

## Digital Spatial Methods for Soviet-German History: An Investigation of German Prisoners of War in the Soviet Union, 1941-1956

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### ABSTRACT

This article explores the methodology of creating a geographic information system (GIS) in order to reach new historical conclusions that can otherwise not be reached due to the nature of Soviet archival sources. The article uses the case of German prisoners of war (POWs) of World War II in the Soviet Union to illustrate how digital methods can lead to new research findings. It shows the exact methods the author used to build and refine the GIS as well as the iterative process of developing new maps and research questions. The results are historical conclusions that could only partially be answered solely using archival documents, memoirs, and interviews. The case of the POWs thus serves as a call for similar studies to continue to be undertaken for history in general. By exploring the steps taken to create the maps, the author hopes to be transparent about the amount of time a project like this can require, while also showing how rewarding it can be. Initial results for the POW study have been substantial and many other scholars can benefit from the methods used. Finally, the article concludes with the introduction of a collaborative historical spatial-historical project known as the “World Historical Gazetteer,” which provides mapping services and serves as a data store for digital, data-driven historical scholarship. The author shows how her small subset of spatial historical data can be contributed to this larger system, which will help scholars not only to further their own research, but also to engage with other scholars around the world who are interested in similar historical periods and geographic locations.

**KEYWORDS:** digital humanities, GIS, mapping, Soviet Union, prisoners of war, spatial history

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The author has declared that no conflicts of interest exist.

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Digital Humanities (DH) can often seem an alphabet soup of confusing acronyms. One common one, especially for historians, is GIS (Geographic Information Systems). GIS and history are good companions. Mapping and history have always worked well together, and GIS offers a way to move beyond static maps for simple visualization purposes. Aided by the computer, historians can use maps as research and analysis tools to make arguments based on a large scale. GIS allows for broadening the spatial scope and the overlaying of multiple sources. With it, scholars can re-examine the findings of previous studies and may even discover revisionist interpretations that challenge or overturn orthodoxies in their fields, which I and other scholars have attempted to do for Soviet history. While not all information is best examined through mapping, adding a series of spatial questions to a suitable project can develop a more robust thesis than with traditional archive-based methods alone.

This article aims to help historians make an informed decision as to whether these methods will serve their research goals by explaining the resources needed and the steps one must take to use GIS. It also highlights the extra challenges for researchers using non-English language datasets. By providing a detailed explanation of the process undertaken for my own research, I do not mean to discourage or dissuade those potentially interested in the field, but rather, to provide a realistic cost-benefit analysis of undertaking a GIS component. Published literature on GIS, historical GIS and computer based spatial history is prevalent, but these materials gloss over the trials and tribulations of building and executing a historical GIS project.<sup>1</sup> With this article, I

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\* The impetus for this article came from a presentation at the conference “New Approaches in Central and East European History: The Digital and Spatial Turn,” organized by the University of Göttingen Department of History and the Nordost-Institut IKGn Lüneburg from 7 to 9 November 2019. I must specifically thank Dr. Katja Wezel for the call to produce this article.

<sup>1</sup> For a survey of the field of historical GIS and spatial history see IAN N. GREGORY: Further Reading: From Historical GIS to Spatial Humanities. An Evolving Literature, in: IDEM, ALISTAIR GEDDES (eds.): *Toward Spatial Humanities: Historical GIS and Spatial History*, Bloomington 2014, pp. 186–202. I also recommend some of the following books as an introduction to either GIS, historical GIS, or digital spatial history. The majority of the following books are edited volumes that testify the many uses of historical GIS and digital spatial history to answer research questions across a variety of geographical and temporal studies. IAN GREGORY, DON DEBATS et al. (eds.): *The Routledge Companion to Spatial History*, London 2018; IAN N. GREGORY: *A Place in History: A Guide to Using GIS in Historical Research*, Oxford 2003; IDEM, PAUL S. ELL: *Historical GIS: Technologies, Methodologies, and Scholarship*, Cambridge 2007; ANNE KELLY KNOWLES, AMY HILLIER (eds.): *Placing History: How Maps, Spatial Data, and GIS Are Changing Historical Scholarship*, Redlands 2008; PATRICK MCHAFIE, SUNGSOON HWANG, CASSIE FOLLETT: *GIS: An Introduction to Mapping Technologies*, Boca Raton 2019; NADINE SCHURMAN: *GIS: A Short Introduction*, Malden 2006.

strive to fill this gap in the literature. By delving into my own work on German prisoners of war (POWs) in the USSR from 1941 to 1956, I want to show that GIS cannot automatically solve all problems, and it is certainly not a multitool that fits any dataset or project, but when wielded proficiently, it can be powerful. As I will briefly discuss and illustrate in the coming paragraphs, spatial, environmental and temporal analysis of the geography of the German POW camp system have enabled me to support a hypothesis that Soviet officials detained POWs for eleven years after the end of World War II to aid in post-war reconstruction. This argument could not have been supported with traditional archival sources.

However, the main goal of this article is not to present my research findings but to describe how to undertake a similar digital mapping project. Those who have undertaken digital historical projects often only write about the results of their endeavors. In this article, I aim to do the opposite. I present here the steps I took to create and refine my project and provide a more limited discussion of results.<sup>2</sup> The results are important, but they cannot direct others in the steps that need to be taken to make a similar project. While this type of information is not the most entertaining or interesting to read, the level of detail regarding data cleaning, processing and mapping that I provide here will allow others to replicate my workflow for themselves. I also hope that others can learn from some of the mistakes I made and bypass them, saving themselves valuable time in their own projects. Moreover, while my findings are important to my subfields of history, the work I have done should not be limited to that niche. I aim for this article to appeal to a wider audience as an informative piece on how and why one might wish to execute a digital spatial analysis project of this nature. Finally, I discuss how my results can contribute not only to my field of research, but how they can also benefit a wide range of scholars interested in World History in that my data is available to a larger, linked open data project known as the “World Historical Gazetteer” (WHG)<sup>3</sup>.

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<sup>2</sup> For a full discussion of my mapping results in conjunction with Russian archival sources, please see SUSAN GRUNEWALD: *Applying Digital Methods to Forced Labour History: German POWs during and after the Second World War*, in: ALAN BARENBERG, EMILY JOHNSON (eds.): *Rethinking the Gulag*, Bloomington 2022 (forthcoming). A much more truncated version of the main points of this article can be found in an earlier article I wrote for the newsmagazine of the American Historical Association. SUSAN GRUNEWALD: *Beyond the Archive: What GIS Mapping Reveals about German POWs in Soviet Russia*, in: *Perspectives on History from 2019-02-29*, <https://www.historians.org/publications-and-directories/perspectives-on-history/february-2019/beyond-the-archive-what-gis-mapping-reveals-about-german-pows-in-soviet-russia> (2021-02-25). Additional samples of my mapping work can be found on my website. EADEM: *Digital Mapping* (2020), <http://susangrunewald.com/digital-mapping/> (2021-02-25). The maps on the website are of an older generation of maps as of spring 2021.

<sup>3</sup> *World Historical Gazetteer* (2021), <http://whgazetteer.org/> (2021-02-25).

## Data and Context

The Soviet government kept approximately 1.5 million German POWs in forced-labor camps after the end of the war. Although each of the Allied Powers detained German POWs on their soil, only the Soviets kept theirs after 31 December 1948. Much of my research concerns the reasons why the Soviet government chose to hold their German captives for so long. Initial archival research indicated that this would be a difficult question to answer. Although the Soviet bureaucratic apparatus saved records concerning the use of German prisoners of war in forced-labor camps, the accessible declassified records do not explicitly state the reasons for the lengthy incarceration. Mapping the locations of the thousands of German POW camps across the USSR served as a way to supplement the scattered and incomplete documents to argue that initial detention related to the destruction of the war and post-war reconstruction. Over the course of the war, the USSR lost 27 million citizens and a quarter of its total material assets.<sup>4</sup> Due to these damages, Soviet officials mobilized able-bodied German POWs to mitigate labor shortages for post-war reconstruction. However, after 1949, the economic contribution of the POWs waned, and those remaining in captivity were detained for their potential as political bargaining chips in the early years of the Cold War.

The use of GIS mapping to study German POWs not only helped to answer my specific research question, but also allowed me to engage with broader themes in Soviet history. Any discussion of forced labor in the USSR is incomplete without a discussion of the notorious GULAG (Chief Administration of Camps) forced labor camp system.<sup>5</sup> The NKVD (People's Commissariat of Internal Affairs) administered the GULAG and the system that organized POWs, the GUPVI (Chief Administration of Prisoners of War and Internees). The NKVD used its experiences from running the older GULAG system for information on the management of the GUPVI POW labor camp system. Given the relation between these two systems, I was partially inspired to conduct my own series of maps by Judith Pallot and Sofia GavriloVA's online GULAG mapping project.<sup>6</sup> Pallot and GavriloVA's work has helped to

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<sup>4</sup> DONALD FILTZER: *Soviet Workers and Late Stalinism: Labour and the Restoration of the Stalinist System after World War II*, Cambridge 2007, p. 13; ELENA ZUBKOVA: *Russia after the War: Hopes, Illusions, and Disappointments, 1945–1957*, London 2015, p. 20.

<sup>5</sup> In 1929, the Politburo, the Soviet Union's chief policy making body, created the GULAG prison camp system. Soviet officials hoped for the labor camp system to be self-sustaining. The system would colonize remote regions of the USSR by way of prison laborers extracting resources and undertaking construction tasks in undeveloped areas. O. V. KHELVNIUK: *The History of the Gulag: From Collectivization to the Great Terror*, New Haven 2004, especially p. 9.

<sup>6</sup> [JUDITH PALLOT, SOFIA GAVRILOVA:] *Why Map the Gulag* (2009), <http://www.gulagmaps.org/> (2021-06-24).

overturn the notion that GULAG camps only existed in remote regions of the Soviet Union. Mapping the entire GULAG system quickly shows that it stretched across the entire geographic area of the USSR. While some of the most notorious camps may have been located in the isolated permafrost regions of Siberia or north of the Arctic Circle, others operated in the Caucasus or Central Asia. Additionally, mapping the extent of the geography of the camp system has cast aside the notion that it was entirely remote. Many camps existed near population centers of the USSR. Thus, mapping has worked in conjunction with robust archive-based studies of the GULAG system to overturn common misconceptions linking the GULAG to isolation and the frozen extremities of Russia.

Pallot and Gavrilova's project also helped me to define a series of research questions for my own mapping work and archival research. The maps she uses include temperature and railroad information, so I knew that I wanted to try to replicate these features for my own analysis. Were POW camps also located near railroad corridors? Knowing that would help determine if POWs were mainly transported to camps by train as opposed to punishment marches intended to kill many along the way. Temperature data would also determine if the POWs faced the harshest extremes of the Soviet Union, places that regularly plunged below  $-40^{\circ}\text{C}$  for weeks at a time. Many GULAG camps operated in such regions because Soviet authorities could not convince free citizens to work to extract coal or precious metals such as gold in such conditions.<sup>7</sup> I also quickly realized that it would be important to map the relationship between camps and population centers. GULAGs often intentionally punished inmates via not only the harsh climates of their locations but also the sheer distance between a camp's location and population centers. I wanted to see if GUPVI camps also operated in the harshest and most remote regions of the USSR and how distanced POWs were from Soviet society.

My ability to engage in GIS mapping and analysis to answer such research questions relied on the existence of one source. A joint German and Russian project produced an encyclopedia of the approximately 4,000 German POW labor camps in the USSR from 1941 to 1956.<sup>8</sup> In addition to listing the locations of the camps, which included the nearest city and Soviet Republic (e.g.

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<sup>7</sup> KHLEVNIUK, p. 9. ALAN BARENBERG: "Discovering" Vorkuta: Science and Colonization in the Early Gulag, in: *Gulag Studies* 4 (2001), pp. 21–40, here pp. 24, 27–28.

<sup>8</sup> VERONIKA CHVATOVA, ULRICH AUSTERMÜHLE: *Orte des Gewahrsams von deutschen Kriegsgefangenen in der Sowjetunion (1941–1956): Findbuch. Standorte von Kriegsgefangenenlagern, Arbeitsbataillonen, Friedhöfen sowie Einrichtungen des Frontlager-netzes; auf der Grundlage von Dokumenten der Kriegsgefangenenverwaltung aus dem Staatlichen Russischen Militärarchiv*, Dresden et al. 2010. The book contains more than just the forced-labor camps and includes labor battalions, cemeteries and grave-sites, and front camps. I specifically used the forced-labor camps (pp. 12–247) for this study. In a later project I would like to map the different types of German POW sites together in one GIS.

Moscow, Russia, or Erevan, Armenia), the book includes information about main versus branch camps, their capacities, and opening and closing dates. By digitizing this book, I was able to map the approximate locations of the German POW forced-labor camps. I was then able to map them in relation to resources and infrastructure. Analyzing the results of the mapping allowed me to draw conclusions about POW labor use, which could be supported by the scattered archival sources. Thus, only by using both traditional archival sources and digital methods could I make a comprehensive argument linking post-war destruction and labor needs to lengthy incarceration. In the next section, I will explain in detail each of the steps of my mapping process, including the digitization of the POW camp encyclopedia, and, briefly, some of my findings.

### The Mapping Process

The first step to any mapping project is to study existing ones. While I was particularly fortunate to find a related mapping project, this is not necessary to execute this type of research. Looking at existing maps can provide information indicating the kind of spatial questions to ask in your own project. One needs to think about what the existing maps do or do not do well, what questions they do or do not answer, what they emphasize and understate, etc. The same types of questions can be applied to any maps that visualize historical phenomena. Studying a project on medieval Europe could, for example, supply information to a scholar of modern China.

In my case, studying GULAG maps helped me to develop a series of spatial research questions I wanted my maps to answer. For example, were the main POW camps located in rural or in urban areas? What contribution did the POWs make to reconstruction? Were they primarily used for resource extraction? To what extent did they have a hand in reconstructing the massively destroyed cities? Finally, was their incarceration politically or economically motivated, driven by punishment or by labor needs? Although archival sources can supply some answers to these questions, mapping provides immediate, large-scale and comprehensive results which are sometimes not otherwise available due to the fractured nature of the document base.

The processes involved in creating my maps and drafting my primary spatial research questions were neither simple nor quick. Like much historical research, it has been a combination of serendipity and dedication. I received much of the practical training in digital methods through the DH infrastructure at Carnegie Mellon University. The Dietrich College of Humanities and Social Sciences supports both a week-long, intensive summer course on DH tools and methods, as well as a year-long fellowship, which includes a semester off from teaching. During this time, fellows meet weekly as an interdisciplinary cohort to learn the computer-based skills needed to produce their research projects. In my case, I spent a semester learning how to use the pro-

fessional mapping program ArcGIS by taking a course at the Heinz College of Information Systems and Public Policy at my university. What took more time, though, was learning how to clean data and finding the right programs to use to manipulate the data into the necessary form to work with the mapping software. Much of this support came from my DH reading group. This is another reason why I contend that the standard literature on GIS and historical spatial research is lacking. Those types of publications are either heavily discipline-specific, such as human geography or public policy for GIS, or focus too much on the final results without much explication of how data was sourced and processed before analysis. Publications that discuss the process behind the projects also often fail to mention the dead ends or revisions of the process. At times, knowing both what does and does not work is helpful for the replication of a process.

The first major decision of a spatial mapping project such as mine is always choosing which software to use. A key question is whether or not open-source software is sufficient for large-scale research tasks. Some researchers may feel compelled to purchase software due to a misconception that it is in some way superior or necessary for their projects. For most applications related to history, the open-source QGIS is more than sufficient. Having access to the paid, professional software ArcGIS is not necessary to conduct robust historical research. I only started my project in ArcGIS as I was enrolled in a GIS course at my university that taught GIS through ArcGIS and provided students with a license. Currently, I am teaching my students how to undertake similar historical GIS projects to my own with QGIS. Skills learned in one GIS software are often fairly easy to transfer to another as well. If you have the opportunity to attend a workshop or course on GIS with ArcGIS, take it and then reapply the skills to QGIS if you cannot acquire a license to ArcGIS. The differences between the interfaces are startling at first but are very easy to overcome. In fact, some tasks such as importing data are much easier in QGIS than ArcGIS, so for beginners the learning curve is not as steep in QGIS as it is for ArcGIS.

To learn GIS, and other data wrangling skills, historians should not fear leaving their department for assistance. DH is largely inter-disciplinary, and the skills needed to operate its many tools come from a variety of backgrounds. Those dedicated to learning the necessary GIS skills should be able to do so by contacting geography, urban studies, policy, or engineering departments. Libraries frequently employ staff with relevant data management skills as well and often have access to online resources for learning these methods. Outside of one's own university, The Digital Humanities Summer Institute (DHSI) at the University of Victoria, Canada, and Humanities Intensive Learning and Teaching (HILT) at rotating universities across the United States offer annual summer programs and sponsor other events throughout the

year that offer training in DH methods.<sup>9</sup> Those ambitious enough can also self-teach relevant skills through a variety of online tutorials, such as those offered by the excellent web-resource *The Programming Historian*.<sup>10</sup>

After making a decision regarding the software, the next major hurdle is acquiring data to map. My project was completely serendipitous in the sense that I could not have undertaken it had I not come across one particular book, the aforementioned *Orte des Gewahrsams*.<sup>11</sup> A lack of accessible data certainly creates an obstacle to scholarly enquiry, but scholars of U.S. history and other English-speaking nations should not have the same problem as those of us who study twentieth-century Eastern and Central European History. Governments of many English-speaking nations frequently publish datasets that are well suited to GIS research.<sup>12</sup> For those of us who research in foreign languages and with limited access to archival sources, there are additional steps that we need to take to acquire and clean data for GIS research. While I am extremely grateful for the existence of the Russian-German POW camp encyclopedia, its format proved to be problematic for the mapping process. The book exists solely in print form, despite its relatively recent publication date of 2010. I had hoped that at least one party in the large production team would have had the information in an electronic format that I could easily copy and paste into different programs to reduce errors. Unfortunately, such a record was not available. On a related note, researchers should always make sure that they comply with copyright and fair use rules surrounding their datasets. Copyright laws also vary drastically between countries. In my case, I have the permission of the publishers to use this information to make a derivative dataset for my own work. During the process I consulted with my university library's Research Curation and Scholar Communication librarian to

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<sup>9</sup> Institutes such as the Digital Humanitas Summer Institute (DHSI) or the Humanities Intensive Learning and Teaching (HILT) cater to North American researchers. The Digital Research Infrastructure for the Arts and Humanities (DARIAH) provides support for European researchers, <https://www.dariah.eu/activities/training-and-education/> (2021-02-25).

<sup>10</sup> Tutorials for a variety of DH tools and methods can be found at: *The Programming Historian: Lesson Index* (2021), <https://programminghistorian.org/lessons/> (2021-02-25). For those interested in learning the basics of data acquisition and cleaning, mapping, and map analysis, I suggest the excellent tutorial for QGIS by Seth Bernstein. His two part series can be accessed at SETH BERNSTEIN: How to Map the Gulag (the data), in: *Abstractualized*, 2015-10-27, <http://www.abstractualized.com/2015/10/how-to-map-gulag-data.html> (2021-02-25), and IDEM: How to Map the Gulag (the visualizing), in: *Abstractualized*, 2015-11-01, <http://www.abstractualized.com/2015/11/how-to-map-gulag-visualizing.html> (2021-02-25).

<sup>11</sup> CHVATOVA/AUSTERMÜHLE.

<sup>12</sup> While this is by no means a comprehensive list, the following blog provides a list of free global data available for GIS research. As the list shows, the United States offers the most resources. DRAGONS8MYCAT: Free GIS Resources, <https://dragons8mycat.com/gis-data-sources/> (2021-02-25).



double check that I was asking the appropriate questions of the publishers and to receive the correct permissions.

Without an electronic copy, I had to scan the 236 book pages that listed the camps and use a process called “Optical Character Recognition” (OCR) to turn the scans into text. When a book is scanned, the pages are saved as an image file. OCR software takes these images and generates a text layer based on the images. Unfortunately, the OCR process is not perfectly accurate, which was further complicated by the fact that the source material was in German. American DH was largely born out of English departments and, as such, the computer tools mainly work with English.

While OCR software has improved since I did my initial digitization work in spring 2016, it is still not one hundred percent accurate, especially for non-English languages. At the time of writing this article in the summer of 2020, I was working on an analysis of German POW memoirs, the majority of which are in German. Even with the newest version of the premier, paid OCR software, ABBYY FineReader 15, I had issues with the OCR, despite having high-resolution scans produced on professional scanners in the library rather than just the scanner in a copy machine. I had the ability to pre-process the images in numerous ways (e.g. deskewing and straightening text lines) before running OCR complete with a dictionary function to predict words (e.g. German, English, or Russian) and the results were still imperfect. Moreover, the errors produced in the OCR process do not always occur in a regular fashion, meaning that I could not often automate the cleaning of the output files with find and replace or regular expression functions.

Both with my current OCR work and with my OCR process to digitize the dataset of German POW labor camps, the existence of a few German language characters, specifically *Umlaute*, caused errors with the OCR software, even when German was selected as the target language. Moreover, OCR software prefers text formatted in standard paragraph form, but my text for the mapping project was in tabular format and needed to remain as such for the GIS software. To get useable text, I needed to use two different OCR programs: the paid, desktop-based software ABBYY FineReader and the open-source, internet-based Tabula.<sup>13</sup> Both programs created unique errors, but I was able to copy and paste information in bulk from the Tabula output file into the large gaps in the ABBYY file in Excel. For example, ABBYY did not

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<sup>13</sup> The paid OCR software can be purchased from: Abbyy FineReader PDF (2021), <https://pdf.abbyy.com/finereader-pdf/> (2021-02-25). The free, tabular based OCR software can be accessed at: Tabula (2018), <http://tabula.technology/> (2021-02-25). Many thanks to Scott Weingart, the Digital Humanities Program Director at Carnegie Mellon, for introducing me to these tools. Those who are looking for a free alternative to ABBYY FineReader can try the Google sponsored Tesseract (2021), <https://github.com/tesseract-ocr/tesseract> (2021-02-25). Potential users should be warned that this program must be run from a command line, though there are some third-party options for having a graphical user interface.

properly process the entire first page of information concerning German POW forced-labor camps from the book.<sup>14</sup> The initial output header and first row from ABBYY read as follows:

				<b>Kapa- zität (Perso- nenzahl)</b>	<b>Einrich- tungs- befehl</b>	<b>Auflö- sungs- befehl</b>	<b>Signatur RGVA (F./op./ A./Bl.)</b>
				900–400	00694	001038	ln/3r/10/70

The correct information for that particular header and first row of information should have read:

<b>Standort (Rep./ Gebiet/ Kreis/Ort)</b>	<b>Lager Nr.</b>	<b>Zweig- lager Nr.</b>	<b>Betriebs- zeit</b>	<b>Kapa- zität (Perso- nenzahl)</b>	<b>Einrich- tungs- befehl</b>	<b>Auflö- sungs- befehl</b>	<b>Signatur RGVA (F./op./ A./Bl.)</b>
Armenien/ –/ Alawerdi/ Ejlar	115	5	15.06.1945– 04.10.1947	900–400	00694	001038	ln/3r/10/70

ABBYY made this mistake for the first twenty camps listed in the book. The output from Tabula, as mentioned, thankfully created its own series of formatting errors that worked to alleviate the large gaps of information from the ABBYY output. Tabula exported all of the different columns from each page into one single column in the CSV. A single page of book text was rendered as about twenty locations in rows from one through to twenty in the spreadsheet and then there would be twenty rows of camp numbers, etc. Due to that pattern, it was easy to paste the corresponding missing chunks of information from the Tabula output into the ABBYY output.

This initial data cleaning from the two OCR outputs was the most time-consuming part of the entire project. Both sets of output files contained irregular spacing, which meant the files could not be quickly cleaned with some programming hacks (e.g. regular expressions) in a text editor or Excel commands. Instead, I had to go through the files line by line for about 4,000 lines and make sure that all the necessary information was included. To do this, I worked in regular chunks of about two hours at a time. To correct the information, I had the original source book open on the desk and a piece of paper to focus on each row. I also used two computer monitors so that I could modify a copy of the raw export from ABBYY on one screen and have the

<sup>14</sup> CHVATOVA/AUSTERMÜHLE, p. 12.

Tabula export from which to copy the regular large pieces of missing text open on the other screen. For instances where only one or two cells were wrong at a time, it was faster to type the missing information from the book rather than filtering through the Tabular export to figure out the corresponding cells.

After a few months of regular periods of data cleaning, I had a file listing the camps' locations and corresponding information on their size and operation dates, but that information was still not ready for the mapping software. To map locations in ArcGIS or its open-source equivalent QGIS, one requires latitude and longitude coordinates. Initially, I used a web tool to get this information, a process called "geocoding."<sup>15</sup> As the final project for my GIS course I produced a series of maps on the approximately 700 camps that operated in the Ukrainian Soviet Socialist Republic.

I chose Ukraine for the long operational period of the camps there (1942–1954), the relatively manageable sample size and the existence of coal deposit data that could be loaded into ArcGIS. The online tool limited requests to 100 locations at a time and also had a daily limit, which required me to look up the information over the course of a few days. This was acceptable for the smaller number of camps, but would prove to be problematic for scaling up to the full 4,000 camps I needed to map. Thus, I worked with the DH programmer at my university to write a script in the programming language R for use in R-Studio.<sup>16</sup> The script told R-Studio to load the camp city locations and ask Google Maps for the latitude and longitude coordinates. It then automatically took this information and saved it into an Excel spreadsheet. Again, I ran into request limits. At the time of the R script, Google Maps limited a user to 2,500 requests in a day. Due to unanticipated errors in the OCR process and

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<sup>15</sup> Map Developers: Batch Geocode Tool, [http://www.mapdevelopers.com/batch\\_geocode\\_tool.php](http://www.mapdevelopers.com/batch_geocode_tool.php) (2021-02-25). Unfortunately, this and many similar quick online services no longer work after a Google Maps API update. I have outlined other ways to geocode locations in a short OCR and Geocoding tutorial: SUSAN GRUNEWALD: Optical Character Recognition (OCR) and Geocoding Tutorial (2019-10-03), <https://github.com/grunewas/OCR-and-Geocoding-Tutorial/blob/master/OCR-and-Geocoding.md> (2021-02-25).

<sup>16</sup> The R code can be found online. SUSAN GRUNEWALD: MapsR (2018-04-13), <https://github.com/grunewas/MapsR> (2021-02-25). As this article explains in further detail, the code currently no longer works. Those with coding skills are more than welcome to use the code as a base and to try to repair it for their own use.

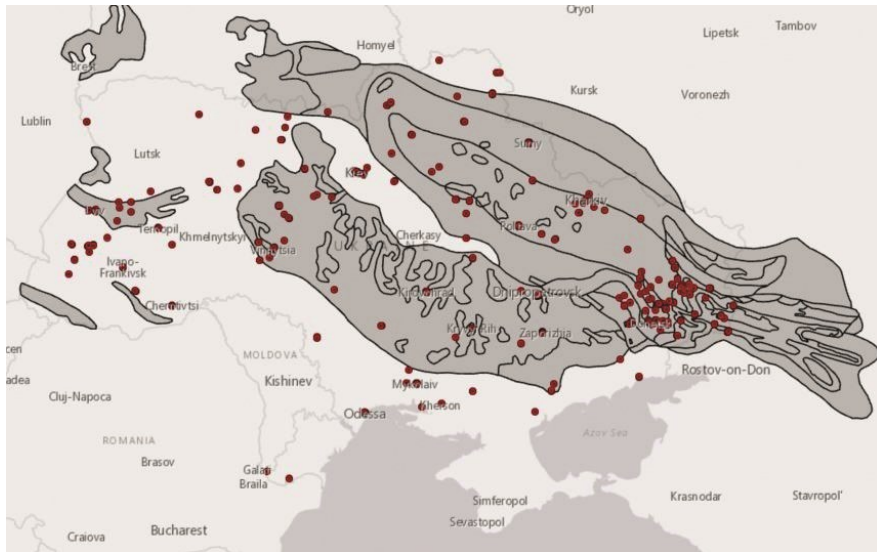


Fig. 1: Ukrainian SSR German POW Camps and Coal Basins, 1942–1954<sup>17</sup>

problems related to name changes in the post-Stalin and post-communist periods, Google found only 2,739 locations of a requested 4,363, or about 62 percent.

The results returned by the first script I used to mass geolocate the approximate locations of POW forced-labor camps were not sufficient to support research claims. Even if all the locations found by the script had been accurate, they still would not have been representative of the entire dataset of 4,363 camps. Additionally, not all the returned locations were correct coordinates. Some locations retrieved in the automated process were in North America or Africa, which the image below illustrates. Thus, using a standard script-based

<sup>17</sup> In the map, the dots represent the location of the camps. The banding and shading indicate coal basins: the tighter the banding, the higher the concentration of coal. The coal data is used with permission from MICHAEL E. BROWNFIELD, DOUGLAS W. STEINSHOUER, MIKHAIL YU. POVARENENYKH, IVAN ERIOMIN, MIKHAIL SHPIRT, YEVGENY MEITOV, IRENA SHAROVA, NINA GORIUNOVA, MARGARITA V. ZYRIANOVA: *Coal Quality and Resources of the Former Soviet Union: An ArcView Project* (2001), <https://pubs.usgs.gov/of/2001/ofr-01-104/readme.htm> (2021-02-25). As a word of caution for anyone who wishes to use this data set, it is in an older file format that cannot be imported immediately into ArcGIS. These files are in an E00 format. I opened the file in ArcMap 10 and followed the steps from ESRI, the publisher of ArcGIS, on their support website to convert the file into a useable format for ArcGIS. ESRI: *How To: Import an ArcInfo interchange file (E00) in ArcGIS* (2016-05-05), <http://support.esri.com/es/knowledgebase/techarticles/detail/21052> (2021-02-25).

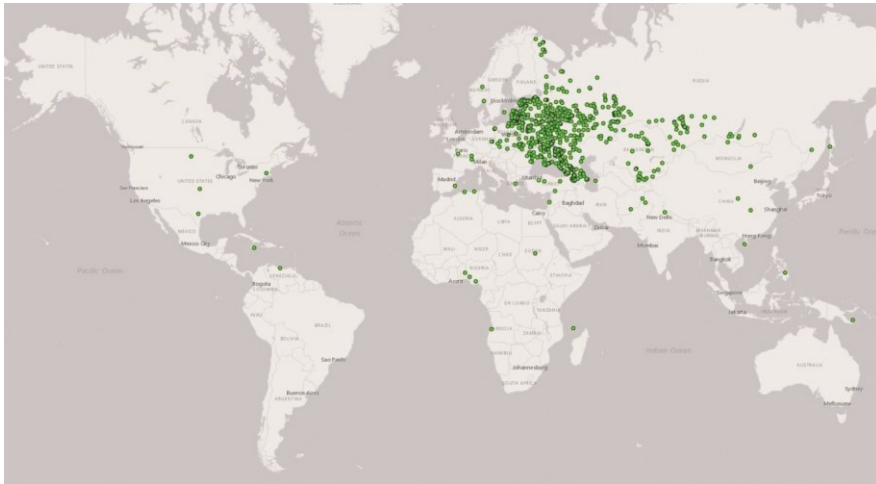


Fig. 2: Initial Batch Geocoding with R of German POW Camps in the USSR, 1941–1956

geocoding service was not possible for a historical and multilingual project for the purpose of supporting an argument. However, these initial results were good enough for the basis of exploratory research. Even with corrupt and insufficient results, the first map of the forced-labor camps across the USSR suggested geographic clustering of camps in the European parts of the Soviet Union. These preliminary mapping results helped condition my future archival research.<sup>18</sup>

The number of erroneous location retrievals as well as the lack of success in finding other locations outright with R required me to think about how to revise the code to return better results. Timing became an issue for this stage of my research. I had created the first generation of All-Union maps with R by summer 2016. I then left for a year of archival research in Russia and did not return to my mapping work until autumn 2017. By that time, Google Maps had updated its application programming interface (API), the information on which its various tools run, rendering the R script defunct. I decided to start anew with the programming language Python because there are several well-documented packages that automate geocoding with not just Google Maps, but a variety of other mapping services including Yandex, Russia's equivalent of Google.

Learning from the initial results from the R script, I worked with a programmer to devise a Python script that included a series of conditions to return more refined results. For example, the script limited the search area to

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<sup>18</sup> For more information about my initial mapping results and how they impacted my research in Russian archives see GRUNEWALD, *Beyond the Archive*.

coordinates within the bounds of a box around the Soviet Union. The script also needed to check the country codes associated with the returned latitudes and longitudes. We told the script to only accept returns from the 15 former Soviet republics. Anyone interested in undertaking a similar type of mass geolocation should also limit the geographic bounds and country codes of their searches to increase the reliability of the results. Finally, the script was set to search for the most precise location and then return a location for the nearest broader area if the smallest location could not be found. That is, if the location was listed as “Nowobelizkaja, Gomel, Belarus,” the script would look for “Nowobelizkaja.” If it could not find that, the script would then look for “Gomel” and give its coordinates, and so on. When there was no result found at all, a note was placed in the output file indicating this. When the script had to use the secondary location, such as Gomel in the above example, it also noted that it had returned a secondary location. Having the script note whether or not it could find the most precise location gives me the potential to produce multiple calculations and maps based on certainty. For example, I can choose to map or calculate statistics based only on places that I could definitively map. Or, I can produce a map that visualizes the precise results (Nowobelizkaja) with black diamonds and visualizes approximate results (Gomel) with hollow diamonds to account for certainty and uncertainty in the same graphic.

Another important parameter for my project, which is likely to be relevant for other scholars creating their own datasets, is that of multilinguality. My dataset had a series of issues with language and transliteration. Each of the fifteen republics of the Soviet Union had its own mother tongue, but central record-keeping was done in Russian. Soviet authorities renamed localities outside of Russia with Russian transliterations of local names. My published source, however, was in German and contained German transliteration conventions for the Russian language. Thus, many of the places in my dataset featured potentially two distortions of a place’s name, provided that the location kept its name between 1941 and the present day. German also has different transliteration conventions for Russian than English, which caused many of my initial errors with batch geolocation. In the hope of preventing this error, the Python script specified that the search terms were in German and asked Google.de for the results rather than English language Google.

The Python script returned far better results than the R script, though it also missed lots of locations with semi-regular frequency. I checked the first 1,200 locations by hand with Google Maps and found coordinates for locations missed by the script. Generally, to find those locations, I needed to sound out the German location and then type it in Cyrillic. With this method, I quickly found most of the locations that were missing and realized that the issue resulted from German transliterations of the Russian place names. To speed up the process, I opened the CSV file of location names and changed some of the common German transliterations into more accepted English ones and reran the script. For example, I changed “w” to “v,” “sch” to “sh,” “ja” to “ya,” “je”

to “ye,” and “sh” to “zh.” In some cases, I used the commands “find” and “replace” to fully change the major city from the German transliteration to the English one, such as in the case of Cheliabinsk. This resulted in more accurate returns. I then took these coordinates returned by the script from the modified transliterations dataset and mapped them.

I still did not necessarily trust that the automatically returned locations were correct. Thus, I used another method to verify the return locations. With the mapping program open, I opened the attribute table of the camp locations and used the select tool to highlight camps on the map for each republic. If any camps appeared outside of the correct republic, such as seeing a highlighted dot in Russia if looking for camps in Armenia, I wrote down that particular camp’s ID number and corrected the coordinates via manual lookup in Google Maps in the main spreadsheet. Eventually, I managed to find approximate locations for 4,266 of the 4,314 camps listed by Veronika Chvatova and Ulrich Austerhmühle, or almost 99 percent of the camps. It should also be noted that these camp locations are approximate, as the most granular data for a camp location is a village or city, not a specific address in the city.

After finally finishing my data cleaning and automatic georeferencing, I was able not only to map the locations of where the camps existed between 1941 and 1956, but also to map them in relation to other types of data including coal surveys, transit networks and temperature. Mapping camps in rela-



Fig. 3: Corrected German POW Camp Locations from Python and Google Maps

tion to coal deposits or industrial centers has allowed me to claim that German POWs contributed to key sectors of post-war reconstruction. Certainly, the Soviet authorities punished the Germans for their role in the war by detaining them after the war's end and employing them in the state economy, but the correlation between camp location and sites of industrial consequence illustrate that economic return overshadowed punishment. In many cases, German POW camps were located in Soviet population centers rather than the remotest regions. In fact, no German POW camps existed in the harshest locations where notorious GULAG camps such as Kolyma or Vorkuta functioned.

### Future Mapping and Collaboration

In this section, I wish to discuss how my mapping work is still incomplete and how I plan to use my research findings for additional studies and scholarly collaborations. Although I have produced three different generations of All-Union maps, my mapping work is still not finished. That is simultaneously one of the greatest returns and greatest pitfalls of mapping. Mapping research is highly iterative. My maps sufficed for the purpose of my doctoral dissertation, and a revised version of them was satisfactory for a forthcoming book chapter in an edited volume on forced labor in the Soviet Union.<sup>19</sup>

However, I still have more questions to ask of my maps and more steps to take to answer those questions. For example, I have only plotted the locations of camps in relation to sites of coal reserves. Based on one archival document from 1946 and the existence of many camps within the Urals region of Russia, a historical site of Soviet iron and steel production, I have made assumptions that the POWs were also heavily engaged in steel production.<sup>20</sup> A future step for my mapping work is to digitize a series of contemporary Soviet economic geography maps in a process called georeferencing. A scan of a map does not include any geographic coordinates, but mapping programs like ArcGIS and QGIS enable users to line up key features such as the coastline or the borders of states from a map picture to the map in the GIS system. Once enough anchor points are chosen, the map image is stretched and saved with the geographic coordinate information. That map image is then a manipulable layer in the GIS software and it is possible to then overlay other map layers such as digitized transit lines or the locations of the camps on top of the other map. It is also possible to trace features from the map picture to save just the

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<sup>19</sup> EADEM, *Applying Digital Methods*.

<sup>20</sup> Statement of M. S. Krivenko on the Distribution of Prisoners of War among Ministries for Labor Use as of 1 June 1946, in: Gosudarstvennyi Arkhiv Rossiiskoi Federatsii [State Archive of the Russian Federation], Moscow, sign. 9401, vol. 2, no. 137, pp. 370–371.



desired subset of information, such as forest boundaries or nickel mines, to then use only those features in conjunction with the simple base map and camp locations.

I intend to carry out the processes of georectification and digitization with contemporary Soviet economic geography books to see if there are any other key industries or extractive industries that used POW labor on a large scale. I can also refine my geographic understanding of certain industries. For example, I already know the POWs were heavily engaged in coal mining in Ukraine, certain Russian coal basins, and Kazakhstan, but I would like to see what POWs might have done in smaller republics with more specific economies, such as Azerbaijan or Uzbekistan. Did they work near sites of the oil industry in Azerbaijan or in the cotton fields of Uzbekistan?

Additionally, my mapping work has revealed the need for a related study concerning German POW memoirs. Anecdotal discussions with Germans about my research project have revealed that many Germans have a familial connection to captivity in the Soviet Union. When asked for more information, these family members almost always reply that their relatives spent their time in Siberia. However, mapping has shown that the majority of the camps were not in Siberia. At the moment, I am undertaking an examination of the memoirs of returnees from the Soviet Union. I have scanned all these books and will run a text analysis searching their accounts for place names. I plan to run a Python script to search the memoirs for the location names from the *Orte des Gewahrsams* dataset that I used for my initial maps. My hunch is that very few or none of the memoirists spent time in Siberia. I also intend to map the locations named in the memoirs to see if there are any trends related to where those who wrote memoirs were incarcerated in the Soviet Union and if there are any key locations associated with East or West German memoirs. My mapping work has thus allowed me to open up new questions for the accessible sources that I would otherwise never have thought to study.

Once I complete my fourth generation of maps that include historic Soviet economic geography maps as well as POW memoir settings, I plan to upload my maps onto my personal website in addition to pursuing traditional monography and peer-reviewed journal publications of the results. Web publishing is a major goal of my work because it has the potential to vastly increase the accessibility of my research to relatives, interested people and those who cannot get past a paywall. Ideally, I envision the web publishing of my maps to turn into a public history project. Many Germans and Russians have told me stories of family members who were either German POWs or interacted with German POWs in the Soviet Union. My web maps will also have a blog linked to them, asking viewers to contribute accounts or evidence of ephemera from German POW captivity if they have any. I will then use ArcGIS Online to embed interactive maps on my website. Users will be then able to explore the maps of camps and clicking on a particular camp will give the user a link to the contributions of others about these camps.

The final aspect of my mapping work is to contribute my location information to the online collaborative project WHG.<sup>21</sup> The WHG aims to provide “content and services that permit world historians, their students and the general public to do spatial and temporal reasoning and visualization in a data-rich environment at global and trans-regional scales.”<sup>22</sup> Essentially, the WHG provides a collection of historic place names. Searching for Leningrad will also return St. Petersburg and Petrograd, for example, and provides the temporal range for which these different names were used to describe the same place. The WHG thus enables researchers, instructors and students to quickly search for information on the location of historic places if their names have changed.

However, the site does not merely provide a static directory of historical place names. Its main feature is called “reconciliation,” which means a user can upload a dataset of historic place names and geocodes and map them within the system, provided that coordinates for these places exist in the system’s gazetteer. If they do not currently exist, users can contribute the geographic coordinates if they have them for their sites. Once users go through and verify the coordinates for their locations, they will be able to generate a map of just those locations. This service should be useful for researchers, instructors and students. Instructors or students, for example, will be able to quickly and easily generate a map for lessons or inclusion in essays or blog posts. The management of the place data in the WHG is done using a data standard for linked data called “Linked Places,” which allows properly formatted spatial data to be quickly and easily accessioned into the WHG.<sup>23</sup> As of March 2021, the WHG’s index of place names includes 942 records from GeoNames, a geographical database with coverage of every contemporary country, (including cities with a population larger than 500,000 and world capitals); about 1.8 million records from Getty Thesaurus of Geographic Names; 252 countries, 982 rivers and 217 mountain ranges from Natural Earth; 1,491 lakes from the Wildlife Research Institute; 1,482 societies (peoples, cultural groups) from D-Place; 10,643 records from the *DK Atlas of World History*<sup>24</sup>; and about 14,000 locations from the HGIS de las Indias project.<sup>25</sup> Furthermore, there are approximately twenty additional historical datasets waiting to be ingested into the system.

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<sup>21</sup> GROSSNER, World Historical Gazetteer.

<sup>22</sup> IDEM: Introducing the World Historical Gazetteer (2020), <http://whgazetteer.org/about/> (2021-02-25).

<sup>23</sup> Linked-Places (2021), <https://github.com/LinkedPasts/linked-places> (2021-02-25).

<sup>24</sup> JEREMY BLACK: *DK Atlas of World History: Mapping the Human Journey*, London 1999.

<sup>25</sup> KARL GROSSNER: Guide: WHG Data (2020), <http://whgazetteer.org/tutorials/guide/> (2021-02-25).

While the team behind the WHG project focuses on building a gazetteer of historic places, they also care deeply about showing the connections between these places and the development of World History. Thus, there are not only the linked places format and information about those places in the system, but also a feature called “traces” and its own “Linked Traces” data format. For the purposes of this project, a trace is defined as “any historical entity having a spatial-temporal setting (i.e. footprint) of interest.”<sup>26</sup> In other words, examples of traces may be people, events, artifacts and journeys. The idea is to show users a series of links to data related to a place. Currently, I am in the process of uploading two historical datasets to the WHG, one on major battles of the Eastern Front and one with the locations of POW camps. If a user searches “Moscow” in the WHG after both are ingested, they will see that there are two traces attested to this location with links to the data sources. In this case, Moscow will be listed as a battle site from World War II as well as the location of a POW forced labor camp. The trace attestation will list both the full name of the dataset as well as the link to the full dataset.

The WHG will not assume ownership of these trace datasets; rather, it serves as a search and visualization service for openly accessible historical data. For a trace dataset to be uploaded into the WHG, it needs to have a stable URL. If a scholar has access to an institutional repository, they may use this as the source by which to publish their dataset. If a scholar’s institution does not have its own digital repository, they may upload their data for publication to the University of Pittsburgh’s Collaborative for Historical Information and Analysis Dataverse, a free data repository open to all researchers from any institution.<sup>27</sup> The WHG is in the process of building an editorial board, which will review contributed datasets for both publication on the Dataverse as well as the WHG. For our purposes, the datasets must be robust and scholarly, and have full citation information for the contained data. The University of Pittsburgh is committed to maintaining the WHG and its supporting data after the grant funding runs out. It is also in negotiations with another university around sharing the maintenance of the website infrastructure to ensure its longevity.

Once more traces are loaded into the WHG, users will be able to find accessible data for projects pertaining to specific locations. With the growth of the WHG traces datasets, users will be able to investigate how different locations in the world have been part of a global, historical system. These traces will also allow researchers to expand their own research projects. With the example of uploading my German POW camp dataset into the WHG, anyone

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<sup>26</sup> IDEM: Linked Traces (2019-03-26), <http://blog.whgazetteer.org/2019/03/26/linked-traces/> (2021-02-25).

<sup>27</sup> World-Historical Dataverse (University of Pittsburgh): CHIA Collaborative for Historical Information and Analysis (2021), <https://dataverse.harvard.edu/dataverse/worldhistorical> (2021-02-25).

who searches for a location that had a POW camp will see that a listed trace for the particular settlement, such as Moscow, had a connection to German POWs. Similarly, as the system grows, I will be able to see what happened in more obscure locations of POW camps. Perhaps a Russian user will contribute datasets about industry or population statistics during the time period that I study. The ability to access more data like that will allow me to continue to perform more statistical analysis of the POW camps. For example, I have approximate camp capacity numbers. If someone uploads demographic data, I could answer questions as to whether the largest POW camps were located in proximity to larger or smaller Soviet population centers. Or did the size of the camp roughly correlate in a certain ratio to the settlement size? Other researchers should easily be able to think of how a system such as this can vastly expand their research questions and source base. I hope that instructors can also see the value of such a resource for pedagogical practices and fostering student research capabilities.

## Conclusion

As this article has shown, GIS mapping is hard work, but it is also worthwhile. Mapping is not only a visualization of research conclusions but is itself a research tool that can offer solutions to otherwise unanswerable questions. This was the case for my own research and will likely be the case for many others. Although I did not discuss the results of my mapping work in depth in this article, I hope that my references to my own research have helped to justify the use of GIS for historical enquiry. Computers are increasingly a part of our daily lives, and it is important that we integrate them into our research at a higher level beyond word processing and statistical analysis. Digital humanities, especially GIS, analysis of traditional sources gives researchers the potential to either re-investigate a topic in a fresh way or to generate results that were previously inaccessible due to problems with sources. GIS can, and should, become the next major intervention in the study of history.

However, the computer is not a magical machine that instantaneously produces results. If one wants to undertake a similar project, one needs to remember that there are many steps in getting and cleaning the data before the information can be mapped and analyzed. This task accounts for ninety to ninety-five percent of a project of this kind. Scholars peer-reviewing the digital work of others need to understand that far more time and effort goes into these projects than the finished product reveals. Often, the time commitment embedded in these projects is not fully comprehended by those who have not undertaken this type of work. For those motivated to acquire the skills and prepare the data, GIS can open new vistas of analysis and provide startling insights. The efforts undertaken to produce one's own GIS research also need not be locked away. Once a researcher has finished their work, they hopefully will contribute some of their findings to projects such as the WHG. Contribu-

tions to a linked open data project should draw attention to their work as well as help develop the study of World History as a whole. History happens as the result of a series of deeply complex and interrelated events. The computer has facilitated and advanced our study of the human organism. It is time we used the computer to advance our understanding of the human past. Although this work comes with significant time investment, the rewards are great.

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