

Deconstructing Borders, Territories, and Toponyms: Cartographic Designs in the Politically Disputed Territory of Sakhalin

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In this research, we aim to deconstruct and quantify the cartographic designs of post-war maps of Sakhalin—a politically contested island claimed at points in history by Russia, China, and Japan. The goal of this research is to enhance understanding of how the design of borders, territorial fill colors, and toponyms (place names) are presented and used to advance territorial claims. We conducted a quantitative content analysis of 138 maps in four languages, identifying key cartographic designs, including border and fill-color symbol designs, and toponym types to identify when these designs were used to express certainty and uncertainty of control. We found that uncertainty regarding territorial claims was communicated through the design of borders and territorial fill colors and was more frequently adopted by Japanese mapmakers to express the neutrality of the contested region of Southern Sakhalin and question Russia's legitimate control. Toponyms, on the other hand, were used to communicate uncertainty through double labeling which appeared more in Chinese and Japanese maps to signify their historical presence and control of the island. This paper illustrates the ways cartographic design of border symbols, territorial fill colors, and toponyms serves to assert and facilitate political stances and claims of the contested territory of Sakhalin.

1. INTRODUCTION

MAPS HAVE LONG BEEN USED FOR A VARIETY OF PURPOSES in the political space, as maps have made political boundaries and state control legible (Scott 1999). Maps can also be a powerful means to explicitly or subtly convey a variety of biases. The biases in maps can be particularly prominent when representing politically contested regions. For example, since the Russian annexation of Crimea in 2014, several controversies have emerged concerning the ways maps have depicted the Russia-Ukraine war. Cartographers and web map providers have been accused of using Ukrainian-designated place names in Russian-controlled Crimea (Taylor 2016). Dataset providers, such as Natural Earth, have been criticized for placing the Crimean Peninsula in Russian territory (Nordmann 2023; asiryk-888 2023). Some publishers, such as *National Geographic*, have used dashed borderlines, city labels with multiple spellings, and annotations about territorial issues in dark red text near these disputed regions to accommodate more diverse interpretations. This illustrates how sensitive and complex depicting contested regions is, even

when the goal of the cartographer is to provide what they deem as an unbiased map or dataset.

In this research, our goal is to better understand the nuances of reference maps as a tool for building, reinforcing, and disseminating political narratives. We specifically focus on the case of Sakhalin, an island that has been the focus of both historical and ongoing geopolitical tensions among China, Japan, and Russia. These three countries have published maps in different scripts and with different cartographic designs meant to imply (or outright declare) political control, and to promote land claims, narratives, and territorial-legitimation arguments. Through an empirical content analysis of post-WWII maps of Sakhalin, we illustrate that the cartographic designs of borders, territories, and toponyms vary depending on the authorship of the map. Often these elements are used to delegitimize another party's political control or imply political claims. Sometimes these representations follow international treaty agreements, while others might be viewed as in conflict with those agreements.



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We use the name *Sakhalin* in this paper to describe the island which sits north of Hokkaido, Japan and east of the Russian mainland. The name *Sakhalin* is the most recognized name of this place, which is currently controlled by Russia and recognized as Russian by most countries in the world. In the following sections, we introduce other place names of this island and how these place names are depicted on maps. This research not only focuses on analyzing the specific cartographic designs of maps relevant to the Sakhalin issue; it also seeks to incorporate a discussion on how maps generally imply political stances in the face of broader political territorial contestations. Thus, we aim to answer two questions.

1.1 RESEARCH QUESTIONS

RQ1. How are cartographic design elements, including (a) border symbols, (b) territorial fill colors, and (c) toponym labels, used differently on

Chinese, English, Japanese, and Russian maps of post-WWII Sakhalin?

RQ2. In what ways do these elements imply political contestation or uncertainty of political control?

In the following sections, we begin with a literature review through which we examine the current literature and scholarship on maps and power relations; then we illustrate why Sakhalin is an important example to investigate, including the richness in both territorial claims and cartographic representations by China, Russia, and Japan. Subsequently, we illustrate how we conducted our research using quantitative content analysis. After describing the results of that analysis, we discuss further how this research illustrates the complex ways cartographic design reflects views of political territorial contestations, narratives, and stances behind the contestations.

2. LITERATURE REVIEW

2.1 CARTOGRAPHY AND POWER

STATE POWER MUST PROJECT A SENSE OF LEGITIMATE political control, which influences cartographic representations on maps. Critical cartography research has engaged with questions of how maps serve the goals of those in power (Crampton 2009) and the interests of nation-states (Branch 2013; Biggs 1999). Harley (1989) argues that all maps convey political, cultural, and social processes rather than merely being representational, and this is especially true for maps which protect the power of the state. Borrowing Derrida's power of *metaphor*, Harley deconstructs maps into a series of "cartographic texts" which shows the implicit meanings behind the seemingly neutral "truth" that they convey. By borrowing Foucault's *governmentality* and other discourses of power, Harley also indicates that the process of map making, publishing, and distribution is shaped by and embedded in the larger power of the state. Monmonier's (1996) *How to Lie with Maps* also discusses the ideological manipulations of a wide variety of maps. He explores maps of all kinds, but especially political propaganda maps and disinformation maps. He notes that even minor aspects of map design, such as the color-fill of one arrow, the arrangement of a border design, or the spelling of a place name, carry certain political meanings that could trigger anger in one group and advocacy in

another. Fish and Kreitzberg (2023) illustrate that some government and media entities selectively promote maps to convey particular ideas and provide legitimacy to their claims. And finally, Muehlenhaus's work on cartographic manipulations expands on Monmonier's as well as Tyner's (1982) work on persuasion by providing a quantitative and systematic analysis of persuasive cartographic design (Muehlenhaus 2012, 2013, 2014). Muehlenhaus (2012) shows that a reader's perspectives and emotions are dependent on design decisions, signifying a direct relationship between users' emotions and cartographic design.

2.2 TOPONYMS AND POWER

The nature of place naming and place names is also inherently political. Critical place name studies, also called critical toponymy, has emerged to reveal the connections between place naming and power (Berg and Vuolteenaho 2009; Rose-Redwood 2011). Giraut and Houssay-Holzschuch (2016), using Foucauldian governmentality as a frame, discuss how place naming can enhance government control in a society. They examine how geopolitical contexts, actors, and technologies interact and influence the establishment and modification of specific toponyms.

There are two primary categories of toponyms: exonyms and endonyms. Endonyms are the place names used by local people, while exonyms refer to place names used by people outside of that place. An exonym thus does not include any transliterations of a local endonym. For example, Danzig is a German exonym used to describe the Polish city that locals refer to by the endonym Gdańsk. The forms and spellings of place names are typically embedded materialistically or ideologically by the state government, as the government handles relationships with minority interests within its territories (Riordan 2016; Socquet-Juglard 2022). For example, Rundstrom (1993) investigates how an Arizona county-level government forced Hopi place names to be transliterated into the Latin script, representing a textual erasure of indigenous landscapes. Similarly, place names can also be used in international relations and diplomacy to advance certain state-centered arguments. For instance, contestations of place names are apparent in waterbodies (Choo 2012; Kadmon 2004) or in East Asian island names between China, Korea, and Japan (Medzini 2017; Koo 2010; Dzurek 1996). Many modern publications (e.g., *The Times* and *National Geographic*) and datasets (e.g., Natural Earth Data and OpenStreetMap) are now attempting to include multiple spellings, including exonyms and endonyms, to account for the complexity of place names.

2.3 MAPPING BORDER AND TERRITORIES

Maps represent most spatial data, including borders and territories, using what we often refer to as the *visual variables* (Roth 2017). First described by Bertin in *Sémiologie Graphique* (1967), these are ways of altering graphical elements to achieve differentiated visual designs that can communicate visual information. For example, altering the width of a line, or its color, can convey information to the reader. These variables are widely discussed in cartography as the building blocks of visualizing spatial data.

Across political geography and cartography there are many examples of how borders and territories come to be represented with the visual variables. Boria (2015) identifies how the modern conventions of showing borders with either discrete or continuous lines correlate to the institutionalization of the modern state system, and van Houtum (2012) emphasizes how the current cartographic notion of borders, which are often shown with solid lines, is stagnant and does not reflect their porous nature. Van

Houtum (2012, 412) argues that “drawing fixed lines on a map as a representation of borders does not help us to understand and describe the complexity and multidimensionality of borders and migration” and these are “drawing table politics.”

Critical human geographers, including feminist geographers, also point out that borders are embodied through psychological, gendered, and localized experiences (Hillier 2014; Jackman et al. 2020; Smith et al. 2016). In the case of Syria during its recent civil war, Kelly (2019) found that the experience of individuals in Syria conflicted with how borders are often depicted on maps, especially for fleeing refugees. Through exploring personal drawings of refugees, Kelly reimagines the Syrian border by depicting it with a variety of line styles, each one trying to capture the nuance of individual embodied experiences. These drawings too are built from the visual variables originally described by Bertin (1967), mostly by varying the thickness and pattern of boundary lines. Finally, Van-Essen (2019) argues that digital map technologies, such as Google Street View and virtual reality, empower users to view borders in a three-dimensional space by allowing users to view how high a border fence or wall is and how that appears on the ground. Van-Essen contrasts this with how borders are traditionally drawn on maps as two-dimensional lines.

Geographers and cartographers have also considered the influence of the use of polygons to represent political-territorial powers. Biggs (1999) notes that the development of modern cartography reflects political authority based on the concept of sovereign states with exclusive territories, by depicting those territories using filled polygons with discrete borders. Applying discrete colors to state polygons is now widely practiced by cartographers for political mapping. However, recent research advocates for anti-colonialist and anti-state ways of representing territories that do not rely on the use of these colored country polygons (Oslender 2021). For instance, there are many alternative ways of mapping practiced by indigenous communities, which emphasize local societies, women’s bodies, and local land relations, instead of state-based political structures. Some examples include applying perspectivism to connect human and extra-human actors into indigenous senses of territories (Norton-Smith 2010; Uzendoski 2012), illustrating the manifestations of power along the riverscape in everyday politics (Zaragocin 2019) and combining GIS technologies to visualize the delineation of Hawaiian

traditional territories via natural landscapes (Pearce and Louis 2008).

2.4 MAPPING UNCERTAINTY

An uncertainty or dispute over state control can be visualized in the representation of borders and territories on maps. While cartographers can clearly demarcate states and other political areas through border lines and colored polygons, at the same time, the cartographer can represent uncertainty through the design of those same elements in the map, making room for varied interpretations of political control. MacEachren (1992) synthesizes the concept of uncertainty in the field of cartography and proposes to expand the list of traditional visual variables by adding new ones that can be used to present uncertain information. Specifically, MacEachren proposes *contour crispness*, *fill clarity*, *fog*, and *resolution* as techniques to visualize uncertainty. Since then, researchers in cartography have investigated other ways of expressing uncertainty in map design (Aerts et al. 2003; MacEachren et al. 2005; Retchless and Brewer 2016). For example, MacEachren et al. (1998) and MacEachren et al. (2005) assess and review the use

of color value and saturation for this purpose. Retchless and Brewer (2016) focus on best practices for combining the visual variables to represent uncertainty. Reuschel and Hurni (2011) implement fuzzy and gradient visual effects on points, lines, and polygons in their interdisciplinary project “A Literary Atlas of Europe.” Griffin (2020) calls for more research on the correlation between trustworthiness and the representation of uncertainty in cartographic design, and Prestby (2025) directly connects uncertainty with trust in maps, which serves as a central argument to signal how the cartographic design of uncertainty is vital to the persuasiveness of cartographic representation.

In general, previous studies suggest that political ideologies and agendas influence cartographic representations of borders and territories. Uses of particular visual variables in cartographic designs also affect how map users interpret borders and territories. Our research integrates across these subdomains by interrogating maps as a politically contested medium where borders, territories, and place naming are dynamically manipulated through these cartographic designs. The next section outlines a brief history of Sakhalin to provide more context to our case study.

3. BACKGROUND

THERE ARE MANY POLITICALLY CONTESTED AREAS IN the world, and every disputed area has its own geopolitical story. We chose Sakhalin as a case to analyze because this geopolitical conflict involves three non-Western states with drastically different cultures and languages often overlooked by Western literature: China, Japan, and Russia. Sakhalin is an island north of the Japanese islands and east of the Eurasian continent. It is separated from the northernmost part of Japan, the island of Hokkaido, by La Pérouse Strait (also known as the Sōya Strait) and from the Eurasian continent by the Strait of Tartary (or, Tatar Strait; Figure 1).

Due to Sakhalin’s location and proximity to Russia, China, and Japan, each one of these geopolitical powers has played a part in the history of the region. The Sakhalin Ainu people and Tungusic people are considered indigenous to the southern part of the island, and they maintained sovereign control of this portion of the island until the nineteenth century. Around the early fifteenth century, Chinese empires incorporated the northern part of the island into the Chinese tribute system. Later, in the

nineteenth century, Russia and Japan began expanding their territories and had overlapping interests in Sakhalin. In 1875, the Treaty of Saint Petersburg was signed between Russia and Japan, affirming Russian sovereignty over the whole island. However, in 1905, Russia lost the Russo-Japanese War and ceded the southern half of Sakhalin to Japan. As a result, the Japanese government established Karafuto Prefecture as the southern portion of Sakhalin. The northern part of the island continued to be controlled by Russia.

Near the end of WWII in 1945, Soviet troops entered Southern Sakhalin without facing much resistance, and brought all of Sakhalin under Soviet control. In 1951, the Treaty of San Francisco was signed by the Allies and Japan, and is regarded as the end of the war’s Pacific theater. In the treaty, the Japanese government officially abandoned claims to the southern portion of Sakhalin; however, they did not acknowledge Soviet legitimacy over that portion. Thus, since 1951, Japan has viewed Southern Sakhalin as a politically disputed territory.

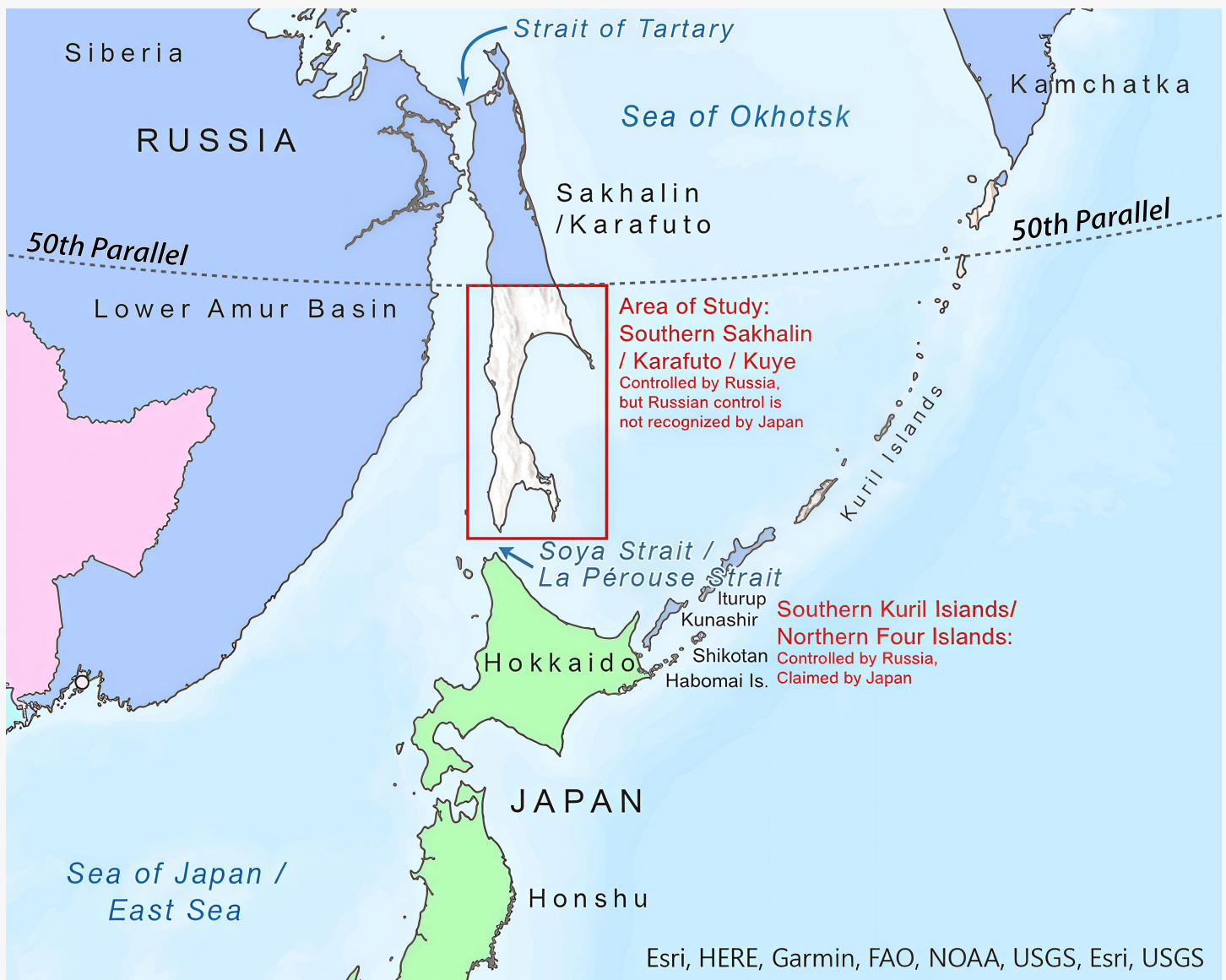


Figure 1. A map of Sakhalin and the surrounding areas (map created by the authors).

As a condition of the Soviet-Japanese Joint Declaration of 1956, the Japanese government prepared to recognize Soviet control over Southern Sakhalin, but a lack of follow-up negotiations meant that this recognition was gradually abandoned due to the intensifying Cold War in the 1970s (Williams 2006). In 1969, the Japanese Ministry of Education, Culture, Sports, Science, and Technology (shortened as the Ministry of Education), which reviews and ratifies maps in Japanese educational materials, issued an official notice regarding the cartographic treatment of Southern Sakhalin. This notice has been enforced since 1971 (Teikoku Shoin 2024). In the notice, cartographers were directed to show a border at the 50th parallel and Sōya / La Pérouse Strait, and use a white fill-color to represent the southern portion of the island.

The 1990s witnessed a softening of the territorial conflict. The Russian Federation was seeking support from the broader global economy, including Japan, to access global markets, and thus the Russian government negotiated with Japan over Sakhalin. In 2001, the Japanese government opened a new consulate in Yuzhno-Sakhalinsk, the capital of the southern portion of Sakhalin Oblast, a friendly gesture towards recognizing Russia's sovereignty over Southern Sakhalin; however, this did not last long. The inauguration of Vladimir Putin in 2000 in Russia and the election of Junichiro Koizumi in Japan in 2001 reshaped the foreign policies of each country to align them with strong nationalist movements (Kapur 2012). As a result, Japan continues to denounce Russian claims over Southern Sakhalin (All Japan Federation of Karafuto 2024).

4. METHODOLOGY

IN THIS STUDY, WE CONDUCTED A QUANTITATIVE content analysis of post-WWII maps of Sakhalin, in which we evaluated border designs, fill colors, and toponyms across four different cultural-linguistic groups. As used in cartography, quantitative content analysis relies on researchers collecting a large number of maps, creating a set of codes, applying those codes to the maps, and analyzing the subsequent collection of codes to derive conclusions (Muehlenhaus 2012). This method has been increasingly used to understand cartographic design in a wide variety of cases (e.g., Fish 2020; McGurk and Caquard 2020).

4.1 SAMPLE COLLECTION

In this study, we collected 200 maps of Sakhalin from the internet using three different search engines across four different cultural-linguistic groups: Chinese, English, Japanese, and Russian (Table 1). China, Japan, and Russia have all, at various points in history, controlled the whole or parts of Sakhalin. English was included to serve as a reference group. Google is the most popular search engine among English and Japanese speakers (Yamada 2024). Baidu is the most used search engine in China, and Yandex is likewise in Russia (Li 2022; Kravets et al. 2024). All these search-engine platforms have image search functionalities, which is how we identified maps to be included in our analysis.

We translated the term “*Sakhalin map*” into each language to use as our search query. Here, we used “*Sakhalin*” instead of *Karafuto* (the Japanese exonym) or *Kuye* (the Chinese exonym), because Sakhalin is the current endonym—the name that is currently used most in both local contexts and international relations, and Table 1 presents the transliterated forms of this endonym in three languages.

	Chinese	English	Japanese	Russian
Search Engine	Baidu	Google	Google	Yandex
Search Query	萨哈林岛地图	Sakhalin map	サハリン地図	Сахалин карта

Table 1. Image search engines & corresponding keywords for map querying.

Each of the four searches yielded hundreds of image results. Our goal was to collect the top 50 images for each cultural-linguistic group. To be included in our selection, the image needed to be a map, and needed to include the entirety of Sakhalin, both north and south. If a subsequent map in the search results had high visual similarities with a previous map, we did not collect the subsequent map.

We collected the maps in the sequenced order of how the images were ordered in the search engine results from top-left to bottom-right. For instance, the first image to appear in the upper-left corner of the browser webpage was our first image, and we continued until we reached and collected the fiftieth image that fit the criteria. The reason for collecting the images in this order was that image search engines typically place the most relevant images to the queried words at the top of the results, thus our collection methodology was designed to identify the most relevant maps for the criteria (Graph and Ramesh 2019; Jing and Baluja 2008; Wang et al. 2014; Tian et al. 2015). We stopped adding maps to our collection once we had 50 maps in each cultural-linguistic group that fit the criteria, for a total of 200 maps across the four groups. We were able to find only 50 unique Russian maps, and so this defined the number that we collected for each group, in order to remain consistent.

Once we had our 200 maps, we filtered out maps that depicted Sakhalin before 1945, the end of World War II. To do this, we relied on contextual information included on each map, and/or an assessment of the representation of surrounding territories to decipher the specific time featured in each map. This resulted in a total of 138 post-1945 maps for analysis, including 25 Chinese maps, 32 English maps, 35 Japanese maps, and 46 Russian maps. We saved these 138 maps to a shared server drive and documented each map image in a separate spreadsheet, where we coded each map according to the coding scheme.

4.2 CODING SCHEME

Content analysis relies on creating a set of codes related to a project’s research questions, in order to analyze the content (Krippendorff 2018). Our codes for these maps of Sakhalin were divided into four groups: *Metadata*, *Borders*, *Territorial Fill Color*, and *Toponym* (see the Appendix).

4.2.1 Metadata Codes

The *Metadata* codes were designed to keep track of the following information: (1) the cultural-linguistic group (**Group Name**), (2) a unique identifier for each map in the collection (**ID**), and (3) how we found the maps (**Keyword**).

4.2.2 Border Codes

The next set of codes were the *Border* codes. These included three major Boolean codes to identify and classify maps that included borders at three locations of interest (**Strait of Tartary** code, **Sōya / La Pérouse Strait** code, and the **50th parallel** code).

The **Border Arrangement** code was used to code the visual variable of *arrangement*, such as dashed or dotted lines versus solid lines. The goal of this code was to classify whether a map used solid lines, implying a defined/definitive border, versus dashed or dotted lines that imply less definitive, potentially uncertain, porous, or dynamic borders (Drecki 2007; Kelly 2019). A value of *0* was applied if the border(s) was a solid line. A value of *1* was applied if the border(s) used a dashed line, dotted line, or any other pattern. There were not any maps with a mixture of solid and dashed lines in our dataset.

4.2.3 Territorial Fill-Color Code

The *Territorial Fill Color* group included just one code, with six possible options to categorize how territories were colored on the maps (and thus how they implied territorial control). Maps with fill colors not directly related to political entities were coded as *0*. These included maps that used random colors, thematic variable colors, or terrain shading. The codes of *C*, *R*, and *J* were used if the fill color of Sakhalin aligned with the fill colors of China, Russia, or Japan, respectively. The code *RJ* was used when two fill colors were used to divide Sakhalin at the 50th parallel, with the fill color of Northern Sakhalin aligning with Russia and Southern Sakhalin aligning with Japan. The code *RW* was used when the fill colors divided Sakhalin at the 50th parallel, and the fill color of Northern Sakhalin corresponded with Russia while Southern Sakhalin was filled in white, suggesting that it was not controlled by either Japan or Russia.

4.2.4 Toponym Codes

We created five codes related to the use of toponyms on the maps to ascertain how they represented political control. There were three major codes (**Chinese**, **Japanese**, **Russian**), corresponding to the origin of the toponym used for the island itself. The script used on the map is irrelevant to the origin of the toponym. For example, Sakhalin can be transliterated into 萨哈林 (Sa-ha-lin) in the Chinese script, but it is still a Russian-originated name that is simply “spelled” in Chinese. In this case, it would be coded as a Russian toponym. We coded a *0* if there was no toponym that originated in the corresponding language, *N* when the corresponding toponym was used only on Northern Sakhalin, *S* when it was used on Southern Sakhalin, and *NS* when it was used for the whole of Sakhalin.

The **Toponym Numbers** code was used to classify whether maps featured both exonyms *and* endonyms (*1*) versus maps that only used one or the other (*0*). The scenario of multiple toponyms for one feature is also called double labeling. Cartographers can imply uncertainty about control when both are used at the same time.

Finally, the **Toponym Differences** sub-code was only used if the **Toponym Numbers** code was a *1*. The goal of this code was to identify when each of the double labels had the same design (size, font, and other typographic variations; coded with a *1*) versus when they did not (coded with a *0*). Uncertainty can be implied when label designs are identical for both toponyms, whereas if the two labels have different styles, the difference in styles might be used to emphasize one name over the other.

4.3 ANALYSIS

Once all the maps were collected, we coded each one according to the coding scheme. We analyzed the coded dataset to first identify similarities and differences across the four cultural-linguistic contexts (RQ1) and further explored the ways in which these designs implied political contestations or uncertainty of control using the results from the first research question (RQ2).

4.3.1 Cartographic Designs Analysis (RQ1)

To answer RQ1, we used descriptive statistics to identify similarities and differences across the four different cultural-linguistic groups, by summarizing the frequencies

of both the major code and sub-code values for all the maps in each cultural-linguistic group (Chinese, English, Japanese, or Russian).

We defined maps as “pro-Russian,” meant to indicate Russia’s control of all of Sakhalin, when they contained each of the following: (1) only *one* border at the Sōya / La Pérouse Strait and no other international borders shown at either the Strait of Tartary or the 50th parallel, (2) one fill color for all of Sakhalin matching the rest of Russia, and (3) Russian-originated place names, with no exonyms.

We defined “pro-Japanese” maps as those which followed the 1971 notice by the Ministry of Education of Japan (Teikoku Shoin 2024). Thus they needed to include each of the following: (1) international borders at the Sōya / La Pérouse Strait *and* at the 50th parallel on Sakhalin Island, (2) a white fill color used for Southern Sakhalin to indicate this area is neither controlled by Japan nor Russia, and (3) double labeling with Russian *and* Japanese names on Southern Sakhalin. While the 1971 notice does not prescribe toponyms, we determined that labeling with both Russian- and Japanese-originated toponyms implies contested control or neutral control by not favoring any side, which appears to align with the 1971 notice.

As we expected, there were maps that did not easily fit into the pro-Russian or pro-Japanese groupings, and we describe those maps in Section 5.1 of our results and throughout the discussion in Section 6.

4.3.2 Uncertainty of Political Control Analysis (RQ2)

Conflicts over politically contested territories are often dynamic and fluid. To represent this fluidity, sometimes

cartographers design their maps to imply uncertainty through the use of the visual variables (MacEachren 1992; Monmonier 2006; Retchless and Brewer 2016). Four codes from our scheme were intended to describe uncertainty in political reference maps: **Border Arrangement**, **Territorial Fill Color**, **Toponym Numbers**, and **Toponym Differences**. We recognized that other cartographic design choices can imply uncertainty, but these four attributes covered a wide range of the designs we saw and were easily measurable.

The **Border Arrangement** code was designed to identify the maps with solid vs. those with dotted or dashed lines. Dashed lines are often used to illustrate uncertain, porous, and dynamic geographic information (Drecki 2007; Kelly 2019). The **Territorial Fill Color** code served many purposes, and for this portion of the analysis we focused on maps using white for the southern portion of the island, suggesting that this area is neither controlled by Japan nor Russia. The **Toponym Numbers** code was used to identify maps with both exonyms and endonyms. Cartographers can imply uncertainty about control when both are used at the same time. Finally, the **Toponym Differences** code was designed to identify differences in the design of the two different labels used in double-labeling situations. Uncertainty is implied when label designs are identical for both toponyms, because the same design leads to the perception of the same graphical importance.

Similar to the methods used to answer RQ1, we calculated the frequency of these values in maps of post-war Sakhalin and associated them with cultural-linguistic groups to characterize how maps from various countries imply uncertainty through visual design.

5. RESULTS

5.1 OVERVIEW OF MAPS DEPICTING POST-WAR SAKHALIN

OUR CODES, SEEN IN TABLE 2, ALLOWED US TO ANALYZE these 138 maps to better understand how Russian and Japanese territorial views of Sakhalin are represented in maps.

Across the four cultural-linguistic groups, there were distinct overall patterns. First, compared to the Russian and English maps, the Chinese (10/25, 40%) and Japanese

(16/35, 46%) maps included more border lines at the locations of interest. However, none of the Chinese maps featured borders at the 50th parallel, whereas the 50th parallel was used in 81% of the Japanese maps (13/16).

Fewer maps included distinctive territorial fill colors than those which used distinctive border designs, with a frequency that varied significantly between the groups.

Chinese maps were the most likely to apply fill colors (10/25, 40%) whereas only 2 out of 46 (4%) Russian maps used color-coded polygons, with the English and Japanese maps using fill colors in 8 (25%) and 4 (11%) of their maps respectively.

Labeling Sakhalin was more common than using borders or fill colors in all groups. It was most common for Chinese maps to label the island (20/25, 80%), but least common in English maps (13/32, 41%). Japanese and Russian maps each labeled the island 60% of the time.

5.1.1 Representing Russian *de facto* control of all of Sakhalin.

Russia has controlled all of Sakhalin since 1945, the end of WWII. This control is recognized by most countries in the world and the United Nations. In Table 3, we summarize the results of the content analysis to illustrate maps that align with the definition of “pro-Russian” we provided in Section 4.3.1.

All the Chinese and Russian maps placed a border at the Sōya / La Pérouse Strait between Japan’s Hokkaido and Sakhalin, supporting Russia’s control of the entire island. Similarly, while all the English maps included a border at Sōya / La Pérouse Strait, one of those maps also depicted a border at the 50th parallel. Finally, a few Japanese maps (19%, 3/16) fully acknowledged Russia’s control by having only one border placed at the Sōya / La Pérouse Strait.

Code	Chinese	English	Japanese	Russian
Total Number of Maps	25	32	35	46
Borders at locations of interest (Sōya / La Pérouse Strait & 50th parallel)	40% (10/25)	9% (3/32)	46% (16/35)	4% (2/46)
Border @ 50th parallel	0% (0/10)	33% (1/3)	81% (13/16)	0% (0/2)
Border @ Strait of Tartary	0% (0/10)	0% (0/3)	0% (0/16)	0% (0/2)
Border @ Sōya / La Pérouse Strait	100% (10/10)	100% (3/3)	63% (10/16)	100% (2/2)
Dashed Border	40% (4/10)	33% (1/3)	75% (12/16)	50% (1/2)
Fill colors are used to represent political control	40% (10/25)	25% (8/32)	11% (4/35)	4% (2/46)
Fill Color = China	0% (0/10)	0% (0/8)	0% (0/4)	0% (0/2)
Fill Color = Japan	0% (0/10)	0% (0/8)	0% (0/4)	0% (0/2)
Fill Color = Russia	100% (10/10)	100% (8/8)	25% (1/4)	100% (2/2)
Fill Color = Russia/Japan	0% (0/10)	0% (0/8)	0% (0/4)	0% (0/2)
Fill Color = Russia/White	0% (0/10)	0% (0/8)	75% (3/4)	0% (0/2)
Sakhalin is Labeled	80% (20/25)	41% (13/32)	60% (21/35)	61% (28/46)
Chinese Toponyms	75% (15/20)	0% (0/13)	0% (0/21)	0% (0/28)
Japanese Toponyms	0% (0/20)	0% (0/13)	57% (12/21)	0% (0/28)
Russian Toponyms	65% (13/20)	100% (13/13)	100% (21/21)	100% (28/28)
Toponym for Southern Sakhalin is an exonym	40% (8/20)	0% (0/13)	33% (7/21)	0% (0/28)
Multiple Toponyms used	40% (8/20)	0% (0/13)	57% (12/21)	0% (0/28)
Multiple Toponyms in same design	50% (4/8)	N/A (0/0)	0% (0/12)	0% (0/28)

Table 2. Coding results of post-war maps. Bolded codes are major codes.

Of the maps with distinctive fill colors (24/138), 21 of them (all except for three Japanese maps) illustrate Sakhalin with a fill color aligning with the rest of Russia. Finally, the use of toponyms varied across different groups. All the English and Russian maps used Russian place names. However, only 43% (9/21) of Japanese maps and 25% (5/20) of Chinese maps used *only* Russian place names.

Unsurprisingly, all the Russian maps represented Russian control as undisputed, through the use of borders, territorial fill colors, and toponyms. Similarly, almost all English post-war maps showed the same, with only one exception (Figure 2).

Group Name	Pro-Japanese Borders	Pro-Japanese Fill Colors	Pro-Japanese Toponyms
Chinese	0% (0/10)	0% (0/10)	0% (0/20)
English	33% (1/3)	0% (0/8)	0% (0/13)
Japanese	44% (7/16)	75% (3/4)	57% (12/21)
Russian	0% (0/2)	0% (0/2)	0% (0/28)
Total	25.8% (8/31)	12.5% (3/24)	14.6% (12/82)

Table 3. Content analysis results for how the maps illustrated a pro-Russian view across cultural-linguistic groups. This table only includes maps with borders, fill colors, or toponyms.



Figure 2. The only English-language map—produced by the [Geospatial Information Authority of Japan](#) (GSI)—with borders in accord with the 1971 notice from the Japanese Ministry of Education.

However, the Japanese and Chinese maps show something a bit different. For instance, while not very surprising, the Japanese maps were the least likely to have elements that represent Russian territorial control. Perhaps what is more surprising is that despite the 1971 notice from the Ministry of Education of Japan (Tekoku Shoin 2024) and the general understanding that the Japanese government does not accept Russia’s control of Southern Sakhalin, close to one-quarter of the Japanese maps actually did represent Russia’s full control of the island by rendering pro-Russian borders (19%) and/or territorial fill colors (25%). Finally, the Chinese maps acknowledged Russia’s administration of Sakhalin using border placements and fill colors, but instead of the Russian-originated toponym, they often used the Chinese-originated toponym or a combination of both. This use of toponyms could suggest that Chinese-originated mapmakers disagree with Russia’s total control over the entire island, or it could simply be an indication of trying to make maps as accessible as possible to potential audiences in China.

5.1.2 Representing the Japanese Political Stance

While Russia has controlled the whole of Sakhalin since 1945, Japan only officially renounced its claim on southern Sakhalin in 1951 in accord with the Treaty of San Francisco; however, the Japanese government has never acknowledged Russia’s control of Southern Sakhalin. In this section, we discuss the results of the content analysis of the maps with designs that support Japan’s political stance (Table 4).

Group Name	Pro-Russian Borders	Pro-Russian Fill Colors	Pro-Russian Toponyms
Chinese	100% (10/10)	100% (10/10)	25% (5/20)
English	67% (2/3)	100% (8/8)	100% (13/13)
Japanese	19% (3/16)	25% (1/4)	43% (9/21)
Russian	100% (2/2)	100% (2/2)	100% (28/28)
Total	55% (17/31)	88% (21/24)	67% (55/82)

Table 4. Content analysis results for how the maps illustrated a pro-Japanese view across cultural-linguistic groups. This table only includes maps with borders, fill colors, or toponyms.

Despite the 1971 notice by the Ministry of Education specifying the cartographic drawing of Southern Sakhalin, surprisingly only 44% of Japanese maps included borders at both the 50th Parallel and Sōya / La Pérouse Strait to separate Southern Sakhalin from the rest of Russia (Figure 3). None of the Chinese and Russian maps featured borders at these locations.

In terms of fill color usage, most of the Japanese maps (75%) followed the 1971 notice and used white for

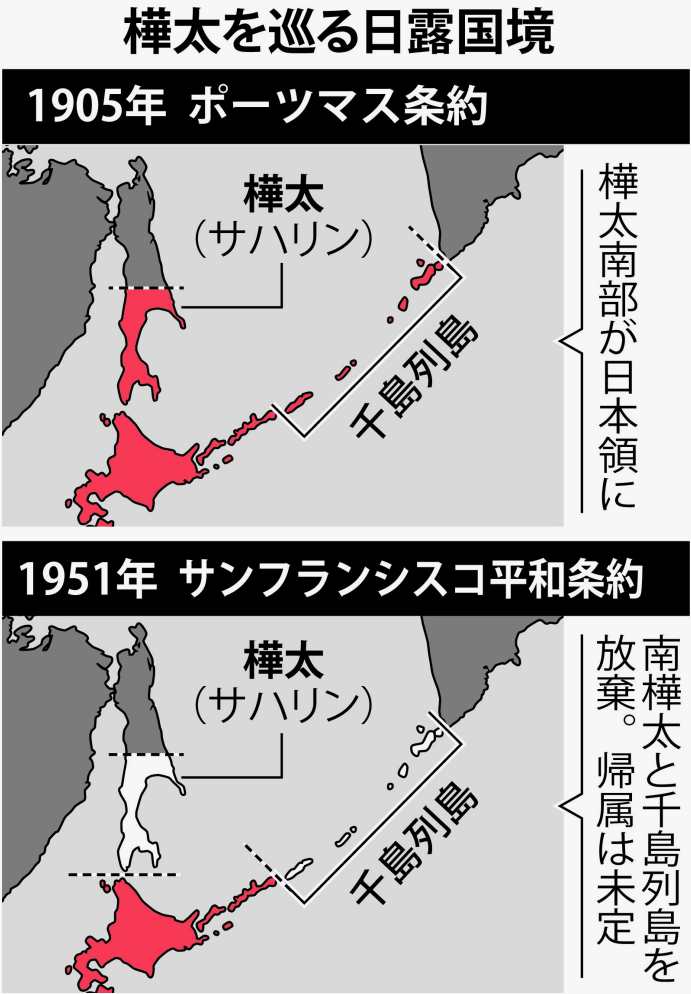


Figure 3. A Japanese map of Sakhalin and surroundings titled “The Japanese-Russian border surrounding Karafuto.” The top portion of the map showcases Sakhalin between 1905 and 1945 following the signing of the Treaty of Portsmouth, when, according to a translation of the accompanying text, “the southern part of the island became Japanese territory.” The bottom portion illustrates the island after 1951 following the signing of the Treaty of San Francisco, with a description stating that the “Southern Karafuto and Kuril Islands are ceded. The territorial status remains undetermined.” All cartographic designs of borders and fill color on the bottom map comply with the 1971 notice. The Russian name *Сахалин* (Sa-ha-ri-n) is labeled in parentheses under the Japanese name *樺太* (Karafuto). Image retrieved from the [Sankei Shimbun](#).

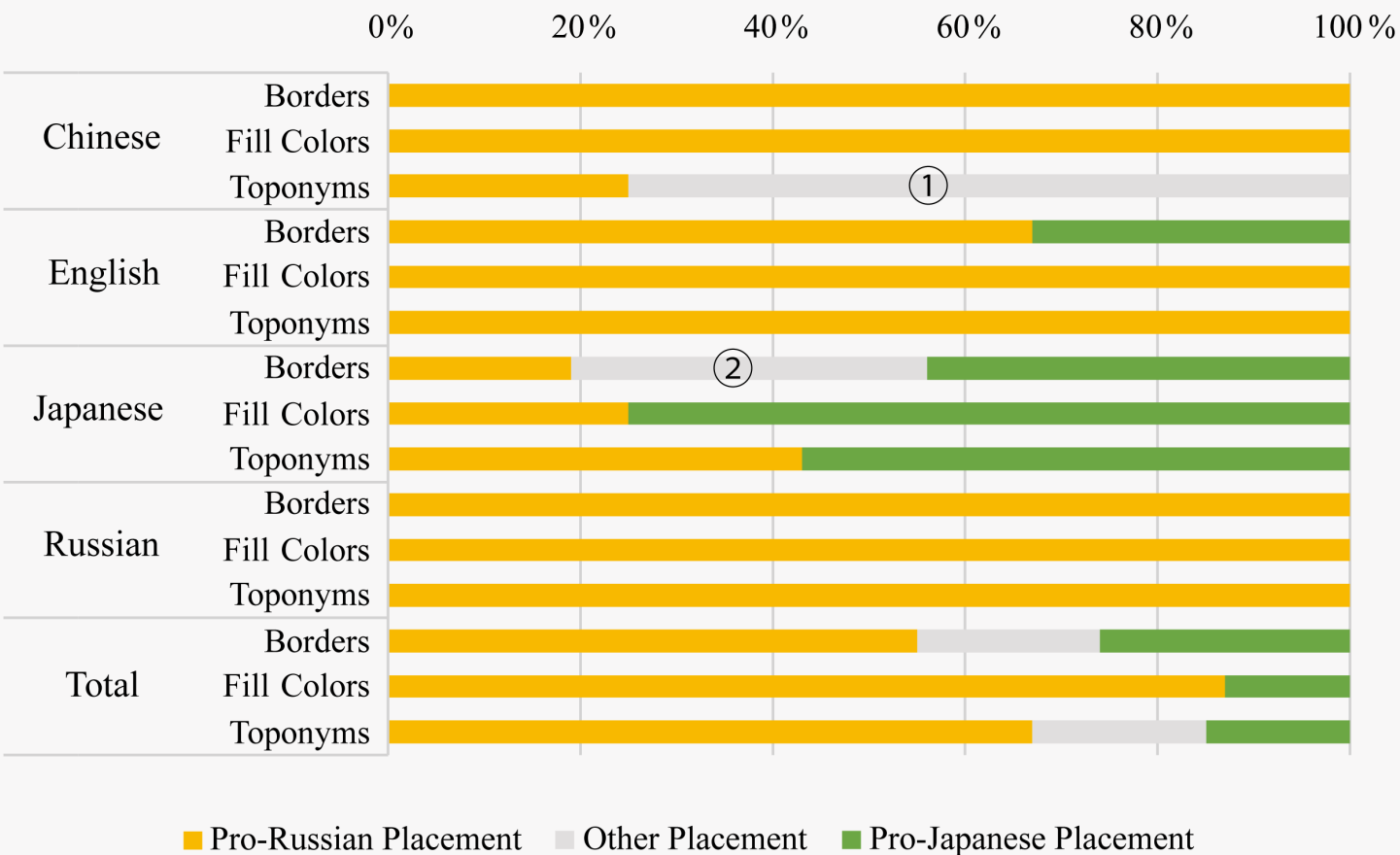
Southern Sakhalin, indicating a lack of clarity of control over the southern portion of the island. The Japanese maps were unique compared to the other cultural-linguistic groups, which did not use this fill-color design.

Finally, none of the Chinese, English, and Russian map-makers labeled Southern Sakhalin with both Japanese and Russian place names. Only 57% of Japanese maps used both Japanese *and* Russian-originated toponyms.

Figure 4 illustrates how the maps within each cultural-linguistic group apply borders, fill colors, and toponyms to represent either pro-Russian or pro-Japanese political stances. Compared to maps illustrating Russian control of Sakhalin, far fewer maps followed the specification from

the Japanese 1971 notice to illustrate neutrality. Most of the maps that did follow the notice were Japanese except for one English-language map published by a Japanese state institution (Figure 2).

Interestingly, unlike all the Russian maps illustrating Russia’s full control over Sakhalin (Figure 5), not every Japanese map illustrated the Japanese government’s stances. These maps could be divided into two categories. The first category of Japanese maps adopted designs that recognize Russia’s control of all of Sakhalin by placing the only border on the Sōya / La Pérouse Strait, using Russia’s territorial fill color, and/or labeling with the Russian-originated toponym. The second category of Japanese maps did not represent Russia’s administration of the island but



- ① Chinese maps also labeled Chinese toponyms or a combination of Chinese and Russian toponyms for Sakhalin.
- ② Japanese maps also placed only one delineation on the 50th parallel without featuring the second one on the Sōya / La Pérouse Strait.

Figure 4. Content analysis results, illustrating how the placement of borders, territorial fill colors, and toponyms were each used.

also did not fully align with the border specifications in the notice, with some of them only featuring the border at the 50th parallel but not the Sōya / La Pérouse Strait.

5.2 Maps designed to depict uncertainty in post-war Sakhalin

According to our methodology in Section 4.3.2, we proposed using four of our sub-codes to measure the representation of uncertainty in the 138 reference maps (Table 5). In this section we describe the results of the maps that use what we call “uncertain designs,” cartographic representations that imply uncertainty of political control.

Across the four cultural-linguistic groups, we found that uncertain designs were more common in the Japanese maps (72.5%). Specifically, 75% (12/16) of the Japanese maps used dashed or dotted borders, and 75% used a white fill-color for Southern Sakhalin. Only one map had dashed or dotted borders in the Russian and English groups each, and the sample size for these two groups was very small.

However, in terms of toponyms, uncertain designs were more common across Japanese (83%, 10/12) and Chinese (50%, 4/8) maps. In fact, only the Chinese and Japanese maps adopted multiple labeling. The Chinese maps labeled Sakhalin as 萨哈林岛 (Sa-ha-lin Dao, a transcribed Russian endonym) and 库页岛 (Kuye Dao, the Chinese exonym). The Japanese maps labeled Sakhalin with サハリン (Sa-ha-ri-n) and 樺太 (Karafuto, the Japanese exonym).

In conclusion, maps in the Japanese group were the most likely to indicate uncertainty through the use of borders, territorial fill colors, and toponyms. Interestingly, the 1971 notice only regulated the design of fill colors and the *location* of borders (not design), yet we found many cases where the symbol design of the borders also implied uncertainty (dashed/dotted). The English and Russian maps did not express uncertainty through these methods, whereas the Chinese maps indicated uncertainty primarily through double labeling, rather than borders or fill colors.

6. DISCUSSION

6.1 OVERALL DISCUSSION

FROM OUR CONTENT ANALYSIS, IT IS EVIDENT THAT maps published in different languages diverge in their



Figure 5. A Russian map of Sakhalin and surrounding areas from Sharada. The map shows Sakhalin in a color which aligns with how each of the other Russian first-order administrative subdivisions is colored. While there is no border at the Sōya / La Pérouse Strait, the fill color and place naming undeniably show Sakhalin as a part of Russia.

Uncertain Design Element	Chinese	English	Japanese	Russian
Dashed border	40% (4/10)	33% (1/3)	75% (12/16)	50% (1/2)
White color in Southern Sakhalin	0% (0/10)	0% (0/8)	75% (3/4)	0% (0/2)
Multiple toponyms	40% (8/20)	0% (0/13)	57% (12/21)	0% (0/28)
Same toponym designs	50% (4/8)	N/A (0/0)	83% (10/12)	N/A (0/0)

Table 5. Content analysis results for the use of “uncertain designs” that imply uncertainty of political control, for the four cultural-linguistic groups.

design of border lines, territorial fill colors, and toponym labeling, the result of the complicated political status of

Sakhalin. While we assumed that Russian maps would support Russian claims, and Japanese maps would support Japanese claims, our results are more nuanced.

Indeed, *most* Russian maps supported Russian control over the island by labeling with the toponym Сахалин (Sakhalin) to emphasize Russian sovereignty, and occasionally by using lines to demarcate the border between Hokkaido and Sakhalin. Japanese maps more often used designs that conveyed uncertainty, such as through the use of dashed lines or multiple labels to blur and complicate the political status of Southern Sakhalin. Chinese maps, while supporting Russian claims through border drawing and color fills, still use the Chinese-originated toponym of the island in labeling. These unique cartographic representations of the island should lead to a deeper discussion about how lines, polygons, and labels can be used differently on maps to support particular political narratives, and how cartographic representation can influence the clarity or uncertainty of interpretations of political control.

6.2 UNCERTAIN DESIGNS TO UNCERTAIN STANCES

Our research connects the use of representation of uncertainty in cartographic designs with political stances. For instance, many of the Japanese maps use dashed borders rather than solid borders to imply the ambiguous status of Southern Sakhalin. These designs are used based on political narratives that state powers project over the contested areas.

It is clear that across the maps there was more variety in the designs among Japanese maps than expected, signaling different political stances among mapmakers. Several factors could explain this. First, printed maps and atlases, especially in educational materials, typically go through a screening process by state institutions to be published. During this process, the content of the printed maps and atlases is examined to make sure that they with the relevant standards and regulations carried out by the state, such as the 1971 notice (Okaya 2016; Kikuchi 1970). In contrast, publishing or uploading a map to the internet is easier. Cartographers have greater freedom to apply styles or designs based on their own personal preferences, objectives, or narratives. While there might be arguments that the world of mapping and cartography has not been fully democratized as suggested by critical cartography scholars (Boulton 2010), our research here does imply that there

is the potential for less state regulation of maps published online.

Post-WWII maps representing and/or implying Russian political control used cartographic designs that convey a sense of that control being certain. These techniques included applying solid and obvious borders, using fill colors aligning with Russia, and labeling only with the Russian-originated toponym. Our content analysis made it evident that there was less variety among Russian maps in the representation of Sakhalin than we saw on the Japanese maps. Among the Russian maps, we found only one form of border placement, one form of territorial fill color, and one form of toponym placement. This suggests a lack of diverse discussion of the Sakhalin territorial conflict within Russia, both in maps published online and those that were physically published. A large portion of the Russian maps we analyzed were scanned pictures of printed atlas pages, and atlases are usually published with more standardized cartographic designs.

In general, we identified how borders, territories, and toponyms were depicted on maps and how the use of these visual variables relates to the representation of clarity of political stances towards Sakhalin. The Japanese have a complicated narrative related to control of Southern Sakhalin that correlates with a larger portion of those maps representing political control with designs that prompt uncertainty in the reader. In contrast, Russia does not identify Sakhalin as a disputed territory, and Russian maps also represent much more clarity in their designs.

6.3 TOPONYM DESIGN TO HISTORICAL NARRATIVES

It is clear across all the maps in the sample that the toponym-labeling strategy was deeply rooted in the history of particular regimes' control of Sakhalin. For example, Chinese maps in the sample more often represent Sakhalin using the Chinese toponym even while China has not held control of the island since the nineteenth century (Figure 6). Chinese authorities require cartographers to label Sakhalin with both the Russian and the Chinese names and enforce this policy on all maps published in China (The State Council of the PRC 2023). As such, Chinese maps emphasize China's historical presence in Sakhalin while other aspects of design respect its current control by Russia.

Historical narratives of control over Sakhalin are also part of maps designed by cartographers in Russia and Japan. Unlike China, a state without any claims on Sakhalin after 1945, Russia and Japan have different views and stances on the political status of the island. Historical narratives are used to justify territorial legitimacy, and using their own toponyms to assert historical presence is important to the representation of Sakhalin on Russian and Japanese maps. For example, more than half of the Japanese maps (57%, 12/21) and all of the Russian maps (28/28) had Sakhalin labeled with their own toponyms.

While Chinese maps and Japanese maps use Chinese- and Japanese-originated toponyms, they do not always erase Russian-originated ones. In fact, all the Japanese maps (21/21) and more than half of the Chinese maps (65%, 13/20) adopted the Russian toponym too, sometimes by juxtaposing the Russian toponym with their own toponym. In the case of Sakhalin, drawing attention to a country's historical presence in contested areas does not necessarily undermine or erase the local endonym but can instead promote a more inclusive perspective. The preservation of exonyms serves to highlight the historical administration of the territory and constitutes a part of a territorial-claim justification (Murphy 1990), but also does not explicitly oppose the existing territorial arrangement (e.g., China in the case of Sakhalin). Quantifying the use of multiple labeling, and the use of both endonyms and exonyms, on our maps reveals historical connections to a foreign territory.

Finally, the English-language maps in our study serve as a control group. It was clear from this group that the Russian *de facto* control is widely recognized, and the island was represented in all of the English-language maps with only the Russian toponym.

6.4 DENYING CONTROL BY DEPICTING NEUTRALITY

For Russo-Japanese conflicts over Sakhalin, there are two confronting narratives that originated in each side's differing understanding of the Treaty of San Francisco in 1951. Unlike a traditional territorial conflict where two confronting states actively contest a territory, Japan's twofold political stance posits that (1) the Japanese do not accept Russian control of Southern Sakhalin, and (2) the Japanese do not claim control over Southern Sakhalin. The 1971 notice makes clear how to map this through international



Figure 6. A Chinese map of Sakhalin and surrounding areas. The Russian name Sakhalin is spelled as 萨哈林 (Sa-ha-lin), with the Chinese name 库页 (Kuye) labeled in parentheses. This is an example of the double labeling that was common in the Chinese maps. Fill colors and borders were not coded at the sub-code level in this map because the fill colors were based on terrain rather than political units, and no borders were illustrated on this map. Image retrieved from the [Baidu Baike's page gallery of Sakhalin](#).

borders placed at both Sōya / La Pérouse Strait and the 50th parallel, and the use of a white fill color; this was reflected in the maps in our sample.

6.5 LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

There are several key limitations to our analysis which we describe below.

6.5.1 Land vs. Maritime Borders

First, cartographic borders are typically treated differently on land than in the water. Land boundaries are usually demarcated with border symbols, while maritime boundary lines are often not placed at all (Blake 1995) except sometimes over narrow waters between states. Thus, while border lines are often placed across the Strait of Tartary and the Sōya / La Pérouse Strait, these borders are also often left off, thus limiting the ability of our content analysis to determine the mapmaker's perspective on control of the island.

6.5.2 Sources, Regulations, and Censorship

When collecting our sample maps, we found that there is a scarcity of maps from governmental agency websites. While state governments express their territorial claims

and concerns, official map visualizations of their claims are less common than expected. This finding raises questions for future research to differentiate how and when maps are censored by government or other entities to reflect political stances and/or state regulations. It would be helpful in future studies to investigate map regulations in China, Russia, and Japan, and how these regulations are proposed, passed, and enforced. Understanding the prevalence of these map designs is a useful first step to assess representation, and a future study might be able to identify how much of this is dictated by the government versus widely practiced cartographic conventions.

7. CONCLUSION

MAPS HAVE BEEN USED EXTENSIVELY AS AN INSTRUMENT for visualizing politically contested territories and territorial disputes. In this study, we investigated the specific case of Sakhalin, a place where Japanese and Russian political stances have been in conflict. Specifically, we set out to answer two research questions by conducting a content analysis of maps across four cultural-linguistic groups (Chinese, English, Japanese, and Russian) to better understand how cartographic design is used in this politically contested context.

RQ1. How are cartographic design elements, including (a) border symbols, (b) territorial fill colors, and (c) toponym labels, used differently on Chinese, English, Japanese, and Russian maps of post-WWII Sakhalin?

It was evident through this research that there were differences in the use of borders, fill colors, and toponyms across the four groups. In terms of border lines, Russian maps rarely ever showed borders at the locations we focused on, while Japanese maps were far more likely to do so. Similar to the Japanese maps, 40% of Chinese maps showed these borders, but only 9% of English maps did so. Russian and Chinese maps only ever showed borders at Sōya / La Pérouse Strait, while the Japanese maps were more likely to show borders at Sōya / La Pérouse Strait *and* the 50th parallel. Of the three English-language maps with borders at any of the locations, all three showed the Sōya / La Pérouse Strait border; one particular map stands out here because it was produced in English by the Japanese Geospatial Information Authority (Figure 2) and includes a border at the 50th parallel. Similar to borders, fewer than half of the maps in each of the groups used fill colors to

6.5.3 Perception of Contested and Uncertain Cartographic Design

There are also open questions related to how map users perceive the contested areas illustrated with these cartographic designs. Quantitative content analysis can help us measure the use of visual variables on a map, but future research, such as a user study, should explicitly assess how these different designs affect emotions, comprehension, and the perception of contested areas.

illustrate territorial control, and there was significant variation across the different groups. The English, Chinese, and Russian maps that used territorial fill color all depicted Russia's territorial control. However, 75% of Japanese maps used white for Southern Sakhalin. Finally, for toponym labeling, all the English, Japanese, and Russian maps labeled Sakhalin with the Russian-originated toponym. The Chinese maps and the Japanese maps were more likely to have Russian-originated toponyms labeled along with Chinese- or Japanese-originated toponyms.

RQ2. In what ways do these elements imply political contestation or uncertainty of political control?

The design of borders and fill colors, along with toponym use, can imply political contestation and uncertainty in control. More Japanese maps used what we called “uncertain designs.” In particular, Japanese maps were more likely to use a dashed border and a white fill-color on Southern Sakhalin following the Japanese 1971 Ministry of Education notice to imply the twofold stance of Southern Sakhalin sovereignty. The Chinese and Japanese maps were most likely to imply uncertainty through labeling, using either Chinese- or Japanese-originated toponyms, something not found in the English and Russian maps. Along with Russian-originated place names featured together with an exonym, this double labeling indicates that the Chinese and Japanese may want to keep their historical narrative alive, while the Russian maps illustrate that Russia does not consider Sakhalin to be contested.

Through this study, it is evident that historical and political narratives shape cartographic representations of

borders, territorial fill colors, and toponyms. By connecting the representation of uncertainty through cartographic designs with political narratives, this research also illustrates how the visualization of political contestation on maps can be largely dominated by the cultural-linguistic context from which a map originates.

Quantitative deconstructions of borders, territorial fill colors, and toponyms can deepen our understanding of the

relationship between cartographic representations and underlying political-territorial ideologies. We believe these practices could also be adapted to examine narratives of other contested areas to increase the generalizability of this research. We plan to implement some of these practices to illustrate different contested areas across the world for better comprehension and clarity of contentious scenarios.

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9. APPENDIX: CODING SCHEME SPECIFICATION

Title	Data Entry Options
Metadata Codes	
Group Name	Chinese, English, Japanese, or Russian
ID	Unique map identifier given to each map
Keyword	Keyword used for querying the map in search engine platform
Border Codes	
Border on the 50th Parallel	0: International Border Absent 1: International Border Present
Border on the Strait of Tartary	0: International Border Absent 1: International Border Present
Border on the Sōya / La Pérouse Strait	0: International Border Absent 1: International Border Present
Border Arrangement	0: Border is solid 1: Border uses visual variable of arrangement, such as dashed or dotted.
Territorial Fill Color Code	
Territorial Fill Color	0: Fill color is not associated with territorial control. C: Fill color aligns with fill color of China. J: Fill color aligns with fill color of Japan. R: Fill color aligns with fill color of Russia. RJ: Two fill colors are used to divide Sakhalin at the 50th parallel, with fill color of Northern Sakhalin aligning with Russia and Southern Sakhalin aligning with Japan. RW: Two fill colors are used to divide Sakhalin at the 50th parallel, with fill color of Northern Sakhalin aligning with Russia and the fill color of Southern Sakhalin in white.
Toponym Codes	
Chinese Toponym Label	0: Chinese toponym not used N: Chinese toponym used on Northern Sakhalin S: Chinese toponym used on Southern Sakhalin NS: Chinese toponym used on whole of Sakhalin
Japanese Toponym Label	0: Japanese toponym not used N: Japanese toponym used on Northern Sakhalin S: Japanese toponym used on Southern Sakhalin NS: Japanese toponym used on whole of Sakhalin
Russian Toponym Label	0: Russian toponym not used N: Russian toponym used on Northern Sakhalin S: Russian toponym used on Southern Sakhalin NS: Russian toponym used on whole of Sakhalin
Toponym Numbers	0: Toponym(s) for Southern Sakhalin written in only one form for each individual geographical feature 1: Toponym(s) for Southern Sakhalin written in more than one form for each geographical feature.
Toponym Differences	0 – Toponyms have different size, font, color, and other attributes. 1 – In case of having more than one toponym for one geographic feature, toponyms have identical size, font, color, and other attributes.

Table A1. Content analysis coding scheme divided into four categories: (1) Metadata Codes, (2) Border Codes, (3) Territorial Fill Color Code, (4) Toponym Codes. Underlined sub-codes focus on what we call “uncertain designs,” defined in Section 4.3.2.