

A CRITICAL ANALYSIS OF TAN-HSIN ARCHIVES MAPS

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INTRODUCTION

Tan-Hsin Archives are the Qing dynasty's official documents about Taiwan's local government, including files of judicature and administration. The contents of the Tan-Hsin Archives lasted from 1776 to 1895. Tan-Hsin Archives contain 1164 cases, covering the areas of Tansui Prefecture, Taipei Government, and Hsin-chu County in Qing Dynasty. These official documents are composed of court judgments and official correspondence. They can provide clues to investigate the organization and functioning of local governments in Taiwan during the Qing Dynasty. In 1895, as Taiwan was ceded to Japanese by the Qing government, these files were stored at the Hsin-chu court, and later transferred to the High Court of colonial government. Finally, the archives were transferred into Taipei Imperial University, the precedent of National Taiwan University (NTU), for its potential value in academic research. During Japanese colonial period from 1895-1945, the archives were named "Taiwan Documents" because they were files about Taiwan ruled by the Qing authority. During 1947-1953, Prof. Yen-Hui Tai of Law School at NTU started to reorganize, reassign, and recompile these files. At the same time, Professor Tai renamed the archives from "Taiwan Documents" to "Tan-Hsin Archives". Along the development of digital archives program initiated by National Science Council (NSC) of Taiwan in the late 1990s, these archives were then digitalized and stored in the library of NTU. According to the library of NTU, Tan-Hsin Archives contains 19,281 files of documents. These documents were categorized into three categories—administrative, judicial, and criminal. The majority of them are administrative documents. Temporally speaking, the majority were generated in the Kuang-hsu era.

Tan-Hsin Archives are unique and treasurable as there are only two such official archives of local government left by the Qing Authority, one in Taiwan and the other in Shi-Chuan Province of Mainland China. Tan-Hsin Archives represent the first-hand documents covering administration, judicature, economic, society, agriculture, geography of Taiwan in the Qing Dynasty. They not only reveal the characteristics of the Qing Dynasty's official maps, but also fill the gap in Taiwan's map history. In addition, Tan-Hsin Archives provide abundant map elements which may reveal the spatial knowledge of people in the Qing Dynasty.

Within the 1,164 cases contained by Tan-Hsin Archives, there are 182 maps. As a whole, 5.8% are cases with maps, and they are mostly civil cases. These maps were made for various purposes. Some of the maps were used to show the locations of property, while others show the backgrounds of lawsuits.

The crux of this paper lies in studying the accuracy of two maps in the Tan-Hsin Archives as well as exploring the historical and cultural contexts in which these two maps were generated. To do so, we will first review important studies which have inspired us to examine both the scientific representation and cultural contexts of these two maps. The third section explains our research method. The fourth section discusses our findings, while the last section concludes by pointing out relevant topics for future research.

LITERATURE REVIEW

In this section, we review two kinds of literature. We begin with literature discussing the necessity to explore the cultural, historical and ideological messages hidden in cartographic work. In 1989, Brian Harley brought up the concept of deconstructing maps with postmodern and critical cartography thinking. According to Harley, mapmaking is not neutral and objective, and the process of mapmaking involves creativity. Harley believed that each map is affected by the mapmaker's value and judgment which may further reflect the cultural background where the mapmaker is coming from. Furthermore, Harley suggested that maps are the production of existing knowledge, and they produce knowledge of the world. That is, maps are not just a kind of objective representation of geographic reality out there, but can be the output of the society and power (Harley, 1989). This is also one of our motives for analyzing the Tan-Hsin Archives maps in this paper: we aim to reconstruct the society and where the maps were produced by examining the messages coded in the Tan-Hsin Archives maps.

To uncover the hidden stories of old maps, however, we need to scientifically measure the accuracy of maps. Many previous studies follow this track, yet most of them are concerned with map projection and coordinate grid. For instance, Waldo Tobler (1966) started with investigating the projection of Middle Age maps. He went further by using interpolations to identify the possible authors of maps based on the

assumption that mapmakers usually depict more details for areas familiar to them. After Tobler, more different methods are adopted to analyze map accuracy. Ravenhill and Gilg (1974) analyzed Benjamin Donn's 1765 map with the help of computer analysis. Hooke and Perry (1976) chose statistic indicators, such as areas, scales, and distances, to study the planimetric accuracy of Tithe maps. Locke and Wyckoff (1993) used statistics to estimate the accuracy of 30 maps about the Colorado-Green River system and explored the spatial and temporal results to demonstrate how map accuracy changed with time. Hu (2001) assessed the accuracy of The Map of Prefectural Capital of 1261 using geographic information system (GIS). He found that the relative position in the map was more accurate than the absolute position, which illustrated the inherited mapping concepts of ancient Chinese. From these researches, we see the gradual inclusion of GIS and computer mapping to analyze old maps. Owing to the development of digital mapping and analysis technology, tools for analyzing planimetric characteristics of maps are becoming much powerful and versatile. In this paper, we will use MapAnalyst to measure the accuracy of the Tan-Hsin Archives maps.

RESEARCH METHOD

MapAnalyst is an open software program aiming to analyze maps accuracy. Developed by Bernhard Jenny and Adrian Weber in 2005, this software can analyze and represent planimetric accuracy of maps. Most of all, it is equipped with visualization capability for measuring maps' distortion, rotation, displacement, and deformation. The indicators for visualizing map errors by MapAnalyst include distortion grids, displacement vectors and circles, and standard inaccuracy circles. When using MapAnalyst, we compare the old map with a reference map using the map overlay concept. The reference map should be correct in planimetric coordinates. After importing two maps to MapAnalyst, we need to select and register reference points respectively on two maps. The reference points link two maps in pairs. By comparing the positions of relevant points pair by pair, MapAnalyst calculate the errors of target maps and shows statistic values, such as the scale and direction. Based on these values, MapAnalyst can go further to generate the indicators mentioned above and visualize the errors of maps.

Distortion grids represent how the scale varies in different parts of a map. With a compressed grid, the scale is larger on the reference map than on the old map. On the contrary, with a dilated grid, the scale of the old map is incorrectly enlarged. The scale of the old map was incorrectly enlarged during its production. It is quite possible that a distortion grid of an old map contains both compressed and dilated areas. In that case, the old map could have a varying scale which implies the planimetric inaccuracy. In short, the compression and dilatation of a distortion grid indicate the uneven and inconsistent scale of an old map.

Displacement in MapAnalyst is presented in two different indicators: displacement vectors and displacement circles. The displacement vector indicates distance between a pair of reference points. The farther the distance is, the longer the vector will be. In addition, the direction of displacement vectors is meaningful. "Each vector line starts at a point in the analyzed map and ends at the position where the point would be if the analyzed map were as accurate as the modern reference map." (Jenny and Weber, 2010) The second displacement indicator is displacement circles. In fact, displacement circles and vectors have the same geometric meaning—the farther the distance between a pair of reference points is, the larger the circular area will be. It should be noted that the length of a displacement vector is not equal to the radius of a displacement circle. They are proportional but not equal. So, both vectors and circles indicate how far reference points are displaced. However, they lack the ability to illustrate the "local" accuracy of a map. To this end, we can use standard inaccuracy circles. Standard inaccuracy circles indicate the local accuracy of a map, which means that larger inaccuracy circles imply larger (higher degrees of) positional inaccuracy. "A [standard inaccuracy] circle's radius depends on the accuracy of the position relative to the neighboring points." (Jenny and Weber, 2010)

This study uses the Taiwan Bauto (Taiwan Village Maps) published in 1904 as reference maps to investigate the accuracy of maps in Tan-Hsin Archives. Taiwan Bauto is a set of topographic maps in 1/20,000 scale created by the Japanese authority using modern triangular survey. We use Taiwan Bauto as the reference map because it has the correct coordinate system and clear map symbols. This study analyzes two of Tan-Hsin Archives maps because the reference points in the maps can be easily defined. For example, Map 2 contains several cross-roads, so we can refer the crossing points as reference points. In Map 1, we selected 28 reference points; in Map 2, we selected 17 reference points. The number of reference point is selected according to the drawing style, the map content, as well as the visibility of map content.

DISCUSSION OF RESULTS

According to the result of MapAnalyst analysis, the direction of Map 1 is distorted 39 degrees counterclockwise (see Figure 1), which is apparently erroneous. Furthermore, as shown in Figure 1, we can see that the distortion grid is very irregular in the east side of maps, and relatively regular in the west side. By studying the topography of this map, we may find that the east side is mountainous while west side is rather flat. The complexity of terrain relief affects the planimetric accuracy of maps. This echoed the theory brought up by Harley (1989) that map-makers tend to enlarge and put more details on familiar areas while overlooking unfamiliar areas.

On Map 2 (see Figure 2), the distortion grid is pulled away in the central part, indicating a huge distortion. Compared with the three reference points on Figure 2 and Figure 3, which are encircled by the blue color, we may see clearly the difference between these two maps. In the reference map (Figure 3), the distances of three points are short, while on the old map, these three distances are pulled away. This indicates the old map is erroneously enlarged and the distortion grid is inflated.

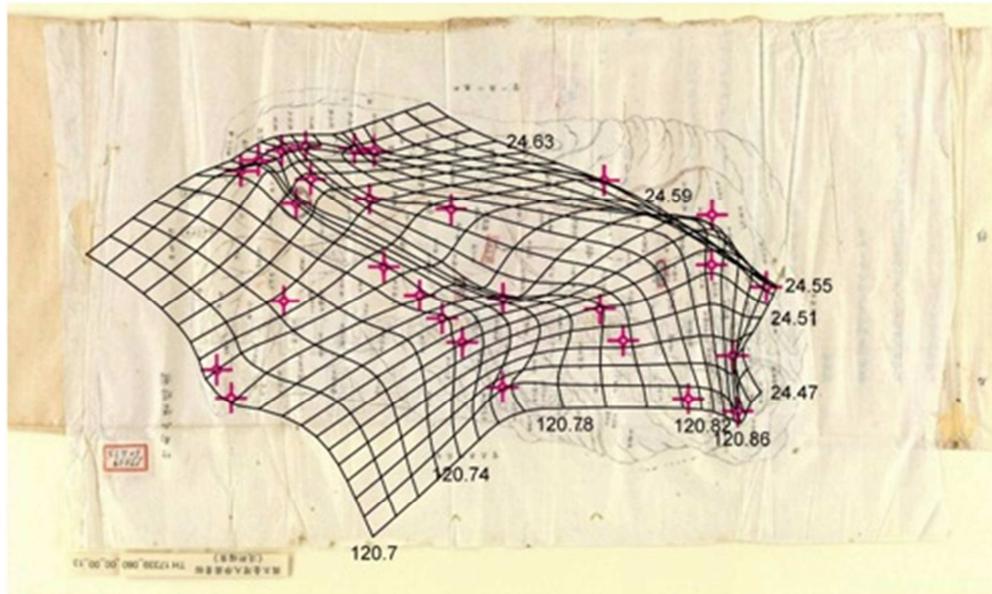


Figure 1. The distortion grid of map 1.

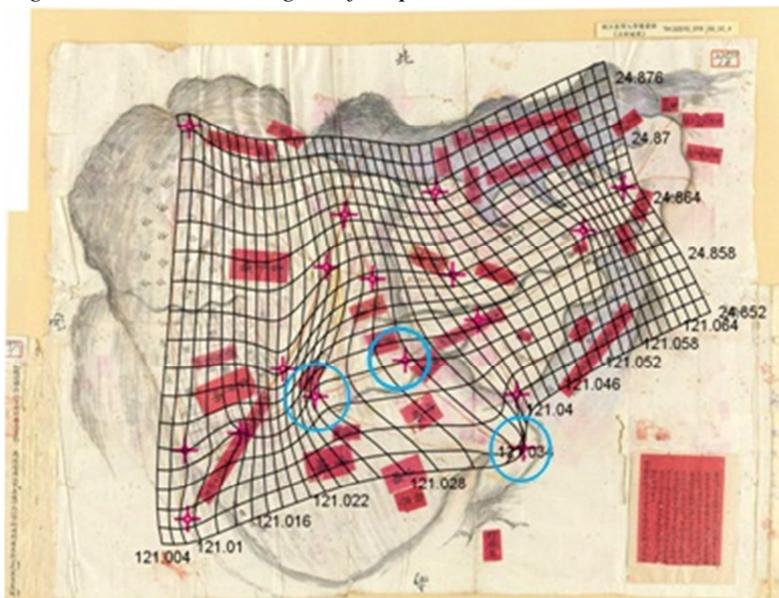


Figure 2. The distortion grid of map 2.

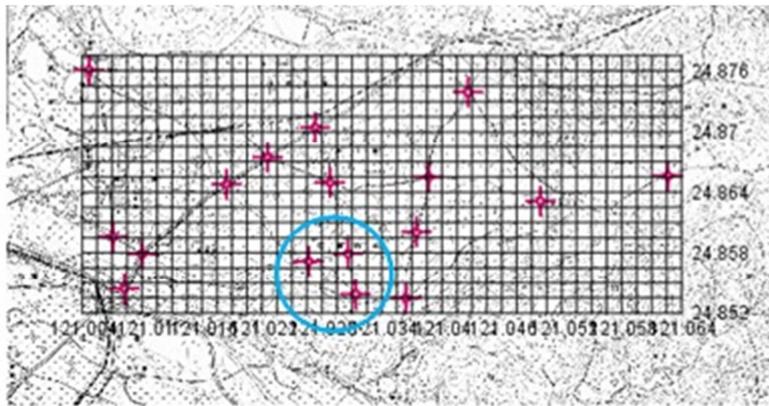


Figure 3. The reference map of Map 2.

CONCLUSION

Inspired by Harley's critical approach to study cartography, we look for the various features of maps stored in the Tan-Hsin Archives and choose two maps for further investigation. We use MapAnalyst to measure and analyze the planimetric accuracy of these two maps. Results of current study reveal that such planimetric accuracy varies on different part of the maps. In future study, we would like to investigate the association among map accuracy, the characteristics of area being mapped, the subject and the purpose of maps, and the various backgrounds of map-makers. By doing so, we hope to integrate the cultural and technical aspects of map-making together.

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