes and relationships such as argument and person.

The network graph shows that the journal in which Kim Gwang-jin and Do Yu-ho argued was *Historical Science* (*Ryeoksa gwahak*), and they were both faculty members at Kim Il Sung University. Kim Gwang-jin graduated from Tokyo University of Commerce, and we can see that his debate opponent, Paik Nam-un, graduated from the same school. The graph

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21. http://dh.aks.ac.kr/~jisun/cgi-bin/Story02.py?db=s_jisun&project=NKH2&key=삼국시
    대_사회성격_논쟁, accessed November 13, 2023.

shows that Kim Gwang-jin and Paik Nam-un exchanged arguments not only in North Korea but also during the colonial period. Paik's book *Joseon sahoe gyeongjesa*, which included the argument of whether or not slavery existed in Korean history, was published in 1933. The network graph shows that the controversy that Kim Gwang-jin had with Paik Nam-un, his senior at Tokyo University of Commerce, during the colonial period was repeated twenty years later in North Korea.

The NKHDA Knowledge Graph platform is not a finished product. It may need to adopt a new data visualization implementation technology to replace Vis.js' Network. However, the success of data visualization in the humanities does not depend on digital technology alone. The success of digital humanities will be determined by humanistic thinking that captures the characteristics of the domain of North Korean history or North Korean humanities, and the design of data models based on it.

Archiving and Writing in Digital Environments

We also worked on building a wiki database using the logic of NKHDM as the basic schema. In parallel with the triple (S-P-O) data description, we installed MediaWiki on the server and started compiling data through wiki pages. The titles of the wiki pages are instances of the classes designed in the ontology: journal, volume, article, book, person, institution, group, event, place, etc. The wiki DB aims to describe North Korean humanities knowledge and information that is difficult to express by triple (S-P-O) data description, while archiving North Korean humanities materials on the Web.[22]

As shown in Figure 7, wiki page creation follows a standardized layout based on the designed ontology. The most basic information, a kind of metadata, is placed at the top of the page. Below the metadata is the body, which is a description of the title. The body is divided into several sections, and contextual information that appears in the body is hyperlinked to each other. During the writing process, when specialized knowledge that can be

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22. NKHDA Wiki, accessed November 13, 2023, http://dh.aks.ac.kr/~nkh/wiki/.

이극로(李克魯)

출처 : 동아일보 1930년 9월 30일자 기사

한글명	이극로	한자명	李克魯	영문명	Lee Geuk-Ro	가나명		이칭	Kolu Li
성별	남성	생년	1893년	몰년	1978년	출신지	경상남도 의령군	전공	국어학

개요 [편집]

국어학자. 한글운동가. 1893년 경상남도 의령군에서 태어났다. 마산 창신학교에서 수학한 후 만주 동창학교와 백산학교 교원으로 재직하다 상해 동제대학에 입학하였다. 동제대학 예과를 마친 뒤 독일 베를린 프리드리히-빌헬름대학교에서 '중국의 생사 공업'을 주제로 박사학위를 받았다. 영국, 프랑스, 미국, 일본 등을 시찰한 뒤 1929년 귀국하여 조선어학회 간사장 등을 맡아 한글 맞춤법 통일안, 외래어 표기법 통일안, 사전 편찬 작업을 주도하였다. 1928년 파리대학에서 조선어 음성 실험에 참여했던 자료를 바탕으로『實驗圖解 朝鮮語 音聲學』(1947)을 편찬하였다. 남북연석회의에 조선건민회 대표로 참석한 뒤 평양에 잔류하여 과학원 조선어 및 조선문학연구소 소장, 최고인민회의 상임위원회 부위원장, 조국평화통일위원회 위원장 등을 역임했다. 1978년 타계하여 애국열사릉에 안장되었다.

생애 [편집]

출생과 성장 [편집]

1893년 경상남도 의령군 지정면 두곡리^{出典}에서 태어났다. 자서전『고투사십년^{서지}』(1947)에 따르면[1] 세 살 때 어머니를 여의고 맏형수와 서모 밑에서 자랐다. 독일어로 쓴 이력서에 따르면 자신이 "의사 이근주^{出典}의 아들"로 태어났다고 적혀 있는데,[2] 이극로의 아버지는 전문적인 의원은 아니었지만 동네에서 의원 일을 보았다고 한다.[3] 자서전에 따르면 그의 집은 가난한 농가였고 농사일을 하다가 짬을 내어 글을 몇 자씩 배우며 주경야독하였다고 한다. 8세 이후부터 한시를 짓는 데 재능을 보였다. 동리에서 공동으로 보는『대한매일신보』를 통해 세상 소식을 접하고, 가정을 떠나기로 결심한다.

1910년, 집안의 반대에도 불구하고 가출하여 머리를 깎고 마산^{出典} 창신학교^{기관}에 입학한다. 마산 창신학교에서 보통과 1년, 고등과 1년으로 2년 동안 수학하였다. 1912년 4월[4] 이극로는 서간도 신흥강습소로 향한다. 경성역^{出典}과 안동현^{出典}을 경유한 뒤 강원도에서 서간도로 향하는 이주민들과 동행하여 압록강을 거슬러 회인현^{出典}에 도착한다. 한편 회인현으로 가는 여정 중에 이극로는 평안북도 창성군^{出典}에서 아침밥을 먹게 되는데, 일행 중 한 명이 '고추장'을 청했으나 듣는 사람은 평북 방언 '댕가지장'으로만 알고 있어 말이 통하지 않는 경험을 한다. 이 경험은 이극로가 표준어 사정 등 어문 정리의 필요성을 느끼는 계기가 된다.

Figure 7. Example of a "person" page on the NKHDA Wiki: Lee Geuk-ro[23]

Source: Authors.

explored in online and offline environments was used as a reference resource, the source information was given in a footnote, as shown in Figure 8.

Wiki articles have been created under the titles of persons, documents,

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23. NKHDA Wiki "Lee Guk-ro (이극로)" page, accessed November 13, 2023, http://dh.aks. ac.kr/~nkh/wiki/index.php/이극로.

Figure 8. Example of annotation on a "person" page of the NKHDA Wiki: Lee Geuk-ro[24]

Source: Authors.

institutions, etc. Some of the wiki pages are written by researchers working on research projects, while others are written by outside experts for a fee. In the long run, scholars and citizens interested in North Korea will be able to participate in the accumulation of information by being granted editing and revision rights. This is in keeping with the spirit of sharing and collaboration that the wiki platform represents.

In addition to describing information about the title, the NKHDA wiki will archive related materials in a variety of formats. While reading the text of a document is a fundamental part of the humanities, documents represent more than text. Archiving images is necessary to preserve intuitive information such as the texture of the paper and the font of the writing. NKHDA also includes photographs, videos, and other materials wherever possible. Rather than being arranged alphabetically or chronologically as in a typical digital archive, these materials are placed in a network of semantic relationships to form and express a context.

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24. NKHDA Wiki "Lee Geuk-ro (이극로)" page, accessed November 13, 2023, http://dh.aks.ac.kr/~nkh/wiki/index.php/이극로.

For example, take a look at the "Lee Cheong-won" page[25] on the NKHDA Wiki. It contains photographs, handwritten resumes, Soviet Party school materials, Japanese police documents, North Korean official documents, and more, collected from a variety of sources, including Lee's own work. The accumulated materials are available for anyone to view directly through a web browser. The photo of Lee found in the old Soviet documents and uploaded to the wiki page soon became one of the top results in Google's image search.

Images of Lee's handwriting were also archived, as shown in Figure 9.
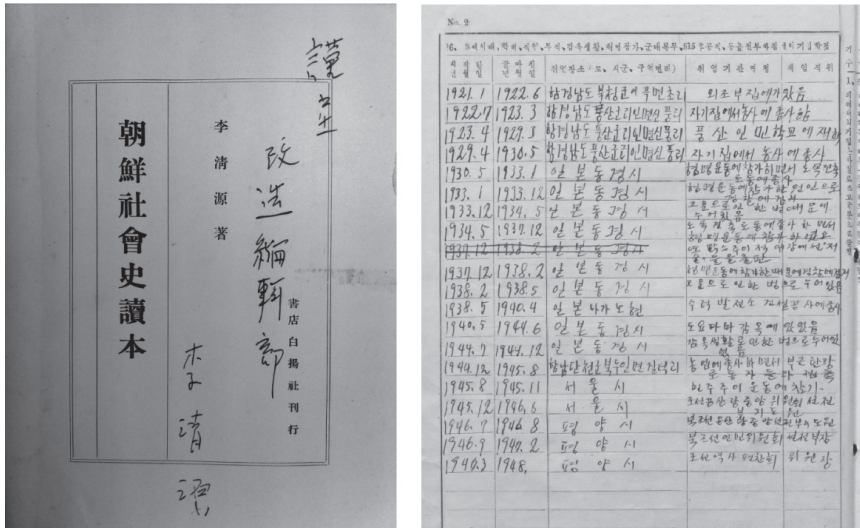
Figure 9. Example of images on a "person" page of the NKHDA Wiki: Lee Cheong-won; these are examples of Lee Chung-won's handwriting (on the left, a book signature from the colonial period; on the right, a handwritten resume from after liberation)

Source: Authors.

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25. NKHDA Wiki "Lee Cheong-won (이청원)" page, accessed November 13, 2023, http://dh.aks.ac.kr/~nkh/wiki/index.php/이청원.
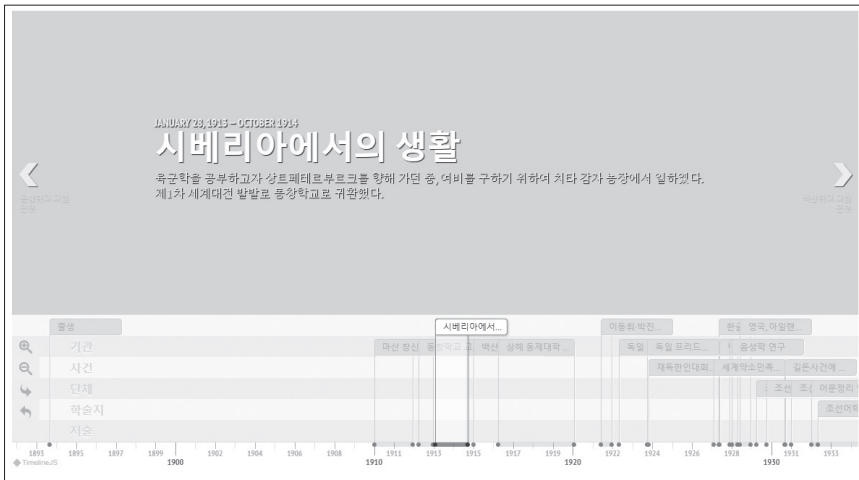
The image shows Lee's fluent Chinese-Japanese handwriting on a book he donated to a Japanese publisher, as well as the awkward Korean handwriting he submitted to North Korean authorities after liberation. Lee Cheong-won fought for Korean independence as an anti-imperialist fighter, but at least in his handwriting he was an imperial intellectual rather than a national one. This is what the handwriting image intuitively suggests. By placing it in semantic relation to Lee's activities, it brilliantly forms the context of an intellectual's life and scholarship.

The purge of Lee Cheong-won was mentioned in the previous section characterizing North Korean historiography. North Korean academia attempts to obscure not only the fact of the purge, but the very existence of Lee Cheong-won as a person. While dissertations and monographs can explain Lee's activities and the purge, the NKHDA can better reveal what North Korean control archives have concealed by providing a context for the academic controversies that led to the purge and by presenting the traces of the purge as living material.

The archiving of Lee's work also holds a number of potential developments. Because this is a digital web environment, archiving the original paperback book is not considered. However, by providing a clear image of the original text, it can provide a great deal of information that cannot be reduced to textual content. In the future, textual data of works suitable for data mining will also be created. Intellectuals on the colonial periphery were inevitably bilingual. Lee Cheong-won, for example, wrote extensively in Japanese. In this case, it would be useful to have a Korean translation available.

Media wikis can embed a variety of multimedia-based visualizations. In the NKHDA wiki, in addition to text and photograph, a timeline and an electronic map were implemented and embedded based on information about the instance. This shows a significant difference in quality from the academic information distributed via PDF.

MediaWiki creates and serves XML data on a per-page basis, while storing the information created in the web browser as data in an RDB such as MY-SQL or MariaDB. Pages formatted according to a consistent data schema can be saved as XML files with the same template. This XML data

Figure 10. Example of timeline visualization on the "person" page of the NKHDA Wiki: Lee Geuk-ro[26]

Source: Authors.

Figure 11. Example of XML Data of NKHDA: *Ryeoksa gwahak*[27]

Source: Authors.

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26. NKHDA Wiki "Lee Geuk-ro (이극로)" page, accessed November 13, 2013, http://dh.aks.ac.kr/~nkh/wiki/index.php/이극로#데이터.
27. The NKHDA XML data can be downloaded from the dataset page, http://dh.aks.ac.kr/~nkh/wiki/index.php/Dataset.

can be used to easily build an RDB and visualize data in the form of a knowledge graph.

Figure 11 is an example of XML data that we built experimentally while considering the layout of creating individual wiki pages based on instances. The XML data was built by applying the data schema of *Ryeoksa jemunje* and *Ryeoksa gwahak* as reflected in Google Spreadsheet. The XML schema applied here is expected to be used to process the same type of XML data by batch outputting wiki pages created with article instances as titles.
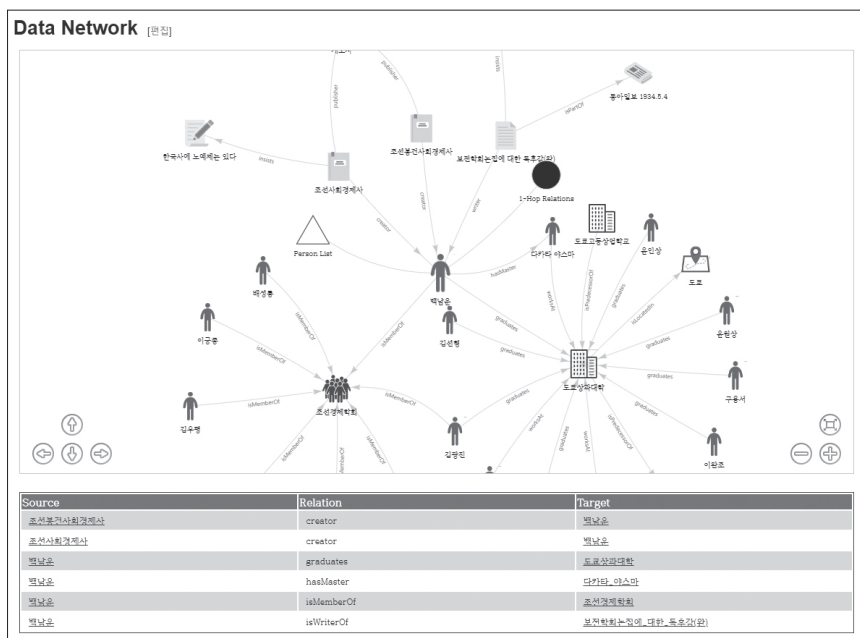
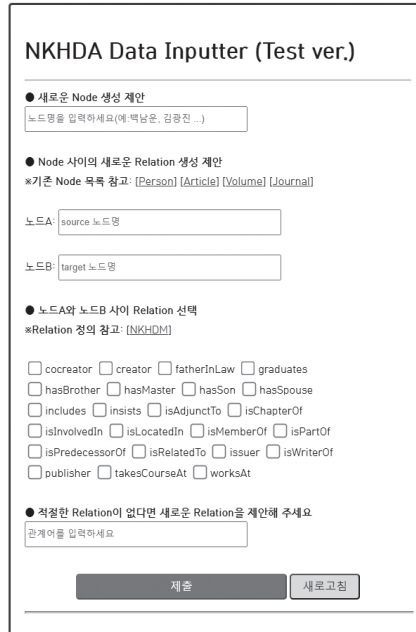## A New Model of Semantic Data Processing

Integrating Triple (S-P-O) Data with Wiki DB

NKHDA proceeded in two directions: implementing a network graph based on triple (S-P-O) data description, and building an archive based on MediaWiki. The only connection between the two was that the instances of triple data or nodes in the network graph were used as titles in the wiki. The network graph visualized the characteristics of North Korean humanities, and the wiki pages displayed knowledge and information using various multimedia, but the synergy as a single archive was not strong. This self-reflection led NKHDA to try to combine two directions.

First, we embedded triple data lists and network graphs into wiki pages. The triple data containing a particular instance was extracted from the RDB and displayed in the wiki page with the instance as the title. On the same page, we also displayed a network graph with the title instance as the central node. Figure 12 shows the list of Paik Nam-un triple data displayed on the Paik Nam-un wiki page of the NKHDA and the network graph centered on Paik Nam-un. By strengthening the connection between RDB and wiki databases, we can more effectively organize and express knowledge and information about North Korean humanities.

In the long run, the goal is to automatically generate a wiki page with all instances (nodes) described by triple (S-P-O) data as the title. The resulting wiki page will have a list of triple data and the network graph based on it

Figure 12. Example of data network embedding on the NKHDA Wiki: Paik Nam-un[28]

Source: Authors.

embedded from the start. Currently this is done manually by humans, but a system like Data Pipeline could be implemented.

Second, we developed a data entry tool to generate triple data. The bulk of the triple data obtained by processing journal article lists has been accumulated in a RDB using Google Sheets. However, it would be more complete if the fragmentary information obtained from wiki page descriptions could also be converted into triple data on demand and accumulated in the RDB.

The data entry tool is an application that allows users with no under-

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28. NKHDA Wiki "Paik Nam-un (백남운)" page, accessed November 13, 2023, http://dh.aks. ac.kr/~nkh/wiki/index.php/백남운.

Figure 13. Data entry tool (test version) for NKHDA[29]
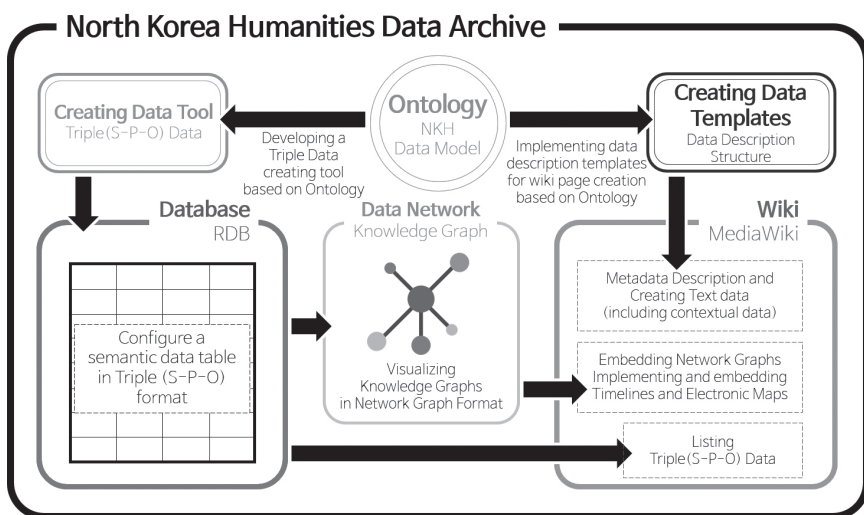
Source: Authors.

standing of data schema to create triple (S-P-O) format data that links nodes and links in a relation through intuitive judgment. By allowing users to review the existing node list and relation definitions in the data model, it helped them to efficiently create accurate triple data. It also allowed us to suggest new nodes and new relation that were not in the existing data. The generated triple data is organized in Google Sheets and then accumulated in an RDB through an administrator's review.

The current implementation of the environment of inputting data is a test version, but it represents the direction of the new archival model that NKHDA intends to implement. The environment of inputting data is

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29. NKHDA Data entry tool (test version), http://dh.aks.ac.kr/~nkh/data/DataInputter_ TestVer.html.

inspired by Linked Jazz,[30] a digital humanities research project led by the Semantic Lab at Pratt.[31] Linked Jazz implemented an independent data entry environment called "Linked Jazz 52nd Street"[32] to enable crowd-sourced data entry. The data entry tool is the key link in making the NKHDA an interactive communication channel that engages not only professional researchers, but also citizens.

Figure 14 is a conceptual diagram of the NKHDA that synthesizes the functional relationships between the various elements implemented at this stage. Archiving begins with the collection of different types of materials such as books, journals, photos, and videos. By organizing the semantic

Figure 14. Concept diagram of NKHDA

Source: Authors.

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30. Linked Jazz, accessed November 13, 2023, https://linkedjazz.org/.

31. Semantic Lab at Pratt, accessed November 13, 2023, https://semlab.io/.

32. Linked Jazz, "Linked Jazz 52nd Street," accessed November 13, 2023, https://linkedjazz.org/52ndStreet/.

relationships between the collected materials, an ontology suitable for North Korean humanities will be designed. Based on the designed ontology, a data entry tool was developed to generate triple (S-P-O) data. The data collected in the spreadsheet are verified and loaded into the RDB. Based on this RDB, a network graph is displayed.

NKHDA interacts with users through the wiki pages. The North Korean Humanities Wiki is based on narrative text with embedded hyperlinks in a format similar to Wikipedia. In addition, it uses multimedia resources such as timelines and electronic maps to help readers understand three-dimensional information. It also acts as an archive of source materials by digitizing various types of materials and placing them in a semantic context within the wiki page. In addition, a network graph implemented with triple (S-P-O) data is embedded in the wiki page to connect the wiki and the RDB.

Digital Humanities Education with NKHDA

NKHDA was used as an online teaching platform for the course "Historical Data Compilation Using MediaWiki," a course developed by the College of Big Data Innovation and Convergence at SNU in the first semester of 2023. The course was a collaborative lecture system in which digital humanities researchers provided conceptual understanding and practice of ontologies and knowledge graphs and instructed on how to use MediaWiki, while historical researchers provided information on how to collect, organize, and interpret North Korean humanities data (Ryu et al. 2023).

Students collected digital and analog materials, accumulated them on wiki pages, and shared them with other participants in real time. They added new triple data to the existing database through a data entry tool and watched as their data connected with existing data. This was visually represented in a knowledge graph.

In humanities classes at Korean universities, students are often required to submit a paper report as an assignment. While the report is a training ground for collecting, organizing, and expressing humanities data in writing, it has a limited effect on adding new knowledge to the world. Instead of

writing a paper report, the students created a wiki page on the Web to organize the knowledge and information they had collected, and when after a while they saw their page being searched on the Web, they felt a sense of pride and responsibility as knowledge creators.

South Korean students were able to understand North Korea and the issue of reunification by participating in the construction of the NKHDA. Many students joined the class because of their interest in digital humanities rather than their interest in North Korea. Students encountering North Korean humanities materials and research for the first time were surprised by its transnationality. The global historical context of North Korea required students to examine materials in Japanese, Chinese, and Russian, as well as Korean and English. Thanks to the experience of exchange between socialist countries, many North Korean materials have accumulated in archives in Eastern Europe.

Students were also able to see the political constraints of the material: they saw North Korean forgeries as well as South Korean government censorship. As they explored the world's Web archives, they encountered the South Korean government's Internet censorship. This is precisely why the NKHDA exists. The students realized the history and reality of North Korea and the world around it. The NKHDA is a place where the value and usefulness of the humanities can be seen in a digital and web environment.

Achievements and Challenges of NKHDA

The achievements and challenges of NKHDA in terms of North Korean historical research and digital humanities methodologies are as follows.

First, NKHDA is expected to contribute to the development of digital humanities by proposing a new model of semantic data processing. The two pillars of NKHDA are wiki compilation and triple data construction. After some trial and error, a new model combining the two pillars was created by embedding triple data lists and network graphs in wiki pages and developing a data entry tool for triple data construction. As a result, the description of North Korean humanities wiki pages can be based on the basic information

presented in the triple data list and network graph. Conversely, the information collected during the wiki page description process is generated as triple data by the data entry tool and accumulated in the RDB.

Wikipedia, which has a global reputation, is expanding its use, but it is not suitable for accumulating verified information and using it for research. The NKHDA model seeks a new way to accumulate accurate information and expand public use. It is necessary to go beyond the use of digital technology to provide large amounts of data for the analog humanities. The NKHDA model can serve as a reference point when considering how to practice the new humanities in the digital Web environment.

Next, NKHDA is expected to contribute to North Korean historical research and education. The network graph between people, documents, institutions, arguments, and controversies represented by NKHDA can be a powerful tool to help scholars brainstorm for specialized research. In addition, NKHDA is a platform for conducting research in the digital humanities spirit of sharing and collaboration. Multiple researchers can access and work on the wiki platform simultaneously. As multiple people contribute their collected knowledge and information, they can experience the process of linking them together to create a new historical picture.

It is also possible to contribute research results to society and educate students. In South Korea, many historians have realized the limitations of publishing their research through academic papers and have created history-related YouTube videos. The new expression of knowledge and information, combined with the multimedia provided by NKHDA, can be a new means of humanities practice that goes beyond dissertations and monographs and is different from YouTube lectures. As a new educational platform using digital and web environments, NKHDA has already shown its potential through university lectures.

We are constantly looking for ways to deepen and expand the NKHDA. One of them is to build a digital collection of intellectuals' works using MediaWiki. In particular, we are focusing on Lee Cheong-won, a historian whose work covers colonial Korea and North Korea. We plan to make Lee's page on the NKHDA wiki platform a hub for a digital archive of his work.

Publication lists of intellectuals are usually limited to a flat table of

information such as author, article, book, journal, journal volume, publisher, and year of publication. In NKHDA, however, each entity, such as author Lee Cheong-won and the book *Joseon sahoesa dokbon* (Korean Social History Reader), becomes a node and is contextualized with other nodes as triple data, and each entity has its own wiki page. For example, the *Joseon sahoesa dokbon* wiki page can digitize and archive original images, texts, and translations, along with comments on the book. And the page for *Joseon sahoesa dokbon* is linked to the page of its author, Lee Cheong-won. In this way, the NKHDA functions as a digital archive of intellectuals by using a layered and combinatorial system.

In order to operate the NKHDA, including building a digital collection of the works of North Korean intellectuals, it is important to keep in mind the legal and institutional constraints on access to North Korean documents. First, there is copyright. North Korea enacted a copyright law in 2001 and acceded to the Berne Convention for the Protection of Literary and Artistic Works in 2003. This obligated South Korea to protect North Korean works. The South Korean government recognizes the need to contact the North Korean government's copyright office regarding the use of North Korean works.[33]

Under North Korean law, copyrights are protected until fifty years after the death of their author. There have been cases where North Korean works have been used in South Korean society, and there have been problems along the way (Choi 2009). However, for example, Lee and his work are not recognized by North Korean academia, which is an important goal of the NKHDA. A different approach may be needed.

The National Security Law requires further caution in the use of North Korean literature in South Korea. Article 7 of the law punishes anyone who "produces, imports, copies, possesses, carries, distributes, sells, or acquires documents, drawings, or other expressions" for the purpose of "praising or inspiring" North Korea.[34] Even in the 2010s, cases of applying this provision

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33. South Korean government Ministry of Culture, Sports and Tourism, accessed November 13, 2023, https://www.mcst.go.kr/kor/s_policy/copyright/question/question16.jsp.
34. "Gukga boanbeop" (National Security Law), Korean Law Information Center, Ministry of Government Legislation of ROK, accessed November 13, 2023, https://www.law.go.kr/법령/국가보안법.

to academic researchers persisted.

The NKHDA has been challenged to find a way around these legal restrictions. While it is currently in a trial phase, to be fully operational it will need to obtain a "special materials handling license" from the South Korean government and to restrict access to the NKHDA to authorized personnel.

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