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Extrastate development: Marshallese stick charts and the politics of infrastructure in the nineteenth-century Pacific

Objects are always looser than they appear.

– Lauren Berlant, *On the Inconvenience of Other People* (Durham, NC: Duke University Press, 2022), 25.

If left unchecked, the ocean that has sustained us for so long will take my home.

– Hilde Heine, former president, Republic of the Marshall Islands, "Forewords," in *Sea Change: An Atlas of Islands in a Rising Ocean*, Christina Gerhardt (Oakland, CA: University of California Press, 2023), viii.

Infrastructures of knowledge and development

Since the late 1970s, a particular artifact of the "Second Hawaiian Renaissance" has hung on my wall in various places I have lived – a Marshall Islands stick chart.[1] It is "Hawaiian" in the sense that I got it on Maui in the late 1970s as an eleven-year-old at a shop aimed at ethnographic tourism. It presumably served – to me and to others – as an emblem of Hawaii's place in Oceania and Polynesian culture as a whole. I brought it back to Oklahoma and hung it next to a National Ge-

1 The first Hawai'ian Renaissance is associated with the nationalist objectives of King Kamehameha V (r. 1863–1872), including replacing the anthem written by Christian missionaries and building a new Iolani Palace (1879). The second Hawai'ian Renaissance from the late 1960's is associated with movements for indigenous land rights and connected with renewed interest in cultural practices like slack-key guitar music, hula dancing, and Polynesian voyaging that had been lost or actively suppressed by missionaries. The reproduction of the chart, and its sale in Hawai'i, should also be understood as part of the broader set of debates about a transcultural Pacific, using the 1970 phrase of the first Prime Minister of Fiji, Kamisese Mara, "the Pacific Way." Ratu Sir Kamisese Mara, "Address to the United Nations," [orig. October 1970] in *The Pacific Way: A Memoir* (Honolulu: University of Hawai'i Press, 1997), appendix 4; Stephanie Lawson, "'The Pacific Way' as Postcolonial Discourse: Towards a Reassessment," *Journal of Pacific History* 45, no.3 (December 2010), 304. Later, the Tongan and Fijian anthropologist Epeli Hau'ofa also tried in his famous "Our Sea of Islands" (1993) essay to transcend the divisions articulated by Europeans starting in the early nineteenth-century between Melanesians, Micronesians, and Polynesians. Epeli Hau'ofa, "Our Sea of Islands," in *A New Oceania: Rediscovering Our Sea of Islands*, ed. Epeli Hau'ofa, Eric Waddell and Vijay Naidu (Suva: School of Social and Economic Development, University of the South Pacific/Beake House, 1993), 2–17.

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ographic map of the world that my half-Cherokee grandfather had given me.[2] In comparison with the flatlands and empty blue oceans of the National Geographic map, the Marshall Island chart layered oceanic temporalities and rhythms. It spoke to how I physically understood the ocean as a child, as a space of waves and swells. This possibility for a shift in perspective mirrors broader historical and theoretical debates about how knowledge infrastructures shape, and are shaped by, their cultural and political contexts. In particular, the Marshallese stick charts have offered and continue to offer an alternative to the dominant Western paradigms of technological development, challenging the imposed logics of imperial mapping and colonial infrastructure-building.

Lauren Berlant's concept of "infrastructural objects" – "living meditations" that shape and are shaped by ("bind and extend") relational processes – offers a productive framework for understanding Marshallese stick charts.[3] Unlike Western infrastructures that prioritize materiality and permanence, these charts have been a dynamic, adaptive technology, binding space, time, and knowledge in ways that defy imperial classification. In this way, they offer a counternarrative to the dominant colonial frameworks of technological progress and development, which have historically marginalized oral and embodied knowledge systems. Moreover, they better enable the understanding what have been called "borderwater" and "hydrocolonial" processes in the Anthropocene.[4] The history of infrastructural ob-

2 On National Geographic maps as promoting a primitive/civilized hierarchy of conservative humanism for the American middle class in this period see Catherine Lutz and Jane Collins, *Reading National Geographic* (Chicago, IL: University of Chicago Press, 1993).

3 Berlant, *On the inconvenience of other people*, 20–21. Berlant takes this concept in part from Marshall Sahlins's commentary on the work of Claude Lévi-Strauss in Marshall Sahlins, "Infrastructuralism," *Critical Inquiry* 36 (Spring 2010): 371–385. See more broadly Paul Edwards, "Infrastructure and Modernity: Force, Time, and Social Organization in the History of Sociotechnical Systems," in *Modernity and Technology*, ed. Thomas J. Misa, Philip Brey and Andrew Feenberg (Cambridge, MA: MIT Press, 2002),185–225. Elsewhere Edwards writes about "knowledge infrastructures for the Anthropocene" (*Anthropocene Review* 4, no.1, (2017): 34–43. I see this literature as an alternative way of talking about ocean "media," compare Melody Jue, *Wild Blue Media: Thinking Through Seawater* (Durham, NC: Duke University Press, 2020).

4 Among the many places stick charts have been used as evocative but silent illustrations is next to the Marshall Islands poet Kathy Jetñil-Lokomer's "Dear Matafele Peinam," read at the opening ceremony of the UN Climate Summit in New York City in 2014, and recently republished in Gerhardt, *Sea Change*, 136–137. On "borderwaters" and the archipelagic see Brian Russell Roberts, *Borderwaters: Amid the Archipelagic States of America* (Durham, NC: Duke University Press, 2021), and on hydrocolonialism see Isabel Hofmeyr, *Dockside Reading: Hydrocolonialism and the Customs House* (Durham, NC: Duke University Press, 2022). For "between" spaces as they relate to ocean science see Michael Reidy and Helen Rozwadowski, "The spaces in between: Science, ocean, empire," *Isis* 105, no. 2 (2014): 338–351. On development see Immanuel Wallerstein, "The Devel-

jects broadens the very limited material and mechanical terms that Westerners (or "moderns") often use to conceptualize "technology" by including embodied, mnemonic, and oral traditions that the discipline of anthropology has traditionally framed as cultural rather than technical. This chapter examines Marshallese stick charts as infrastructural objects that challenge conventional models of development and imperial knowledge-making. Specifically, it asks: How did these charts function as indigenous infrastructures of knowledge, resisting colonial mapping and working towards an alternate conceptualization of development? And what do they reveal about how infrastructures of development can operate beyond state control in multipolar imperial contexts? By positioning stick charts within the framework of infrastructure rather than primitive or culturally alternative mapping, this paper reframes them as tools for managing uncertainty and crisis, whether environmental, political, or epistemological. In keeping with this volume's broader rethinking of development as a historically contingent and contested process, it argues that Marshallese stick charts resist both imperial mapping and the developmental narrative of epistemic hierarchy. At the same time, the charts offer a distinctive mode of *environing*, a means of actively shaping relationships among people, movement, and oceanic space in ways that exceed imperial classification and extractive logic.

Development historiography has often focused on the expansion of state-driven infrastructure, from roads and railways to hydroelectric projects. However, starting in the 1990s, scholars such as Arturo Escobar and James Scott critiqued these paradigms for ignoring indigenous infrastructures of knowledge that operate beyond state control.[5] Historians of science and technology, including Geoffrey Bowker and Susan Leigh Star, began to highlight how even state- or imperial-driven infrastructures work as both technical systems and cultural forms, shaping and mediating power relations.[6] More recently, Brian Larkin further complicated this

opment of the Concept of Development," *Sociological Theory* 2 (1984): 102–116; and Corinna Unger et al., eds., introduction to *Perspectives on the History of Global Development* (Berlin: De Gruyter Oldenbourg, 2022), 1–14. On distinctions between colonial and post-colonial understandings of development see Frederick Cooper, "Development, Modernization, and the Remaking of an Imperial World Order," in Unger et al., eds., *Perspectives*, 81–102.

5 Arturo Escobar, *Encountering Development: The Making and Unmaking of the Third World* (Princeton, NJ: Princeton University Press, 1995); James Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998).

6 Geoffrey Bowker and Susan Leigh Star, *Sorting Things Out: Classification and Its Consequences* (Cambridge, MA: MIT Press, 1999); Susan Leigh Star, "The Ethnography of Infrastructure," *American Behavioral Scientist* 43, no. 3 (November 1999): 377–391; Susan Leigh Star, "Infras-

picture by showing that infrastructures are not just material objects but also ideological constructs embodying competing visions of modernity.[7] Finally, Keller Easterling's framing of *extrastatecraft* demonstrated how non-state infrastructures actively resist and reconfigure dominant models of governance and control as well as definitions of modernity. By applying these insights to Marshallese stick charts, this chapter examines how indigenous maritime infrastructures operated within and against competing imperial orders.

Easterling's concept of extrastatecraft describes how infrastructure operates beyond state governance as a "web of active forms" tied to stories.[8] Marshallese stick charts represent an early form of such extrastate knowledge, emerging not from land-based institutions, but from oceanic borderwaters shaped by movement, memory, and adaptation. Rather than fitting neatly within a binary of imperial versus traditional epistemologies, stick charts mediated indigenous understandings of territory and environmental change on their own evolving terms, resisting absorption into colonial frameworks of mapping and development. Yet, in contrast to European printed maps – designed for fixity, duplication, and central authority – stick charts were pedagogical tools embedded in lived, localized practices. They were not standardized but personalized, taught through kinship relations, ritualized apprenticeship, and embodied mnemonic systems.

The arrival of the first printing press in the Marshall Islands in 1859 – a hand press with a Hawaiian font brought by missionaries – signaled an effort to replace performative, oral infrastructures with textual systems: ones that could be legible to imperial governance and scalable across missionary and colonial networks in the South Pacific, China, and Southeast Asia. As Richard Lingenfelter notes, printing presses were often associated with the consolidation of royal authority and the emergence of official nationalism – Pōmare in Tahiti, Keeaumoku II in Hawai'I – supported by missionization and education. Yet the Marshall Islands proved resistant to this model. Although American missionaries established a Congregational Church on Epoon Atoll in 1857 with the aid of Hawaiian missionaries,

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tructure and Ethnographic Practice: Working on the Fringes," *Scandinavian Journal of Information Systems* 14, no. 2 (September 2002): 107–122.

7 Brian Larkin, "The Politics and Poetics of Infrastructure," *Annual Review of Anthropology* 42 (2013): 327–343. This reviews the anthropological literature.

8 Keller Easterling, *Extrastatecraft: The Power of Infrastructure Space* (New York: Verso, 2014), esp. "Afterforward" 239–241. Going further back, this is what Paul Radin spoke of as "plasticity" or "the free play of participants and story-tellers" in relation to Indigenous conservatism. Paul Radin, *Primitive Man as Philosopher* (New York and London: D. Appleton and Company, 1927; New York: New York Review of Books Classics, 2017), 48. Citation refers to the New York Review of Books edition.

no centralized sovereignty or print-based nationalism emerged. The press failed to displace older epistemologies in the way it had elsewhere.[9]

Marshallese charts were part of this resistance. They persisted not merely as cultural symbols but as operational infrastructures attuned to the rhythms and uncertainties of oceanic life. Their contrast with print-based knowledge highlights the broader stakes of infrastructural control in colonial development projects: whether knowledge could be abstracted, stored, and governed, or whether it remained adaptive, relational, and embodied.

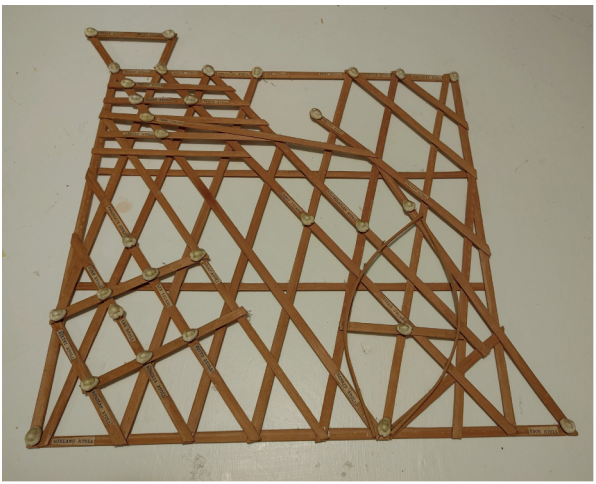
Though embedded in a context of multipolar imperial competition, stick charts retained their epistemic distinctiveness. They offered ways of navigating spatial complexity that escaped colonial legibility. By placing these charts in conversation with wider debates about infrastructure, epistemology, and colonialism, this chapter rethinks the relationship between indigenous knowledge and development. It suggests that development is not a linear, universal trajectory, but a contested, ecologically situated negotiation over forms of knowing, teaching, and surviving.

As an eleven-year-old, I was neither aware that what was on my wall did not equate to a "map" nor that Marshall Island charts had become iconic in a variety of ways on a global scale. During the period of the Pacific "cultural renaissance" of the 1970s, they had started to play a largely symbolic role as icons of loss in efforts to revive traditional navigation practices in the Pacific. This is still the case in some ways. A version of the chart appears, for example, on the cover of *Life in the Republic of the Marshall Islands* (2004), a book dedicated to the efforts of the Marshall Islands mayors' conference to revive the long-dormant Ailinglaplap canoe races on the twenty-fifth anniversary of the founding of the Republic.[10] The map on my wall was perhaps the first time I encountered the geographical marker "Bikini Atoll," yet I remained unaware of the legacy of nuclear testing for what would become the Marshallese 1979 Compact of Free Association (1979), let alone the still unconceptualized Anthropocene.

The charts had been enshrined from the 1960s in revisionist versions of "natural history" museums, notably by Margaret Mead in her "Hall of Pacific Peoples" at the New York Museum of Natural History, where they were used symbolically

9 Richard Lingenfelter, *Presses of the Pacific Islands, 1817–1867: A History of the First Half Century of Printing in the Pacific Islands* (Los Angeles: Plantin Press, 1967).

10 Anono Lieom Loeak, Veronica C. Kiluwe and Linda Crowl, eds., *Life in the Republic of the Marshall Islands = Mour ilo Republic eo an Majõl / written by Marshall Islanders*, trans. Veronic C. Kiluwe, Maria Kabua Fowler and Alson J. Kelen (Majuro: University of the South Pacific Centre, 2004).



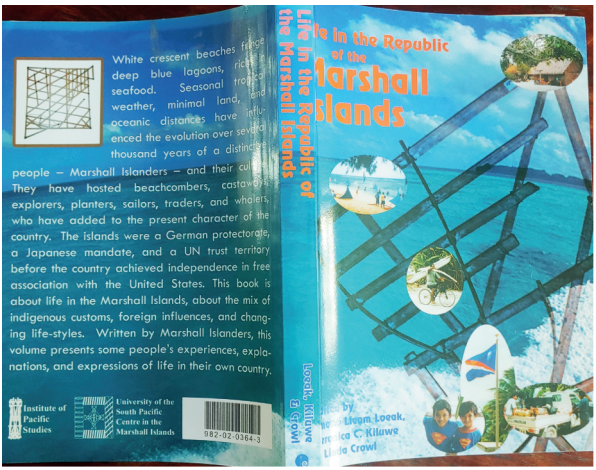


Figure 1: Marshal Islands *rebbelib* chart reproductions associated with the Second Hawai'ian Renaissance.
1a Personal copy of a Marshall Islands stick chart, created ca. 1979. [Personal Photo].
1b Reproduction of a similar chart from that period (upper left) on Anono Lieom Loeak, Veronica C. Kiluwe and Linda Crowl, eds. *Life in the Republic of the Marshall Islands* (University of the South Pacific Centre, 2004). [Personal Photo].

to hold the collection (in this case largely her collection) together.[11] The general idea was that the museum, the anthropologist, and the Indigenous groups represented by them were all allies or at least fellow travelers. Mead wanted to decenter the idea of Western science, mirroring the projects of Claude Lévi-Strauss, Joseph Needham, and her mentor Franz Boas.[12] I realized, while working in the ethnographic collections of the University of Pennsylvania, that the first surviving version of what hung on my wall (and all of the other tourist copies from the 1970s onward) had been obtained in the Marshall Islands by Robert Louis Stevenson in 1890.[13] Of two different full charts of the islands that Stephenson brought back, the Penn chart is largely forgotten while the New York one has been extensively replicated. For Mead's Hall, the American Museum of Natural History restored its Stevenson chart twice, in 1965 and 1979, putting it on display prominently after the Hall opened in 1971 and photographing it. By enshrining these charts firmly within the realm of natural history and a Boas-derived cultural anthropology as well as downplaying their differences, Mead in New York neutralized their earlier role as extrastate knowledge systems, framing them as iconic cultural mementos rather than living and evolving infrastructures. Yet for myself, and presumably Mead, these charts still alluded to a complex multimodal and technical world of sea swells, ocean currents, and island relations, embodied in the dimensionality of shells and sticks (palm midribs on the chart obtained by Stevenson, bamboo on mine) rather than the flatness of paper.[14] Understanding this tension requires

11 See "Margaret Mead Hall of Pacific Peoples," American Museum of Natural History, accessed July 3, 2025, https://www.amnh.org/exhibitions/permanent/pacific-peoples.

12 See more recently the work of particle physicist John Huth also voyaged with Korent Joel. Notably his Harvard class on "Primitive Navigation" (2013), the teaser for which is: "Primitive Navigation – Course Trailer," uploaded August 17, 2012, https://www.youtube.com/watch?v=E7M2MMm6iv8; and his book John Huth, *The Lost Art of Finding Our Way* (Harvard: Harvard University Press, 2013). This approach has been framed as reenactment for the Anthropocene, see Krista Langlois, "Science and Tradition are Resurrecting the Lost Art of Wave Piloting: Can Marshall Islanders' unique heritage help them navigate a rising ocean?" *Smithsonian Magazine* , February 2, 2016, https://www.smithsonianmag.com/arts-culture/science-and-tradition-are-resurrecting-lost-art-wave-piloting-180958005/.

13 The Penn chart is "Navigational Chart," Penn Museum, accessed July 3, 2025, https://www.penn.museum/collections/object/266112. See the early assessment by H. U. Hall, "A Marshall Islands Chart," *The Museum Journal* 10, no.1–2 (1919): 35–42, https://www.penn.museum/documents/publications/journal/10-1and2/marshall_islands_chart.pdf.

14 This has inspired and continues to a large public history literature, such as this piece by Stephen Nash, "Lost or Found? A Stick Chart From the Marshall Islands," *Sapiens*, July 25, 2016, https://www.sapiens.org/culture/stick-chart-marshall-islands/ from the Denver Museum of Natural Science, A.926.1/DMNS, accessed https://www.sapiens.org/culture/stick-chart-marshall-islands/; and this using Library of Congress charts uploaded to Wikipedia, Amelia Soth "Cabinet of Curiosities:

moving between two interlinked frames: first, how Marshallese stick charts functioned as indigenous infrastructures dynamic, embodied, and oral in character, and second, how these same charts were appropriated by colonial science and recast as static artifacts, revealing the limits of imperial developmental frameworks.

Stick charts as navigational technologies or infrastructures?

The interpretation of Marshallese stick charts has long been debated, reflecting broader tensions between indigenous epistemologies and Western knowledge systems. Were these charts tools for reading ocean currents, mapping swells, or something else entirely? Each interpretation, from nineteenth-century missionaries and German ethnographers to twentieth-century anthropologists, reveals shifting colonial and scientific frameworks that sought to categorize and, at times, control Marshallese knowledge. This section examines these competing readings, arguing that stick charts should not be viewed as static artifacts but as adaptive infrastructural tools embedded in social and navigational practices.

In the 1860s, writing the first detailed reports of Marshallese charts, the American missionary L. H. Gulick thought that the wooden bars represented ocean currents.[15] Currents are notoriously difficult to define. Moreover, navigation in the Marshall Islands is unique because the Pacific's Northern Equatorial Current

Marshall Islands Wave Charts," JSTOR Daily, February 23, 2023, https://daily.jstor.org/marshall-islands-wave-charts/. Starting in 1960, Mead (d. 1978) and her husband Gregory Bateson (d. 1980), active practitioners of visual anthropology from their time in Bali in the 1930's, had planned the new hall at the American Museum of Natural History as a multimedia experience – including panoramic visuals, lighting, and sound effects. On the planning of the Hall see Diane Loche, "The Fate of the Senses in Ethnographic Modernity: The Margaret Mead Peoples of the Pacific Hall at the American Museum of Natural History," in *Sensible Objects: Colonialism, Museums, and Material Culture*, ed. Elizabeth Edwards, Chris Gosden and Ruth B. Phillips (Abingdon, Oxon: Routledge, 2006). Mead's efforts also drew renewed attention to the chart at the University of Pennsylvania, see William Davenport, "Marshall Islands Cartography." *Expedition Magazine* 6, no. 4 (July 1964), https://www.penn.museum/sites/expedition/marshall-islands-cartography/. Davenport, who had been at Pearl Harbor during the Japanese bombing, studied at the University of Hawai'i in the early 1950's as well as the Bishop Museum and then completed his dissertation at Yale under the Caribbean anthropologist Sidney Mintz.

15 L. H. Gulick, "Micronesia – of the Pacific Ocean," *Nautical Magazine*, 31 (1862), 303–304. See also a Hawai'ian missionary's manuscript report written in 1862–3, published as Hezekiah Aea, "The History of Ebon," *Fifty-sixth Annual Report of the Hawai'ian Historical Society* 56 (1947): 9–19.

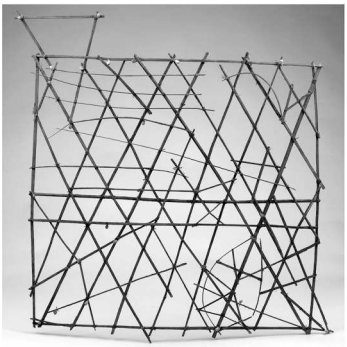


Figure 2a

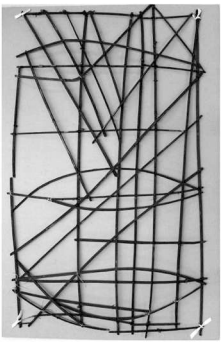


Figure 2b

Figure 2c

Figure 2: Two late nineteenth-century stick charts collected by Robert Louis Stevenson in the Marshall Islands, oriented to match the photograph from the 1914 auction where they were purchased by the two museums.
2a Chart American Museum of Natural History, New York, 80.0-3317. Courtesy of the Division of Anthropology, American Museum of Natural History.
2b Chart University of Pennsylvania Museum, P3297. Courtesy of the University of Pennsylvania Museum.
2c Photograph from *Autograph Letters, Original Portraits, Books, Portraits, and Curios from the Library of the Late Robert Louis Stevenson Consigned by the Present Owner Mrs. Isobel Strong of Santa Barbara, Calif.* (Anderson Auction Company, 1914).

and Equatorial Countercurrent run in different directions through the twenty-nine atolls and five islands of the Ratak ('sunrise' to the east) and Ralik ('sunset' to the west) chains. The northern boundary of the Equatorial Countercurrent heading towards the Americas are Kwajalein and Lae islands, although what a current "boundary" precisely is has remained to this day difficult to determine because of eddies as well as gradual changes in motion at the edges. The southern boundary of the Northern Equatorial Current is just south of Bikini Atoll. A 1955 report using Japanese data (1933–1941) and then US data from Operation Crossroads (1946) offered the first American models of these currents in response to the Castle Bravo hydrogen bomb test in 1954.[16] In relation to the broader Pacific, ocean currents in the Marshall Islands had been so poorly understood before the 1950s that nobody expected large amounts of radiation to flow along the Northern

16 Han-Lee Mao and Kozo Yoshida, *Bikini and Nearby Atolls, Marshall Islands: Oceanography in the Marshall Islands Area* (Washington, DC: US GPO, 1955). This public report includes no data from Castle Bravo the previous year. See also the early report by M.W. de Laubenfels, "Ocean Currents in the Marshall Islands," *Geographical Review* 40 (1950): 254–259.

Equatorial Current up to Japan. One aspect of reading the charts has always been the idea that indigenous peoples might understand these processes better.

While Gulick's current-based interpretation sought to frame the charts within a familiar hydrological paradigm with the hope of local informants, German colonial officials like Captain Otto Winkler took a different approach. By the 1890s, as German control in the Marshalls expanded, Winkler and others attempted to redefine stick charts as representations of ocean swells, reinforcing an ethnographic view of Marshallese knowledge that emphasized difference rather than continuity with Western navigation. Winkler, working for the German government in the aftermath of Robert Louis Stevenson's visit in 1890, used a series of informants to interpret the wooden bars on the charts as patterns of ocean swells generated by trade winds and the way that islands interfere with them. Post-Winkler, swells, not currents, became the dominant interpretation, suggesting a more anthropological and academic approach that emphasized cultural difference. Winkler's work was almost immediately translated into English by the Smithsonian and published in 1901.[17] He argued that the map indicated four kinds of swells – *rilib* ('backbone' or strongest), *kaelib*, *bungdockerik*, *bungdockering*. Currents could also be seen on charts as bent swells or bent pieces of wood, notably when an island split a current. But the significance of the charts came out of the depiction of interactions between winds, swells, and islands, and the height of the sea could guide a navigator towards or away from an island or let them know if they overshot their target.

Then, in the early 1990s, the American anthropologist and surfer Ben Finney put forward a third argument in the context of J. B. Harley's and David Woodward's broad rethinking of the history of cartography. He argued that the *rebbelib* charts resembled Western maps – particularly Tupaia's eighteenth-century Polynesian charts developed on board James Cook's HMS *Endeavour* – raising important questions about how indigenous mapping traditions intersected with colonial epistemologies. Finney had founded the Polynesian Voyaging Society in the 1970s during the Second Hawaiian Renaissance to recreate journeys between islands using traditional methods. He came to this conclusion about the charts not only because of the map-like distribution of islands (similar to Tupaia's charts from the Cook expedition) but also because of scale, the really large maps are, because

17 Captain Otto Winkler, "Über die in früheren Zeiten in den Marschall-Inseln gebrauchten Seekarten, mit einigen Notizen über die Seefahrt der Marschall-Insulaner im Allgemeinen," *Marine-Rundschau* 10 (1898): 1418–1439. Translated into English, "On Sea Charts Formerly Used in the Marshall Islands, with Notices on the Navigation of These Islanders in General," *Annual Report of the Board of Regents of the Smithsonian Institution, 1899* (1901): 1:487–508.

of scale, necessarily poor on swells.[18] Tupaia's chart – recorded by Cook but generally unintelligible to European officers – demonstrates the risks of assuming that visual form equates to epistemic structure. Like Marshallese stick charts, it embodied a relational infrastructure whose logic was encoded not in geometry but in storytelling and kinship. That it could resemble a Western map while resisting its frame underscores the deeper challenge these knowledge systems pose to developmental classification.

Rather than a hybrid product of Western influence, stick charts reflect a different form of infrastructure: one that evolved in response to both indigenous needs and multipolar imperial pressures. This tension between indigenous adaptation and colonial categorization underscores the challenge of historicizing extrastate knowledge systems in the Marshall Islands. Finney made an extensive survey of charts in museum collections made before 1940, but oddly he seems to have been unaware of the earliest documented collection at Cambridge University dating from 1875. They had been given to the Royal Colonial Institute by George Le Hunte, the private secretary to Sir Arthur Hamilton-Gordon, Governor of Fiji from 1875 to 1880.[19] These charts offer crucial insight into pre-colonial Marshallese navigation before the full force of German and British imperial interventions.

Unlike later charts, which were increasingly framed as ethnographic curiosities and found on the walls of colonial outposts, these earlier examples were likely still embedded in active training and navigational use. Their survival in British collections nevertheless highlights the colonial process of extracting and recontextualizing indigenous knowledge as part of the emerging imperial infrastructure.

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18 Ben Finney, "Nautical Cartography and Traditional Navigation in Oceania," in *Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies*, ed. David Woodward and Malcolm G. Lewis (Chicago, IL: University of Chicago Press, 1970), 482, 485. Finney's argument is subtle, but he does argue that it is a fundamental error to think "that the charts portray currents on which the navigator guides his canoe, not the ocean swells."

19 The information on their acquisition is spotty, coming from a 1928 article about the donation, which misleadingly states that George Le Hunte donated them in 1875 as Governor of Fiji. He appears to have started as secretary to the governor in 1875 and probably acquired them after that point. They were first described by Henry Lyons, "The Sailing Charts of the Marshall Islanders," *The Geographical Journal* 72, no.4 (October 1928): 326. Finney does cite this article for a different part of the table. The four surviving Cambridge charts are RCS/ORCS.9.03.1 (*rebbelib*) former ref: 1927–8; RCS/ORCS.9.03.2 (*mattang*) former ref: 1927–6); RCS/ORCS.9.03.3 (*meddo*) former ref: 1927–7); RCS/ORCS.9.03.4 (*mattang*) former ref: 1927–27. A fifth *mattang* chart (1925–7) seems to have been lost sometime between 1962 and 1982. See also Rachel Rowe, "Marshall Island sailing charts", Cambridge University Library, accessed July 3, 2025, https://www.lib.cam.ac.uk/collections/departments/royal-commonwealth-society/collections/marshall-island-sailing-charts; and personal communication with Sally Kent, Curator, Royal Commonwealth Society Collections, Cambridge University Library.

They include one overall chart, a *rebbelib* in the same genre as the two Stevenson charts, as well as one regional chart (*meddo*) and three training or abstract charts (*mattang*). The *meddo* chart is very similar to one at Stuttgart described in 1902 by the German sea captain and amateur scholar Albert Schück as representing Ebon, Memorik, Kili, Ailungslablab, and, in the center, Jaluit. The shell representing Jailut has fallen off the Cambridge copy.[20] The *mattang* in Figure 3b is an abstract representation of water patterns around Jailut Atoll, a ninety-one-island atoll with only 13.4 square kilometers of land and a 690 square kilometer lagoon. The *meddo* and the *mattang* are the strongest arguments for the provenance of these charts as specific products of Jailut.

Because the Cambridge charts have been relatively neglected in the literature, the question of how they were obtained has also been ignored. Indeed, the desire to abstract Marshallese charts from their material history has obscured how museums acquired them in almost all cases. From anthropological work done starting in the 1950s, as well as some comments in the earlier literature, it is almost certain that any use of charts would be accompanied by Marshallese chants (*roro*), a practice used for many things but especially navigation (*meto*). The educational and sailing process involved reciting navigation signs or sea marks (*koklal* or *kaikolle*) in a *roro* to help train the navigator (*ri-meto*) to remain mindful of his task under stressful conditions. Navigator *roro* were secret, as were similar *roro* for divination (*ri-bubu*), magic (*ri-anijnij*), weather (*ri-lale-lan*), and medicine (*ri-wuno*). By the 1950s, all were spoken in what was called the archaic language (*kajin etto*). They had hidden or deep meanings (*mwilal*, similar to Hawaiian *kaona*) ascribable to both the language and the teacher.[21] In the context of competing scholarly and imperial interpretations, with the first focused anthropology coming with American occupation in the 1950s, the charts become striking but ultimately strange emblems. However, when considered in this broader sense as elements of a transforming late nineteenth-century Marshall infrastructure that survived various imperial overlays of knowledge, they suggest something far more complex.

20 See Albert Schück, *Die Stabkarten der Marshall-Insulaner* (Hamburg: Kommissionsverlag von H. O. Persiehl, 1902), plate VII, fig. 42. Schück was the first to try to make a survey of known charts – citing forty-three, with twenty-nine in Germany, six in the United States, three in Honolulu, two in Sydney, two in Great Britain, and one in Vienna. He too had been unaware of the Cambridge Charts. See also his first publication, Albert Schück, "Die astronomischen, geographischen and nautischen Kentnisse der Bewohner der Karolinean und Marshallinseln in westlichen Grossen Ozean," *Aus Allen Welttheilen* 13 (1882): 51–57. The latter publication is perhaps the first to consider these as knowledge (*Kenntnisse*) systems.

21 See Jack Tobin, *Stories from the Marshall Islands: Bwebwenato Jan Aelon Kein* (Honolulu: University of Hawai'i Press, 2002), 7–8.

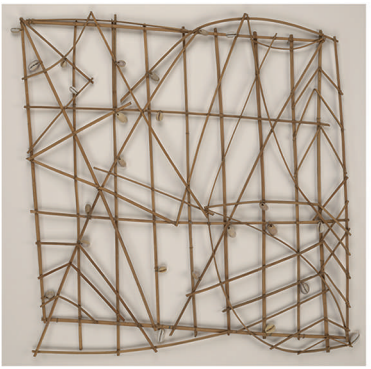

Figure 3a

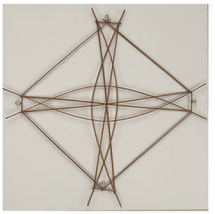

Figure 3b

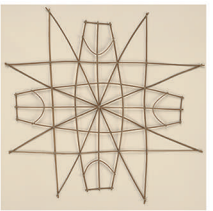

Figure 3d

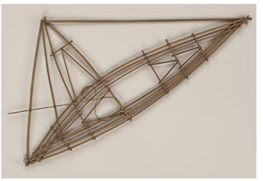

Figure 3c

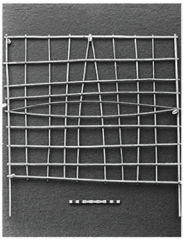

Figure 3e

Figure 3: The Cambridge Marshall Islands charts, ca. 1875. Collection of five Marshall Island charts, given to the Royal Colonial Institute by Sir George LeHunte, then private secretary to Sir Arthur Hamilton-Gordon, Governor of Fiji. Royal Commonwealth Society Library. The *rebbelib* chart (RCS/ORCS.9.03.1) was on display at the Science Museum (London) until 2024, when it along with the other three surviving charts were returned to the Royal Commonwealth Collection, Cambridge University Library.
3a *Rebbelib* chart, RCS/ORCS.9.03.1 (formerly 1927-8), Cambridge University Library.
3b *Mattang* chart, RCS/ORCS.9.03.2 (formerly 1927-6), Cambridge University Library.
3c *Meddo* chart, RCS/ORCS.9.03.3 (formerly 1927-7), Cambridge University Library. Former ref: 1927-7.
3d *Mattang* chart, RCS/ORCS.9.03.4 (formerly 1927-27), Cambridge University Library. Former ref: 1927-27
3e *Mattang* chart. Now lost. Former ref: 1925-5.
Reproduced by kind permission of the Royal Commonwealth Society/Cambridge University Library and the Science Museum.

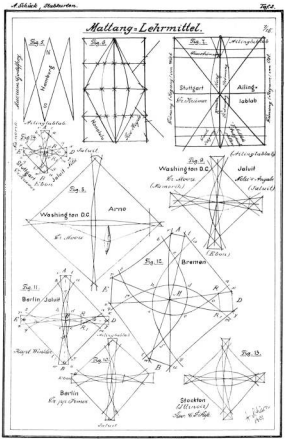

Figure 4a

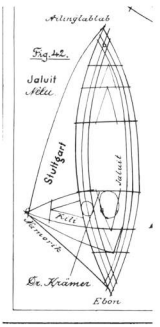

Figure 4b

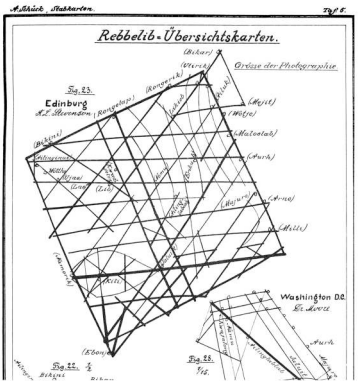

Figure 4c

Figure 4: A selection of Marshall Islands charts drawn by Albert Schück, *Die Stabkarten der Marshall-Insulaner* (Hamburg: Kommissionsverlag von H. O. Persiehl, 1902).
4a Different charts dating from the 1890's that match the *mattang* chart now at Cambridge in Figure 3b. All of these represent Jaluit. Table 2, figures 5 to 13 in original.
4b A *meddo* chart of Jaluit from Stuttgart very similar to the one at Cambridge, Figure 3c. Table 7, figure 42 in original.
4c Schück's identification of places on the Stevenson map (at the time on display in Edinburgh). Table 5, figure 23 in original.

Imperial entanglements: Stick charts in the context of nineteenth-century colonialism and climate

Materially, 1875, the year the Cambridge charts were obtained, was a very important date. In 1875, one of the worst typhoons in the history of the Marshall Islands struck. This helps explain how George Le Hunte acquired such a remarkable and diverse collection of charts, which were generally kept as secrets among different lineage groups connected to rituals.

Made up of twenty-nine coral atolls and 1225 islands and islets, the Marshall Islands comprise ten percent of all coral atolls in the world, including the largest, Kwajalein. None rises more than twenty feet (six meters) above sea level, averaging six-and-a-half feet (two meters). Because of this, they are extremely vulnerable to the storm surge of typhoons (*lañ* or the loan word *taibuun*). The result can be the depopulation of whole islands as storm surge sweeps across the islands. In ad-

dition to deaths from drowning, this can also result in the complete loss of food supplies – especially coconut and breadfruit trees, which take a long time to replenish. The first recorded typhoons date from the 1840s, although no doubt many occurred before that. The more severe storms seem to correlate with ENSO (*El Niño*) events when sea surface temperatures are higher. The November 1875 typhoon occurred in a non-ENSO year and unusually late in the season, which begins in July and peaks in August and September.[22] There is an open and likely unresolvable question of whether such late nineteenth-century climate disasters have any relationship to planetary warming as a whole, as the depopulation and reforestations of Columbian Exchange cooling gave way to renewed warming in the nineteenth century. This shift would have altered ocean weather patterns in both the early modern period and then again in the nineteenth century.[23]

Regardless of causality, as well as the impossibility of measuring shifts in intensity and frequency in this period, because of the 1875 typhoon Kwajalein, the largest atoll in the world, was completely depopulated by an eight-foot storm surge. The storm surge affected the other atolls as well. On Jaluit Atoll, where the Cambridge charts come from, three ships belonging to the German trader Adolph Capelle as well as a Russian ship, the *Julie Reitz*, were driven ashore and their copra cargoes lost. Mary Colcord, the wife of the captain of the missionary ship *Morning Star*, wrote in her diary that Jaluit was,

> quite a desolate sight; ships bilged on the beach, trees up rooted in every direction, and blocking the roads and paths. Hardly a green leaf to be seen; even the leaves of the bushes shriveled and blackened. Some of the trees bent halfway to the ground by the wind still remain, so one can almost imagine the tornado still going on! The people are very downcast; so many breadfruit and coconut trees uprooted, and most of those standing [with] leaves all dead. They fear a famine.[24]

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22 Dirk Spennemann and Ian Marschner, *Stormy Years: On the Association between the El Niño/Southern Oscillation Phenomenon and the Occurrence of Typhoons in the Marshall Islands* (Albury, N.S.W.: Johnstone Centre of Parks, Recreation, and Heritage, Charles Strut University, 1994).

23 Recent scholarship has pointed to the disease epidemics of the Columbian Exchange creating cooling in the seventeenth century because of reforestation of the Americas, which would have disrupted island navigation patterns as well as crops. This pattern reversed would be reversed in the eighteenth and nineteenth centuries, with population growth, deforestation due to shipping and agriculture, and the increasing use of coal. Simon Lewis and Mark Maslin, "Defining the Anthropocene," *Nature* 519 (2015): 171–180; Simon Lewis and Mark Maslin, "A transparent framework for defining the Anthropocene Epoch," *The Anthropocene Review*, 2, no.2 (2015): 128–146.

24 Mary Colcord, *Journal aboard the Missionary packet "Morning Star" on voyage to Micronesia-1875* (1875), 42, typescript by Joanna Colcord, NSW State Library, 279.9/C. Colcord was the wife of

The disaster came on the heels of a widespread syphilis epidemic that started among the elite in the 1850s, which had supposedly been brought back by two clan heads who returned from a shipwreck on Kosrae in the Caroline Islands. By the 1870s, a large amount of ship traffic was visiting the islands, coming from Hawaii, the United States, Germany, France, Britain, and various missionary and private groups.[25] Arguably, the disaster could be understood as a mixture of late Columbian Exchange patterns of disease and of storm intensity. Of course, no European or Pacific Islander in the 1870s would have conceptualized change in this manner.

The mid-1870s thus launched a key phase in the contestation and redefinition of indigenous oceanic knowledge. Spain had claimed the islands in 1874, the year before the great typhoon, as part of Manila's expansion of sovereignty eastward from the Carolines. Fearing that the United States might move in, Britain began secret negotiations with Germany in 1875. After the typhoon, which the Spanish had no resources to address, Germany claimed the islands were unoccupied. They eventually purchased most of them from Spain in 1885 during the scramble for the Pacific. Ben Finney was thus right to be suspicious of such charts, especially those acquired, classified, and described after the 1880s. But it does seem like 1875 might have been the turning point, a moment of imperial competition marked by natural disaster that created the conditions on Jailut for once tightly controlled objects to begin to circulate on a global scale.[26]

Subsequent typhoons also had important regional effects on the balance of imperial powers and techniques of development, and by 1890, when the Stevensons arrived, substantial changes had taken place in both navigation and mapping. In 1889, another devastating tropical cyclone or typhoon at Apia, Samoa, ex-

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the missionary and ship captain Andrew Colcord. The typhoon caused significant damage on Kili, Jaluit, Namorik, Kwajalein. Ebon, and possibly Mile. The information on the complete destruction of Kwajalein comes from James Young, *Diary* (1875–1877), 152, entry for July 14, 1877, and 153, entry for July 17, 1877, Mitchell Library, Sidney (Canberra: Pacific Manuscripts Bureau, n.d.) PMB 21. Young was a trading station manager for the copra firm of Thomas Farrell, the competitor of Capelle and Co from 1876. The typhoon of 1875 was such an important event that according to Young, indigenous survivors on other islands used it as a reference point for preparing for storms that followed. On Capelle and Farrell see Francis Hezel, *The First Taint of Civilization: A History of the Caroline and Marshall Islands in Pre-Colonial Days, 1521–1885* (Honolulu: University of Hawai'i Press, 1994), 216–225

25 See the database compiled by Dirk Spenneman, "Ships visiting the Marshall Islands (until 1885)," accessed July 3, 2025, https://marshall.csu.edu.au/Marshalls/html/Shiplist/Year-1875.html.

26 On the broader issue of loot in relation to German colonialism in the Pacific see Götz Aly, *The Magnificent Boat: The Colonial Theft of a South Sea Islands Treasure* (Cambridge, MA: Harvard University Press, 2023).

acerbated the broader power struggle among the United States, Britain, Germany, and different elite factions on different islands in both Samoa and the Marshalls. New "unprotected" (lightly armored) German cruisers designed to serve as floating administrative platforms, the SMS *Sperber* (1889) and SMS *Bussard* (1890), arrived after the Apia Cyclone sank six ships from the US and German navies. These new mobile infrastructures would shift the nature of colonialism in the region. Germans encouraged the planting of coconut palms to generate both an economy and population growth, concentrated in plantations. This trade had previously been dominated by private firms and pirate slavers from the 1860s to the 1880s. Sail-powered trade ships looking to collect and carry copra (dried coconut cores) had arrived in large numbers during the 1870s, as did increasing corporatization of the copra trade by German firms using typhoon refugees. The colonial-era copra industry exemplifies the imposed developmental infrastructures that sought to transform Marshallese society into a profitable site for German colonial extraction. The *Deutsche Handels- und Plantagen-Gesellschaft* (DHPG) established large-scale copra plantations in Jaluit (Jaluit Gesellschaft) and Ebon Atolls in the 1880s, enforcing a system of coerced indigenous and imported Micronesian labor. These plantations became the primary economic foundation of German control in the region, integrating the islands into a global commodity trade network. The shift to plantation-style copra production displaced indigenous farming, fishing, and exchange practices, aligning the Marshall Islands with an external logic of developmental progress that prioritized monocrop export production for imperial markets.

Robert Louis Stevenson wrote about this new world of copra in *The Beach of Falesá* (1892) and *The Ebb-Tide* (1894) just after the new German cruisers shifted the nature of maritime governance in the region.[27] The Marshall Islands charts given to Robert Louis and Fanny Stevenson are artifacts from the world of 1890, not 1875, and they were clearly embroiled in imperial competition between the British, the Germans, Americans, and even the Japanese in the scramble for the Pacific. Commercial competition related to copra had by this point become entangled in the colonial imaginations of the "great powers."[28] The Stevensons acquired them at the German seat of government on Jailut on the voyage of the *Janet Nichol* in June 1890. Fanny Stevenson tells the story of seeing these German trophies of colonial dominance,

27 See Roslyn Jolly, "Piracy, Slavery, and the Imagination of Empire in Stevenson's Pacific Fiction," *Victorian Literature and Culture* 35, no.1 (2007): 157–173.

28 Ann Colley, *Robert Louis Stevenson and the Colonial Imagination* (Routledge, 2017); Rosalind Williams, *The Triumph of Human Empire: Verne, Morris, and Stevenson at the End of the World* (University of Chicago Press, 2013).

> The [German] commissioner's [Max Bierman] room was decorated with trophies of native arms, armour, etc. He promised to have a native sailing chart made for Louis. These charts are very curious things, indeed, made of sticks, some curved, some straight, caught here and there by a small yellow cowry. The cowries represent islands, the sticks both currents and winds and days' sailing. The distances between the islands have nothing to do with miles, but with hours only. These charts are very little used now, only one old chief knowing how to make them, but the time was when each young chief must pass his examination in the charts, knowing them by heart, as they were never taken to sea but kept at home for reference and continual study.

The Stevensons returned to Jailut on the 26th of June, and Fanny wrote,

> Went to see the commissioner where we found our island charts awaiting us. Louis and the commissioner and Captain Brandeis [a German spy who had fled from Samoa] tried to make out the names of the islands by comparing the charts with our European map, but failed; a man who had been thirty years in the islands was consulted, and afterwards a native, but still they were baffled. It was finally settled that the thirty-year resident should see the maker of the charts (now absent) and get a complete key to be sent to Samoa.[29]

If Fanny Stevenson is to be believed, the large *rebbelib* charts were already in 1890 artifacts of an earlier, perhaps pre-typhoon era. But the charts had become more map-like than they had been in 1875, and the Stevensons brought back no *meddo* or *mattang* charts.

The Stevenson maps seem to have remained behind to be marked up (the Penn copy has inscriptions on it in pencil in a German hand). They were sent to the Stevensons after they had returned to Samoa and moved into the larger Vailima house in April 1891, where Robert Louis died three years later. Fanny's daughter, Isobel Strong, who had worked as Robert's literary assistant in Samoa, sold off the charts as part of a large auction in 1914. Fanny had died that February, and Isobel married her mother's secretary as well as published posthumously Fanny's diary of the voyage. That same year, the Japanese took control of the Marshall Islands as the Germans went to war in Europe. Penn and the American Museum of Natural History bought the charts, anticipating the new emerging world order in the Pacific.[30] In the University of Pennsylvania *Museum Journal* of 1919, Henry Usher Hall, the Ethnology Curator, criticized Fanny Steven-

29 Fanny Van de Grift Stevenson, *The Cruise of the 'Janet Nichol' Among the South Sea Islands* (New York: Claude Scribner's sons, 1914), 151, 160.

30 *Autograph Letters.* One (Penn, lot 613) is rectangular 2ft. 3in x 4ft, and the other American Museum of Natural History is square (2ft 10 x 2ft 8, lot 614). In addition, Stevenson brings a large amount of Marshall Island ebony bead and orange and white shell money back (lots 564–575).

son's interpretations of the charts as uninformed, misreading from a more naive era before German scholarship, especially the idea that some of the sticks represented currents rather than ocean swells.[31]

Hall, in particular, relied on the work of the German writer "Captain Winkler," who had been canonized in the United States by a translation of his 1898 German work by the Smithsonian in 1901. Although nobody in the United States seems to have known his first name, Otto Winkler began his work trying to understand the charts as swell diagrams in 1896. That year he received from a Dr. Irmer, the German land inspector, two charts. Irmer knew nothing about them, claiming they were surrounded with "great secrecy" among the older chiefs. Winkler then interviewed one of the old chiefs in Jaluit named Lojak by way of Irmer's assistant and translator Ladjur. But Lojak refused to tell Winkler or Ladjur anything substantial. Winkler then asked around and only got the explanation about the charts showing currents, which he did not believe because "the current cannot be seen in open water." The next year, Winkler interviewed Lojak a second time, with the help of a new half-Portuguese interpreter named Jochem de Brun. He found that as a "chief" rather than a navigator, Lojak himself did not know what he was talking about. Instead, Jochem interviewed his own navigator, Laumanuan, although this too produced vague results. Such interactions hardly count as the work of "go-betweens" or "native informants." Winkler attributed poor communication to a decline in knowledge on the part of the Marshall Islanders.[32]

It was out of these and a few other conversations that Winkler pieced together the story about swells, arguing the charts were mainly for educating young "chiefs" because the knowledge of navigation was increasingly disappearing among the older generation. These kinds of charts could also be useful authoritative reference points in debates about which direction to go in, when "water indications were not plain and varying interpretations had been made." Winkler thus suggested (as Ben Finney would later) that the charts were in fact nineteenth-century artifacts, representing an effort by male elites, shattered by both disease and typhoons, to create new kinds of local authority through ritual and education. Here, Winkler anticipates the controversial "big man" argument made by Marshall Sahlins in the early 1960s.[33] New techniques would address new needs

31 Hall, "A Marshall Islands Chart," 35–42. Hall's real expertise was in 'aboriginal Siberia,' as he had led along with the Polish anthropologist Maria Antonina Czaplicka a joint expedition sponsored by the Pitt Rivers and Penn Museums to the Yenisei River.

32 Winkler, " Über die in früheren Zeiten in den Marschall-Inseln gebrauchten Seekarten," 1418–1439; see also Schück, *Die Stabkarten der Marshall-Insulaner*, 24–7.

33 Winkler also anticipates the argument of the Catholic missionary Bernard August Erdland, *Die Marshall-Insulaner: Leben und Sitte, Sinn und Religion eines Südsee-Volkes* (Münster: Aschendorff

and create new authority infrastructures in relation to both post-disaster migrations. They would allow localized island kinship groups to think of the Marshall Islands as a collective entity. Even before he published the details of his investigations, Winkler's findings would be embedded in the new German Colonial Atlas in 1897. The shift to clearly defining the charts as maps also helped define relations in the short-lived archipelagic colony of "German New Guinea" (1884–1920). The results were a positivist victory over primitive and fragmented knowledge, a dominance over new and emerging forms of authority in the colony itself. The idealized blue landscape of the German colonial archipelago superseded the old, limited knowledge of the regional *meddo* and its alternate system of authority.

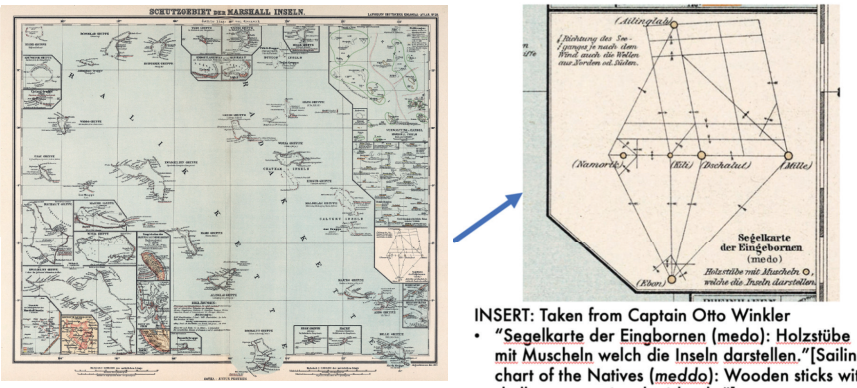

Figure 5: Paul Langhans, "Schutzgebiet [Protectorate] der Marshall Inseln," *Deutscher Kolonial-Atlas* (Gotha: Justus Perthus, 1897), map dated May 1893, with insert after Captain Otto Winkler.

The Stevenson charts, created just before the Winkler charts, thus represent a moment when both the German and the American states and their respective knowledge communities were becoming aware of the value of such charts as an infrastructure for building what Benedict Anderson has called "official nationalism" out

Verlag, 1914). See the summary in Joseph Genz, *Breaking the Shell: Voyaging from Nuclear Refugees to People of the Sea in the Marshall Islands* (Honolulu: University of Hawai'i Press, 2018), 66–70. Erdland argues that German colonialism reduces the social structure into a more patriarchal system with commoners (*ri-jerbal*), lineage heads (*alap*), and chiefs (*roij*), the latter having direct relationships with German colonial authorities in an effort to push the development of the copra trade and end inter- and intra-island fighting over food resources.

of indigenous infrastructures. For Anderson, official nationalism was a conservative and anticipatory response to popular nationalism, adopted by dominant and especially imperialist groups in order to control the struggles and rivalries emerging in the late nineteenth century.[34] In 1899, two years after Winkler published his map, Charles Townsend and H. F. Moore of the United States Fish Commission would acquire a set of charts comparable to what the British and the Germans had on the USS *Albatross* Expedition.[35] This expedition is famous for discovering manganese nodules on the ocean floor, now the target of an ocean mining rush.

These four moments – 1875 (typhoon), 1890 (Stevenson), 1896 (Winkler), and 1899 (*Albatross*) – in the collecting of Marshall Island charts suggest that it is problematic to think of these charts as static, as if they belonged to a people without history, or even to think of a single tradition of "stick charts."[36] Rather than seeking origins, it is more important to think about what specific charts at specific times might have been trying to do, especially in the context of devastating typhoons, famines, and epidemics. There is now general agreement among both scholars and current Marshallese navigators that they depicted currents, swells, and super swells in an effort to understand wave patterns.[37] There also seems to be general agreement that the fragile charts were used in educational settings on land rather than for navigation at sea. Unlike the maps supposedly replicated from examples created in Tahiti (Tupaia) and the Carolines, maps explicitly created in response to queries generated by Europeans, the Marshall Island charts have generally been seen as a kind of trade secret. They formed part of the educational process for navigators from different islands, handed down from masters to apprentices and that education both evolved and differentiated.

The charts were in some ways an emerging ocean science for people who found themselves increasingly displaced by both oceanic and imperial changes.

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34 See Benedict Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism* (London and New York: Verso, 1991), 83–112; as well as Benedict Anderson, *The Spectre of Comparisons* (London and New York: Verso, 1998), 47–55, 233–237.

35 Smithsonian Institution Archives, Record Unit 95, Box 77, Image No. 13037, https://siarchives.si.edu/collections/siris_arc_308085.

36 Note that the phrase stick chart comes from the German "*Stabkarten.*" The comprehensive Marshallese term is a loanword from English – "*jaat*" – and there are three different pre-colonial words.

37 The most detailed and recent assessment of this can be found in the work of the anthropologist and student of Ben Finney, Joseph Genz with captain Korent Joel, a nuclear refugee from Rongelap, esp. Joseph Genz, "Complementarity of cognitive and experiential ways of knowing the ocean in Marshallese navigation," *Ethos* 42, no.3 (2014): 332–351; Joseph Genz, "Resolving ambivalence in Marshallese navigation: Relearning, reinterpreting, and reviving the 'stick chart' wave models," *Structure and Dynamics* 9, no. 1 (2016): 8–40; and Genz, *Breaking the Shell.*

They served multiple purposes – education, navigation, and social cohesion. Rather than a linear progression from "indigenous" to "colonial" knowledge, the charts gave definition to contested spaces where different actors sought to define, appropriate, or erase local epistemologies. This explains why the same artifacts appear across British, German, and American expeditions, each reinterpreting the charts to fit their own developmental and scientific narratives.

Proto-anthropology, development science, and the objectification of Indigenous knowledge

Maps tend to be thought of as stable and official representations – an aura conveyed by print and mechanical reproduction. Berlant notes, by contrast, that "infrastructures… manage ongoing relational disturbances."[38] It is perhaps not surprising, then, that the charts have become the subject of debates surrounding notions of indigeneity. Were they imitations of charts brought by sailors and missionaries, or had they predated the European and American arrival in the Pacific? If there was some kind of borrowing, could it have occurred in the early sixteenth century when the Spanish arrived early in the Columbian Exchange (1526) and then developed into a rich and independent tradition over the next three centuries?[39]

For these kinds of questions, the period of analysis must shift to the early nineteenth century, when the proto-anthropological record began to take shape. From the arrival of the British captains John Marshall and Thomas Gilbert in 1788 in the Marshalls to the first description of the charts in 1862, this period rep-

38 Berlant, *Inconvenience*, 22.

39 The Marshall Islands received a small number of Spanish visitors after their sighting by Alonso de Salazar in 1526. This began with the brief visit of the expedition of Álvaro de Saavedra Cerón on the *Florida* in 1529, which anchored (*surgí*) at three low islands (*tres islas bajas*) at 11.5 degrees N (possibly Bikini, Rongelap, and Rongrik or Enewetak). See "Relacion del iage que hizo Alvaro de Saavedera" in *Colección de los viages y descubrimientos.* 5, Martín Fernández de Navarrete (Madrid: Royal Printing House, 1825), 475. A six-ship fleet arrived under Ruy Lopez de Villalobos in December 1542. The Afro-Portuguese pilot Lope Martin first came in the *San Lucas* (January 1565) and then in the *San Jerónimo.* which he seized and landed at Ujelang Atoll. He was marooned with 26 crewmen in July 1566. See Andrés Reséndez, *Conquering the Pacific: An Unknown Mariner and the Final Great Voyage of the Age of Discovery* (New York: Houghton Mifflin, 2021]. In September 1568, Álvaro de Mendaña and his pilot Hernán Gallego landed at Namu Atoll ("San Mateo Shoals"), where they found a Spanish nail and rope. Alvaro De Mendaña, *The Discovery of the Solomon Islands*, trans. Wiliam Amhurst and Basil Thomson (London: Hakluyt Society, 1901), 185.

resents the emergence of the region as a "borderwater" understood through a Russian-led proto-anthropology that emerged before the typhoon of 1875. After 1788, when the British "first fleet" created the colony of New South Wales in Australia, the Marshall Islands became part of the "easternmost route" to China from Sydney. Both the *Charlotte* (captain Thomas Gilbert) and the *Scarborough* (captain John Marshall) had been part of the "First Fleet" to Port Jackson, NSW, and had left in 1788 to travel to the Pearl River Delta. This "easternmost route" to China from Sydney meant that ships regularly passed by Namu and avoided the difficult passages of the archipelagos as well as the western intensification of the South Pacific Gyre.[40] The British colonization of the supposed *terra nullius* of Australia turned the Marshall Islands into a borderwater between the Qing and the British empires, which demanded a reconceptualization of space, but the region itself attracted the interest of Russia, which in an effort to pursue the trans-Pacific sea otter pelt trade with China had built Fort Ross in what is today Northern California.

Most accounts of the charts begin in 1862, and they skip over the 1875 typhoon, and they include, with the partial exception of Finney, quite limited if any information about the new role of the Marshall Islands from the 1790s as part of the trade between Sydney and China or the involvement of Russian explorers.[41] As a borderwater, missionaries, whalers, traders, and a range of imperial powers (Britain, France, Spain, Russia, the newly-formed United States) using ships with multi-ethnic crews quickly moved into these Pacific spaces from the late eighteenth century, and they brought with them a range of technical media.

But only during the second Hawaiian Renaissance of the 1970s was there a conceptualization of what Roger Green and Ben Finney called "Remote Oceania," a space settled "using deep-sea voyaging canoes, ways of navigating far out of sight of land, and a portable system of agriculture."[42] The history of Remote Oceania, as

40 Rhys Richards, "The Easternmost Route to China and the Robertson Aikman Charts," *The Great Circle* 8, no. 1 (April 1986): 54–67; Rhys Richards, "The Easternmost Route to China: The British Pioneers," *Great Circle* 8, no. 2 (October 1986): 104–116; Rhys Richards, "The Easternmost Route to China: The American Pioneers and the Trans-Pacific Traders," *Great Circle* 9, no. 1 (April 1987): 48–59.

41 See James Clifford, "Fort Ross Meditation," in *Routes: Travel and Translation in the Late 20th Century* (Cambridge, MA: Harvard University Press, 1997), 333, about the shifting ecologies and temporalities of Pacific borderlands.

42 Ben Finney, "The Pacific Basin: An Introduction," in *History of Cartography*, vol.2, book 3, ed. David Woodward and Malcolm G. Lewis (Chicago, IL: University of Chicago Press, 1998), 419. For the definition see Andrew Pawley and Roger Green, "Dating the Dispersal of the Oceanic Languages," *Oceanic Linguistics* 12, no.1 (1973): 1–67; Roger Green, "Near and Remote Oceania – Disestablishing 'Melanesia' in Culture History," in *Man and a Half: Essays in Pacific Anthropology*

a borderwater between the Pacific and maritime East Asia, goes back much further than the 1790s. The argument is largely about technical achievement and abstract environmental conditions, with innovations in Near Oceania setting up the possibility of Remote Oceania. As Paul D'Arcy argued in a more environmentally deterministic way, because of large gaps between islands and archipelagos as well as limited land area, "Remote Oceania is a truly oceanic environment, one of the few settled by humans."[43] However, one could also turn this argument on its head. The Marshall Islands have been on the front of Anthropogenic climate change since the 1870s, and before that, for two thousand or even four thousand years, people living there had to embrace a radical sensitivity to Holocene climate and sea level changes – warm periods and little ice ages – demanding an equally flexible infrastructure.

The British captains Marshall and Gilbert were not particularly attentive to these kinds of questions in 1788, nor were more broadly the Cook expeditions in that period, which did not visit the islands. Otto von Kotzebue's arrival in the *Rurik* in 1817 on the second Russian expedition into the Pacific was different, however, and more sensitive to the question of extrastate infrastructure. Kotzebue visited both the Ratak and Ralik Island chains of the Marshalls, working with the naturalist Adelbert von Chamisso and the artist Louis Choris. Inspired by Cook's work with Tupaia, Kotzebue worked with the elderly Lagediack, as a "friend and teacher," among other islanders to make the first comprehensive map of the islands.[44]

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and Ethnobiology in Honor of Ralph Bulmer, ed. Andrew Pawley (Auckland: Polynesian Society, 1991), 491–502; Ben Finney, "Colonizing an Island World," in *Prehistoric Settlement of the Pacific*, ed. Ward Goodenough (Philadelphia, PA: American Philosophical Society, 1996), 72. This two-fold division was pioneered by Marshall Sahlins in the early 1960s for different purposes. Unlike Finney and Green (who do not cite Sahlins), he argued that it had fundamentally political rather than technical implications, with larger and male-chief dominated polities emerging in Polynesia (Remote Oceania) as opposed to Melanesia (Near Oceania), see Marshall Sahlins, "Poor Man, Rich Man, Big-Man, Chief: Political Types in Melanesia and Polynesia," *Comparative Studies in Society and History* 5, no.3 (April 1963): 285–303. The first major critique of Sahlins's argument was Bronwen Douglas, "Rank, Power, Authority: A Reassessment of Traditional Leadership in South Pacific Societies," *Journal of Pacific History* 14, no.1 (January 1979): 2–27, arguing that a highly diverse set of political formations characterized the region, something particularly true of Micronesia.

43 Paul D'Arcy, *The People of the Sea: Environment, Identity, And History in Oceania* (Honolulu: University of Hawai'i Press, 2006), 9.

44 The report of the privately-financed expedition was published first in Germany, then in London, and finally in Russian, see *Entdeckungs-Reise in die Süd-See und nach der Berings-Strasse zur Erforschung einer nordöstlichen Durchfahrt unternommen in den Jahren 1815, 1816, 1817, und 1818, auf Kosten Sr. Erlaucht des Herrn Reichs-Kanzlers Grafen Rumanzoff auf dem Schiffe Rurick*

In accounts of the expedition, Kotzebue's encounter with Lagediack on Wotje Island receives a relatively extensive description as a "writing lesson" along the lines of Lévi-Strauss.[45] It begins with the notion of writing as magic – if Lagediack's name is written down it will metamorphose the person into letters – but then it took a strikingly different turn. Maps were different kinds of signs than names for Lagediack. Lagediack exhibited no fear in tracing out and marking with coral rocks the islands, channels, atolls.[46] Kotzebue has another elderly man named Langemui describe the Ralik chain, where he had been severely scarred from wounds received in a battle. The double island chains of the Marshalls may have encouraged mapping because of the distance between the two, but perhaps so did regular interactions with the more distant and linguistically distinct Caroline Islands. Kotzebue meets the castaways Edock and Kadu from Woleai in the Caroline Islands, and they also draw a chart for him.[47] Castaway Caroline Islanders had drawn charts in the early eighteenth century for Spanish Jesuits in the Philippines, and Kotzebue was aware of this tradition of charting, as he was of the Tupaia example from the Cook expedition.

Kotzebue arrived on 1 January 1817 at Mejit, which he called New Year Island. Mejit was and still is one of the most remote and poorly resourced of the islands. It pokes out with Utrik on a little trapezoid on the Stevenson-type maps to the northeast. There, Kotzebue encountered seven canoes, each with five or six men (*tibnol*) "entirely made of very small boards" patched together, which he argued, not unpersuasively, "proved a want of timber." Mejit had, in 1817, according to Kotzebue's Lieutenant Schischmareff, lots of pandanus for food as well as basket and housing thatch, limited large breadfruit (used for the hull), and very few coconut trees (used for various parts, including rope).

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unter dem Befehle des Lieutenants der Russisch-Kaiserlichen Marine Otto von Kotzebue (Munich: Hoffmann, 1821); translated as *A Voyage of Discovery into the South Sea and Beering's Straits, for the purpose of exploring a North-East Passage, undertaken in the years 1815–1818, at the expense of His Highness the Chancellor of the Empire, Count Romanzoff, in the Ship Rurick*, 3 vols. (London: Longman, 1821); and Атлас к путешествию лейтенанта Коцебу на корабле Рюрике в Южное море и в Берингов пролив (St. Petersburg: n.p, 1821–1823).

45 "C'est un étrange chose que l'écriture… Le seul phenomenon qui l'ait fidèlement accompagnée est la formation des cites et des empires… elle paraît favoriser l'exploitation des hommes avant leur illumination." [Claude Lévi-Strauss, "Leçon d'écriture," *Tristes tropiques* (Plon, 1955), 352–354.

46 Kotzebue, *A Voyage of Discovery*, vol.2, 69–70.

47 See Kotzebue, *A Voyage of Discovery*, vol.2, 132–133 and chart. Ben Finney argues that this chart may be a synthetic effort using the 1722 chart made by the Jesuit Juan Antonio Cantova, who interviewed Caroline castaways in the Philippines. See Finney, 453–456.

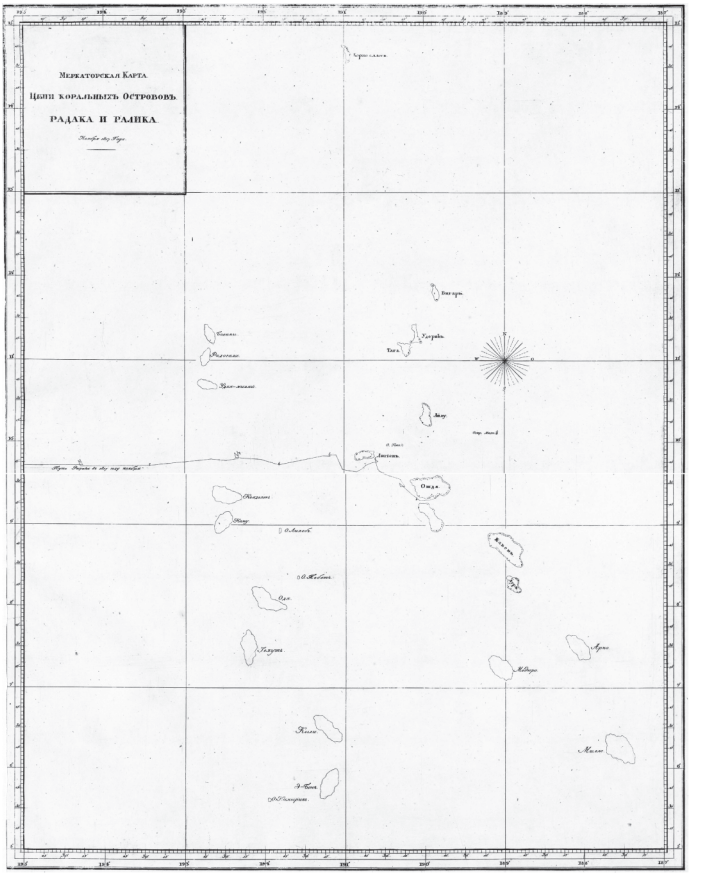

Figure 6: Otto von Kotzebue, Louis Choris, and Langemui, "Меркаторская карта Цепи коральных островов Радака и Ралика. Ноября 1817 года" [Mercator map of the chain of coral islands of Radaka and Ralik. November 1817] (St Petersburg: n.p., 1821–3).

Pandanus, breadfruit, and coconut were the three key trees. Kotzebue would later see, and be impressed by, larger canoes with outriggers and sails, but it was the coconut coir lashings that initially caught his eye as a sailor. Marshall Islanders developed an elaborate language for these big boats, and they are symbolically represented on the charts. The charts, in their nineteenth-century versions, are tied together with coir (the tourist examples use glue). For such lashings, there is a set of words. *Elmakwot* is the first lashing to hold together while building; *emem* is the main knot holding hull together and other principle parts, which has a different style on different islands; *ino kutileik* are lashings for the *ere* connecting the lee side to the outrigger (*lifr*); *ino in rewa* attaches the outrigger float;

ino in Jobarbar attaches two sail booms together; *ieplik* is for the block in center of lower boom; *eloko* is the lashing of main outrigger booms to shelf in center of main hull; *ino in erer* ties the sacrificial keel or *erer* under main hull. When Kotzebue does later encounter more resource-intensive boats with finely braided sails, carrying twenty-five people, thirty feet long, with lots of rigging and a high mast (a *walap* 'canoe'), they recognize Kotzebue's ship as a species of their own, calling it a "*ellap wa*" ('big boat').

Timber for such large was already in short supply in 1817. The reasons for this could be manifold, ranging from overharvesting and population growth to drought and typhoon damage. Life in a borderwater could be precarious. Shortages meant problems with building canoes as well as food. "The water which runs in is obliged to be constantly baled out; and as they can only leave the island in a perfect calm, they have neither masts nor sails."[48] What is clear is that in the aftermath of Kotzebue's voyage and with the steady arrival of more and more European ships seeking materials for repair and an increase in the frequency of typhoons, there would be increasing losses to larger trees in the very small forests. This was radically exacerbated by the shift to copra (coconut) cultivation over the course of the nineteenth century.

Ideas related to what might be called development seem to stem from Kotzebue's voyage. Even more than his late eighteenth-century predecessors, he was attentive to the ecological dimensions of life in the Marshalls. In 1817, he described the forests as dense pandanus (*bōb*), the main food source, with very tall and thick breadfruit trees (*ma*) with the occasional coconut (*ni*). Some islands had newly planted stands of coconut, and others fully grown ones. There were small taro and banana patches, which seem to have been status and luxury plants.[49] There was already iron (*māāl*) economy for nails and sheet metal as well, perhaps from passing ships but clearly from flotsam as well – as evidenced by beach findings.[50] Kotzebue reported all of this, but he also began actively encouraging the development of Pacific-style market gardens using yams, watermelon, and other seeds brought from Hawai'i to both encourage population growth, provide supplies for passing ships, and prevent famine due to an over-reliance on breadfruit monoculture.[51] This was development science, creating a political economy and stable development that could support visitation by ships in need of resupply (water, food, wood) rather than formal incorporation into an empire.

48 Kotzebue, *A Voyage of Discovery*, vol.2, 6.

49 Kotzebue, *A Voyage of Discovery*, vol.2, 28, 52, 57, 103, 117. The three trees put one in mind of the 'three sisters' of North American indigenous agriculture.

50 Kotzebue, *A Voyage of Discovery*, vol.2, 37, 63.

51 Kotzebue, *A Voyage of Discovery*, vol.2, 24, 26–27, 70–71, 75, 83, 106, 118, 210, 212

ENSO cycles (*El Niño*) have historically created droughts in the Marshall Islands, something that presumably predates any Anthropogenic climate change, killing off large numbers of coconut and breadfruit trees as well as taro and arrowroot. Pandanus, along with fish and other marine life in the atolls, are the basic safety net. Tropical cyclones (typhoons/hurricanes) are also more frequent in *El Niño* years, raising the risk for both coastal flooding and tsunamis. There is a way of viewing these environments that is abstract, like a *mattang* chart that sometimes shows swells as a pure geometric form and other times shows swells as they would occur around an idealized island. But abstraction was only one way of viewing the ocean for Marshall Islanders, and the charts, made of pandanus, coconut, and cowrie shells, were always of constant reminder of the materiality of both the ocean and its connection to the resources of the land, which could become scarce or unevenly distributed in times of crisis. Russian strategies, while extending the Columbian Exchange into the ecologies of the Marshall Islands, did little to solve the question of crisis, while the arrival of large-scale shipping traffic did much to exacerbate it.

Conclusion: Rethinking development through infrastructure

The history of Marshall Islands stick charts offers more than an ethnographic curiosity or a relic of lost navigational knowledge. These artifacts challenge dominant paradigms of development, technology, and infrastructure by revealing an alternative way of conceptualizing spatial knowledge in the oceanic world. Rather than serving as primitive prototypes of Western cartography, they operated as dynamic infrastructures for education, environmental understanding, and political negotiation within a rapidly shifting colonial order. Reframing Marshallese stick charts as infrastructures – as living technologies embedded in indigenous epistemologies – invites us to look beyond their museum status and recognize them as tools for surviving environmental and political precarity.

By positioning stick charts within the framework of infrastructure, this chapter reframes them as tools for managing uncertainty and crisis – whether environmental, political, or epistemological. Marshallese charts were not static; they adapted in response to climate events (typhoons, ENSO cycles), colonial interventions (Russian, German, British, and American mapping projects), and the introduction of new economic pressures (copra production, labor migration). These responses complicate traditional narratives of development as a linear progression

from "indigenous" to "modern" knowledge and instead highlight a continuous, adaptive process of knowledge-making in oceanic borderwaters.

The Western imperial obsession with categorizing and objectifying these charts mirrors a larger imperial anxiety about controlling and rationalizing maritime space. While colonial authorities and scientists sought to absorb the charts into a framework of scientific positivism, the charts themselves resisted such containment. They remained embedded in oral traditions, mnemonic techniques, and embodied practice, making them illegible to outsiders who relied solely on material artifacts divorced from their performative and cultural contexts.

The historiography of development has often privileged Western models of infrastructure and progress, portraying non-Western knowledge systems as incomplete or primitive. However, as this study has shown, stick charts are an example of an alternative knowledge infrastructure, one that resists colonial classification, remains embedded in indigenous practices, and continues to serve as a model for understanding complex environmental systems. The very act of mapping – and by extension, developing – is not neutral. It encodes assumptions about what counts as knowledge, who gets to produce it, and how it is used. By reinterpreting stick charts as infrastructural knowledge rather than mere relics of "pre-modern" navigation, this chapter challenges conventional hierarchies of development, progress, and civilization. In doing so, it invites a broader reconsideration of how we conceptualize indigenous epistemologies, oceanic governance, and the legacies of colonial science in the present day. This analysis of Marshallese stick charts as infrastructural objects also offers broader insights into contemporary debates about indigenous resilience and climate adaptation. Today, the Marshall Islands face existential threats from rising sea levels and environmental degradation, echoing historical cycles of adaptation and displacement. In this context, traditional navigation knowledge is not merely a cultural relic but a critical tool for understanding and responding to planetary change.

By the end of the nineteenth century, the Marshallese stick charts had been absorbed into museum collections, ethnographic studies, and colonial mapping projects. Yet their significance extends beyond their material form. As Berlant argues, infrastructures "manage ongoing relational disturbances" – they mediate between past and present, knowledge and power, stability and flux.[52] They are active forms of cultural survival under conditions of precarity.

The history of Marshallese charts is not a story of "discovery" by Western observers but rather one of negotiation, adaptation, and survival within shifting imperial and environmental forces. Marshall Islander work on navigation – both in

52 Berlant, *Inconvenience*, 22.

the nineteenth century and today, as seen in the research of Joseph Genz (a student of Ben Finney) – suggests an understanding of infrastructure that resonates with Bronisław Malinowski's concept of borderlands and borderwaters in *Argonauts of the Western Pacific* (1922). Unlike Franz Boas, who emphasized historical and cultural reconstruction, Malinowski saw limited value in the archive alone. He believed that cultures had to be studied through participant observation, as lived practices entangled with broader environmental and social processes.[53] Indeed, his ahistorical approach was in many ways an Eastern European (Austro-Hungarian) and borderland reaction to nineteenth-century German historicism, which inflected both German and American universities with nationalist and imperialist ideas about science and knowledge.[54]

While both Western and indigenous infrastructures are dynamic in practice, it is the logic of imperial development that demanded infrastructure be rendered static, legible, and extractable. These were qualities at odds with the embodied, adaptive use of Marshallese stick charts. The contrast, then, is not a fixed opposition between Western and indigenous systems, but the result of epistemic violence, in which imperial frameworks attempted to universalize their own standards of abstraction and fixity.[55]

Rather than mapping a clean divide, this chapter has shown how categories such as development and infrastructure themselves emerge from contested encounters between overlapping, and often incompatible, knowledge traditions. Stick charts resist not because they are timeless or traditional, but because they reveal how infrastructures operate across registers of embodiment, memory, and power.

American harvesting of whales, the copra rush of the mid-nineteenth century, and the continued spread of "Columbian Exchange" diseases, plants, and animals

53 Bronisław Malinowski, "The Group and the Individual in Functional Analysis," *American Journal of Sociology* 44, no. 6 (1939): 940; Bronisław Malinowski, *A Scientific Theory of Culture and Other Essays* (Chapel Hill: University of North Carolina Press, 1944), 37. Among Malinowski's most environmental works are *Argonauts of the Western Pacific* (London: Routledge, 1922) and *Coral Gardens and their Magic* (London: Routledge, 1935).

54 For a broader context here in relation to the 'official nationalism' argument of the previous section, see Ernst Gellner, *Language and Solitude: Wittgenstein, Malinowski, and the Hapsburg Dilemma* (Cambridge Cambridge University Press, 1998).

55 Walter D. Mignolo, *The Darker Side of Western Modernity: Global Futures, Decolonial Options* (Durham, NC: Duke University Press, 2011); Benedikt Korf, "Hydraulischer Imperialismus, Geographie und epistemische Gewalt in Sri Lanka," in *GrenzWerte: Tagungsbericht und wissenschaftliche Abhandlungen. 55. Deutscher Geographentag Trier 2005*, ed. E. Kulke (Leipzig: Deutsche Gesellschaft für Geographie, 2006), 627–633.

had devastating effects on Pacific populations during the nineteenth century.[56] Imperial and colonial activities by a huge range of actors – including the Russians and, by the 1890s, the Japanese – meant that supposed moments of encounter were always multipolar and complex. These entanglements required equally complex infrastructures in response. *Mare liberum* (free and undifferentiated oceans) was as much a myth as *terra nullius* (empty land).[57]

In relation to such changes, Marshall Islanders did not produce a flat or empty image of the blue ocean. Instead, they developed a layered and textured approach to complex aspects of persisting cycles and of increasing entropy.[58] These charts, designed largely for teaching and memory, still hold lessons for the oceanic Anthropocene, with its human and non-human actors. They reveal how environing practices – embodied, flexible, and relational – can persist in the face of extractive and imperial development schemes.

This underscores a central theme of this volume: that development, far from a linear or universal trajectory, emerges through layered contests over knowledge, environment, and infrastructural form.

56 It is also likely but difficult to prove definitively, that warming brought about by agricultural changes and deforestation from the sixteenth to eighteenth-century "industrious revolution" as well as the early industrial revolution and end of the "Little Ice Age" would have changed the frequency of ENSO related typhoons near the equator.

57 For a nuanced comparative approach to colonial understandings of land in the Pacific see Stuart Banner, *Possessing the Pacific* (Cambridge, MA: Harvard University Press, 2009).

58 Charne Lavery's "The Southern Indian Ocean and the Oceanic South," *Global Nineteenth-Century Studies* 1, no.1 (2022): 63–72, emphasizes the need to draw in "colder, wilder, more oceanic regions," to see how "distinct oceanic, political, and ecological space[s]" are mediated (71–72).