
Colonial Standards

Using scientific instrument collections
in India and the UK to investigate
mechanisms of control

Whose Science? Whose Story?
Community Research Series
Workshop 1 of 6
History of Science Museum

Colonial Standards

Community Research Series

Workshop 1 of 6

This publication forms part of the Colonial Standards research collaboration exploring measurement, mapping, and authority in South Asia.

Convened by

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We gratefully acknowledge Senthil Babu, with whom we are collaborating on this project, and whose extensive work on the social history of mathematics provided the initial provocation for this line of enquiry. His scholarship prompted us to ask what measurement collections might be held at HSM, a question that led to the discovery and renewed attention to instruments connected with the Great Trigonometric Survey in the museum's collections.

Colonial Standards: What is our project about?

Dr Shankar Nair

- ➔ How and why did the standardisation of measurement practices proceed in India in the 1800s? Was this process uniform?
- ➔ How do we understand the effect of standardisation of measurements on communities in India?
- ➔ What are their long-term legacies? Can we trace a social history of measurement to the present day?
- ➔ Our case studies: Land (survey), agricultural commodities (weights & measures), currency, labour (wage), & time.

Why this matters now?

Systems of measurement introduced and standardised during the colonial period continue to shape land ownership, taxation, wages, property boundaries, and infrastructure in South Asia today.

The ways in which land was surveyed, mapped, and recorded have had long-term consequences for questions of access, inheritance, development, and dispute.

By examining the history of measurement and mapping, we are not looking only at the past. We are asking how systems of authority continue to affect everyday life: from land records to labour valuation to state administration.

Supported by



The art and science of cartography: What's in a map?

The making of maps has long provided a foil for the satirization of scientific hubris in literature. Here are two of my favourite examples:

“What a useful thing a pocket-map is!” I remarked.

“That’s another thing we’ve learned from your Nation,” said Mein Herr, “map-making. But we’ve carried it much further than you. What do you consider the largest map that would be really useful?”

“About six inches to the mile.”

“Only six inches!” exclaimed Mein Herr. “We very soon got to six yards to the mile. Then we tried a hundred yards to the mile. And then came the grandest idea of all! We actually made a map of the country, on the scale of a mile to the mile!”

“Have you used it much?” I enquired.

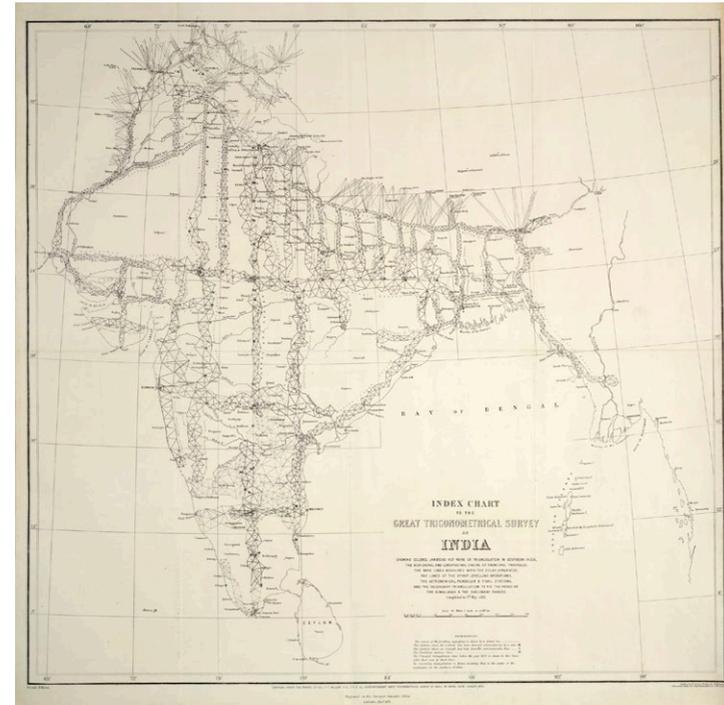
“It has never been spread out, yet,” said Mein Herr, “the farmers objected: they said it would cover the whole country, and shut out the sunlight! So we now use the country itself, as its own map, and I assure you it does nearly as well.”

— from Lewis Carroll, *Sylvie and Bruno Concluded*, Chapter XI, London, 1893

Suarez Miranda, *Viajes de varones prudentes*, Libro IV, Cap. XLV, Lerida, 1658

‘In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it. The following Generations, who were not so fond of the Study of Cartography as their Forebears had been, saw that that vast Map was Useless, and not without some Pitilessness was it, that they delivered it up to the Inclemencies of Sun and Winters. In the Deserts of the West, still today, there are Tattered Ruins of that Map, inhabited by Animals and Beggars; in all the Land there is no other Relic of the Disciplines of Geography.’

— ‘On Exactitude in Science’ by Jorge Luis Borges, *Collected Fictions*, translated by Andrew Hurley.



Index Chart to the Great Trigonometrical Survey of India.

Completed to 1st May 1870.
Scale, 96 miles = 1 inch

On Exactitude in The Great Trigonometric Survey (GTS)

- The Great Trigonometrical Survey was a 19th-century British project to map the Indian subcontinent with unprecedented precision. It began in 1802 under William Lambton and continued under George Everest and others until around 1871. It was part of the much larger Survey of India, which also included topographic, revenue, and military surveys in addition to trigonometrical surveys.
- Surveyors built a vast network of connected triangles across South Asia. By carefully measuring one base line distance and then calculating distances to fixed objects using trigonometry and

astronomical observations, they were able to demarcate territory relative to established coordinates of latitude and longitude.

- This survey also enabled the measurement of The Great Arc, a 1,600-mile meridional arc from India’s southern tip to the Himalayas. This was the longest continuous contemporary meridional arc measured, and it enabled a precise measurement of the size and shape of the earth (geodesy: the branch of mathematics dealing with the shape and area of the earth). It also produced the first reliable height calculation of Mount Everest (then known as ‘Peak XV’).

The GTS as a scientific survey

The GTS was deemed a scientific survey with its use of the latest techniques of geodetic triangulation compared to earlier “route surveys” (or the use of basic tools to measure distance between two points). The GTS provided legitimacy to the East India Company’s rule as an Enlightened patron of science, thought to be advancing the moral and material progress in India in addition to improving the science of geodesy.



“Photograph (Daguerreotype) of Sir George Everest and Two Other Men with Scientific Instruments, c.1850”, Acknowledgement: History of Science Museum, University of Oxford, inv.94483.

...But what goes into the making of a map? What knowledges, forms of work, skills, and tools are required for a ‘scientific’ survey?

What makes the GTS more *scientific* than other forms of surveying?

And how do museum labels, catalogues, and digital records interpret the GTS today: as neutral science, as colonial administration, or as something different and more complex?



“Painting (Oil on Panel, Framed) ‘The Measurers’, Attributed to Hendrik van Balen, Flemish, 16th Century”. Acknowledgement: © History of Science Museum, University of Oxford, inv.27046

Science as Authority: Colonial Knowledge or Many Ways of Knowing

Telling object-led stories of the GTS

Participants handled various scientific instruments held in HSM collections on-site at the museum and at the HSM storage facility, including theodolites, perambulators, sextants, octants, a surveyor's chain, and chronometers.

Several objects had direct links with the East India Company, while other objects were indirectly linked to the GTS, many of the same instruments having been used based on evidence present in historical records.

Participants also handled time-keeping objects derived from Hindu and Islamic astronomy.

In the process, they asked:

- ➔ What materials are these instruments made of?
- ➔ Who made these objects and what were the conditions of its production?
- ➔ What function does the design of the object serve? What is it meant to represent? Utility, science, artisanal skill, religious cosmology, power?
- ➔ Where and how were this survey instruments used? Who were the people designated to use the various instruments? Was a theodolite used by the same person as a perambulator and survey chain? How do hierarchies like caste, class, and gender interact with the use of instruments?
- ➔ What is the scale of the object related to what it is intended to measure? How heavy or light are these objects?
- ➔ Who used these objects in India and under what conditions?
- ➔ Did instruments produce faithful accounts of land being surveyed? What was overlooked?
- ➔ How do surveyors account for errors in measurement?
- ➔ What conditions were necessary for their effective operation in places so far away from their point of manufacture?
- ➔ What happens when these objects break when used? What networks of knowledge sustain these objects through repair and maintenance?
- ➔ What role did local knowledge play in the use of these instruments?
- ➔ How did these scientific instruments compare with older tools of surveying in India?
- ➔ What knowledge was produced using these instruments?

Museums and scientific collections:

- ➔ What do the labels and physical descriptions of our museum catalogue reveal about our assumptions of the object's makers and users?
- ➔ How can we improve the museum's description to reflect the stories of the makers and users of scientific instruments, and of those affected by these new practices of measurement?

...A reference guide to the missing.

The labour of map-making

"The new [3-foot Theodolite] by Troughton was hand-divided and had the horizontal circle read by five flying microscopes... The whole weighed 16 hundredweight and had to be carried over hundreds of miles as well as be hauled up many thousands of feet of mountain and tower. No mean task even with the considerable man-power available." (16 hundredweight = 812 kgs!)

"In late 1833 Everest travelled south to continue his arc measurements between Agra and Delhi. He recorded that his party contained two assistants, three sub-assistants, four elephants, 42 camels, 30 horses and about 700 local personnel. It must have been an awesome sight."

from James R. Smith, "Sir George Everest", *Notes and Records of the Royal Society of London*, Vol. 46, No. 1 (Jan., 1992), pp. 89-102



Sir George Everest and an assistant supervising work on the GTS.
Artist(s): Vigne, Godfrey Thomas (1801-1863).
Source: British Library.

The History of Science in and as South Asian History

- ➔ What do object-led stories tell us about the ‘locality’ of science?
- ➔ What does the movement, use, and disuse of objects in contexts other than their origin tell us about how science works in practice? How different is it from accounts of science focussed purely on invention and the innovators?
- ➔ How might the history of science, in this case of geodetic triangulation and map-making, inform our histories of South Asia, and particularly our notions of justice, trust, fairness, and power under colonial rule?
- ➔ How do local hierarchies such as caste and class which shaped knowledge production in the subcontinent interact with these new ways of understanding land and space?
- ➔ How can South Asian voices, experiences, and histories feature in our museum catalogues, labels, and exhibitions on modern science, particularly from communities and traditions within the subcontinent considered marginal in the scientific canon?
- ➔ How might we retell the history of science in and as South Asian history? And how do these accounts challenge the dominant stories we present as the history of science?
- ➔ Conversely, how might the study of the production of knowledge deemed ‘scientific’ challenge accounts of knowledge production in histories of South Asia?

Colonial Standards: Community Workshop Reflections

The New Cartographers: Naajia Ahmed and Maren Ellermann

The initial thinking behind the colonial standards workshops was to create a space where decolonial practices could be applied to history of science collections and engage audiences who were not typically familiar with the History of Science Museum's collections relating to South Asia. We questioned; who has access to knowledge, who gets to inform research on museum objects and how can we reclaim agency in the history of these objects?

What are we doing?

The initial thinking behind the colonial standards workshops was to create a space where decolonial practices could be applied to history of science collections and engage audiences who were not typically familiar with the History of Science Museum's collections relating to South Asia. We questioned: who has access to knowledge, who gets to inform research on museum objects and how can we reclaim agency in the history of these objects?

In order to address these questions we developed a series of workshops that invited members of South Asian communities to explore scientific instruments held in the museum's collections. By recognising that participants are experts of their own knowledge, and that their lived and professional insights are essential to understanding the history of measurement, we aim to work collaboratively to build a community toolkit.

This work hopes to culminate in a Reference Guide to the Missing, a practical guide to Seeing the Unseen. Our aim is to bring to light the erased histories of the South Asian figures who were essential to the history of science, while providing methods for members of the public to think differently about museum collections—both those in store and on display.

Our primary goal is to shift the museum from being a 'sole authority' to a 'collective authority.'

We are creating a space of learning that prioritises Adda (meaningful, informal conversation) over rigid, formal instruction. Informed by creating a culturally relevant space and format of passing on knowledge for the participants.

This project and its output are designed for South Asian audiences. While our participants—ranging from artists and heritage professionals to students—are the primary co-authors, the final toolkit is intended for the wider South Asian public.

Why are we doing it?

Our objectives include:

- ➔ **Challenging Neutrality:** The history of science is often presented as objective facts, yet colonial legacies complicate this. We want to unsettle the idea of that these objects are 'neutral' and belong to a solely empirical history.
- ➔ **Humanising the Collection:** To shorten the distance between technical museum objects and human lived experience by valuing emotions and human stories when thinking about these objects.
- ➔ **Reclaiming Heritage:** To assert that the history of science is South Asian history. These stories are fundamentally linked to the heritage of our participants.
- ➔ **Seeking Justice:** We use the concept of justice to engage with unfamiliar scientific topics, transforming “intimidating” territory into a space where participants feel they have the agency to speak.

What do we create?

The tangible outputs include:

- ➔ **A Reference Guide to the Missing:** A toolkit that identifies the gaps in current museum narratives—specifically missing expertise, missing knowledge, and the “missing emotion” in how we record history.
- ➔ **Critical Analysis Tools:** A way for the public to critically analyse museum objects through the eyes of those whose ways of knowing were historically ignored.

Who do we create for?

We are building a resource that allows future visitors to see these collections through a lens of shared expertise rather than institutional distance. This was informed by a simple question: how would we create something our own family members would use? We want to remove the “language of the museum” to provide practical ways of accessing and engaging with museum objects.

This is an act of justice.

Why do we create this?

By redressing the power imbalances in the history of science, an area of study that appears to be behind that of social or political history in its decolonial efforts, we are creating a meaningful legacy. In a one-year project, we want to ensure the output has longevity, offering a toolkit that fundamentally changes how the museum interacts with its community partners.

Tensions in the Process

The Question of Audience

Our initial plan was to engage a public completely unfamiliar with museum collections. However, our call-out primarily attracted those from professional heritage backgrounds. This forced us to rethink: how do we create a space that values both professional skills and the intimate, “lived” insight of the individual? We had to ensure that our project didn’t just speak to the “experts,” but remained open to everyone.

The Barrier of Authority

During the workshops, a tension emerged regarding confidence. Participants felt that the history of science was “unfamiliar territory” compared to other areas of history they had engaged with. There was a sense that “Science” still feels like a space of “sole authority.” We realised we needed to share more academic knowledge to break down these barriers, helping to **restore the ways of being that have been severed from the ways of knowing.**

Legacy of Output

Participants questioned how useful the ‘Reference Guide to the Missing’ will be. Very valid points were made to the efficacy of the guide in reaching the ambitions of the project, we hope that as we go through the project we will be able to explore this further. In addition, we recognise that factor such a digital literacy may impact who uses the guide, one consideration is making it shareable through Whatsapp to reach more audiences.

Methodology and Ethics

Participants Informing the Process

A core tenet of our methodology is that the workshops are not static; they are actively shaped by those in the room. One particularly pivotal moment occurred when participants questioned their own place within these narratives, asking: 'Where do we sit in this history, and what is my relationship to it?' This powerful inquiry has been directly embedded into the design of all future sessions, ensuring that personal and ancestral positioning is a point for investigation rather than an afterthought.

Furthermore, participants raised vital questions regarding emotional wellbeing and safety. While we have always sought to ensure these areas were covered, this feedback has prompted us to make an even more concerted effort to ensure safety is felt tangibly by everyone involved. We ensured that there are multiple avenues for participants to address concerns from emotional check ins during session to confidential avenues, ensuring that the emotional labour of engaging with colonial histories is supported by robust institutional and peer-to-peer care.

Avoiding Extractive Practice

How do we create a useful output without being “extractive”—taking knowledge from a community without giving back? We resisted the pressure to work fast or demand immediate results, as this often furthers the historic relationship of museums and communities as one of short-term, project-based extraction. Instead, **our primary output for the first session was Trust.**

Trust as an Output

We prioritised building relationships between the facilitator, the institution, and the participants. By slowing down, we moved away from the traditional museum-community relationship toward a model built on genuine connection and mutual respect. We hope that creating sessions that feel like **adda** will contribute to the feeling of reclaiming ways of knowing and create the sense of authority with an unfamiliar topic.

Intuition vs. Information

In our first handling session, we intentionally provided very little technical information. We wanted participants to be guided by their own emotions and intuitions first, considering these to be extremely valuable insights. These reflections help us understand how a visitor who is unfamiliar with the topic feels when approaching objects they 'don't know anything about.' By fostering a supportive environment, we hope that participants will go on a journey, it may be one of personal discovery, professional, or academic. We have planned the sessions to hold the space for them to go through this whilst feeling supported. We hope that the session will feel more like **adda** than formal learning session serving as a way for us to connection with our ways of knowing, our culture and heritage.

Who Was In The Room?

Who Was in the Room and Who Is This For?

Our original call included those unfamiliar with museum collections. Instead, we found that South Asian heritage professionals were also seeking something that is less available to them: the opportunity to enter museum space not as staff, but as community members.

Even within institutions, the history of science remains a space of heightened authority. Participants described it as 'unfamiliar territory'. This revealed something important: expertise in museums does not automatically translate into confidence when approaching scientific collections.

This project remains open. You do not need to be a heritage professional to take part. As the workshops continue, we are actively working to widen participation. At the same time, we recognise that the presence of heritage professionals has generated important insights about authority, interpretation, and institutional practice that will strengthen the project.

Reflections from the workshop organisers. The first workshop brought together artists, historians, students, heritage professionals, and community practitioners. Many participants worked within museums or cultural institutions. This was not entirely what we expected.

THE REFERENCE GUIDE TO THE MISSING

The Reference Guide to the Missing will exist in three forms:

- ➔ A printed toolkit
- ➔ A digital PDF (shareable, including via WhatsApp)
- ➔ A replicable methodology for other museums and community groups

The guide will:

- ➔ Identify gaps in catalogue records and interpretation
- ➔ Offer prompts for interrogating authority in scientific collections
- ➔ Provide practical methods for co-curation and shared authorship
- ➔ Be usable beyond this project

HOW CAN I TAKE PART

You do not need a background in science or museums to participate.

Future workshops will include object handling sessions, discussion-based learning (adda), and collaborative interpretation exercises.

If you are interested in questions of land, labour, mapping, measurement, family history, or heritage then your experience is relevant.

The project will share updates through the History of Science Museum website.

WHAT WILL THIS CHANGE

The insights generated through these workshops will inform:

- ➔ Revisions to museum catalogue descriptions
- ➔ Interpretive labels and display narratives
- ➔ Future exhibitions and education programming
- ➔ Research methodologies within the project

Our aim is not simply to reflect, but to embed these conversations into institutional practice.

FURTHER READING**Further Reading: Communities, Authority, and Scientific Collections**

Das, S. & Lowe, M. (2018) *Decolonial approaches to interpreting natural history collections*.

— Demonstrates practical strategies for acknowledging colonial histories and centring community knowledge in science collections.

Bunning, K (2022) *Embedding plurality: participatory practice in the Information Age Gallery*.

— Shows how co-curation reshapes interpretation and redistributes institutional authority in a major UK science museum.

UNESCO (1997) *Community-based approaches to museum development in Asia and the Pacific*.

— Documents long-standing models in which local knowledge, scientific expertise, and everyday life are co-curated.

These works demonstrate that community-led approaches in scientific collections are neither new nor anti-science. They are part of a broader movement to make museums more accurate, accountable, and socially grounded.

Interrogating Authority

JC Niala

For many years, my work has centred on Community Action Research: creating spaces in which those traditionally positioned as 'audiences' become co-producers of knowledge. I led the first iteration of Rethinking Relationships and Building Trust around African Collections, and my practice has consistently asked a simple question: who has the authority to interpret objects, and how is that authority formed?

When the *Colonial Standards* project began, I was interested in what would happen if this methodology entered a space where it has rarely been tested: scientific instrument collections.

Natural history and anthropology collections have been confronting their colonial inheritances and engaging in experiments with shared authority. History of science collections have moved more cautiously. Scientific instruments are often presented as neutral, technical, and objective and as though their authority rests solely in precision.

Yet instruments are made, transported, maintained, and used within human systems. They require labour. They rely on hierarchies. They operate within structures of governance. Their authority is institutional and social as well as mathematical.

What happens when communities encounter these instruments as objects they can also make knowledge with and not just learn from?

In our first workshop, something subtle but revealing occurred. Participants did not lack knowledge about land, labour, hierarchy, or measurement. What was less familiar was the permission (particularly within institutional culture) to question canonical scientific narratives using that knowledge.

The New Cartographers proposed the idea of a *Reference Guide to the Missing* as a practical response. Critically as a way of making scientific history even more precise. If science values accuracy, then our responsibility is to be accurate about labour, omission, hierarchy, and the people who made measurement possible.

When we speak of justice here, we do not mean rewriting science. We mean taking care that the stories we tell about it are accountable and attentive to those historically unnamed.

This project does not seek to diminish scientific authority. It seeks to understand how epistemic and institutional authority are constructed and how they might be made more expansive without sacrificing rigour.

If this work succeeds, it can help to widen the frame in which it is understood.

And it will continue to ask: who else must be in the room?

COLONIAL STANDARDS

THE WOMEN WHERE DID THE MEASUREMENTS ORIGINALLY COME FROM?

WHAT IS A STANDARD?

TAPE MEASURES STRETCH OBJECTS + WORDS E.G. 'INDIA' - WHAT + WHERE

WHO WAS ALLOWED TO TOUCH?

SO HEAVY, SO MILITARISTIC ADMIRATION FOR THE CRAFTSMANSHIP THERE SO PRESENT BUT...

WHERE DO I FIT HERE?

A MOUNTAIN CAN HAVE MANY NAMES



ACROSS CULTURES KNOWLEDGE

BETWEEN CLASSES OF UNDER-REPRESENTATION 'N.E. INDIA VERY IGNORED...'
↓ METAL WORKER
↓ DESIGNER
↓ COMMISSIONER

THE IVORY IS SO FROM ITS EXTRACTION METALS ... THEIR NAMES ARE ON OBJECTS, FROM A CITY CREATED BY EXTRACTED WEALTH

GEORGE & SONS
WOOLWICH ROAD
HARLTON

THESE OBJECTS ARE HEAVY!

THE RAGE IS KICKING IN NOW!

WHO CARRIED THEM?!

WE'RE ONLY SCRATCHING THE SURFACE

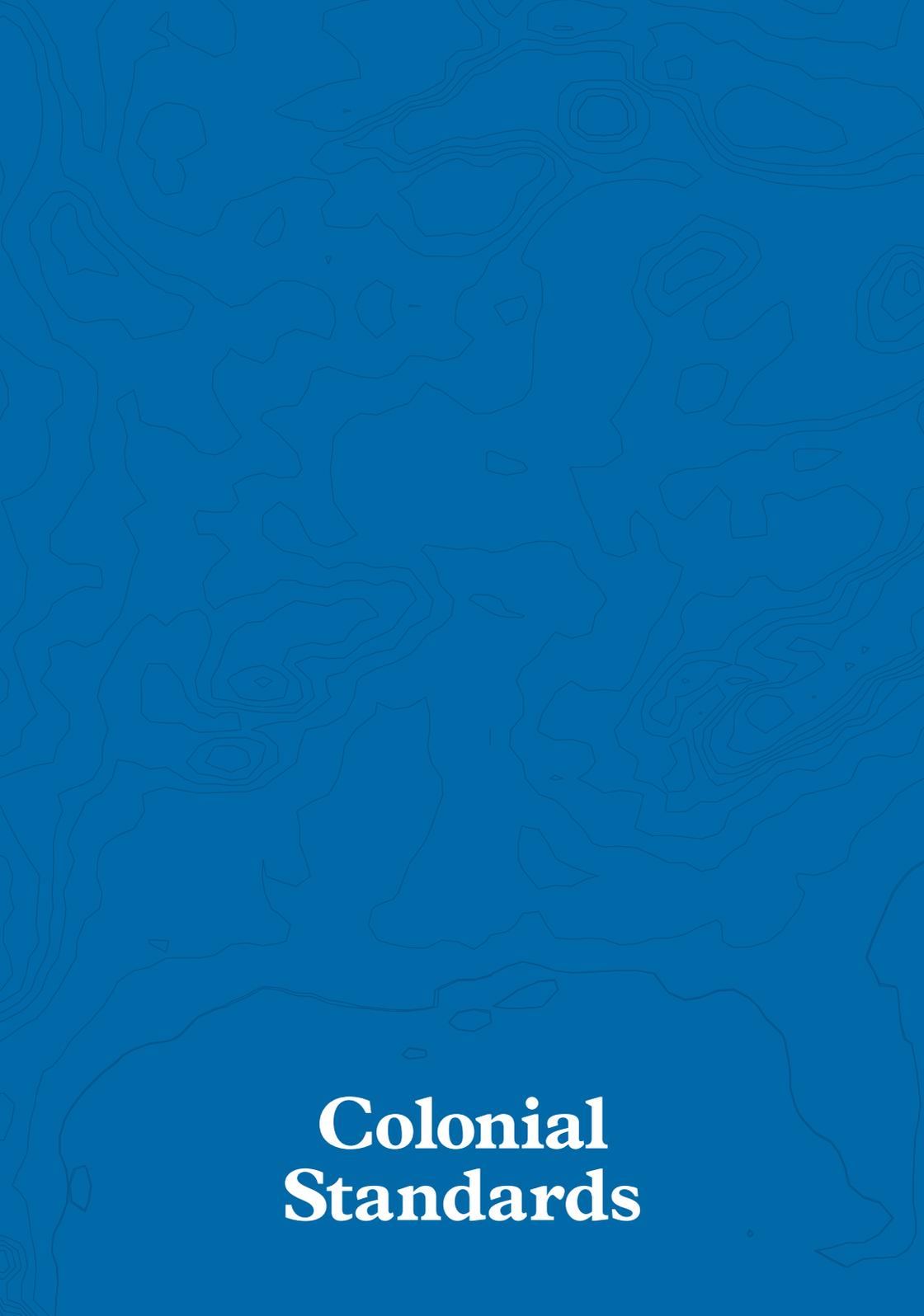


WHO CHOOSES WHAT TO KEEP?

THE AIR FIELD + CONFLICT HARM

THE ECHOS OF WAR



The background of the entire page is a topographic map with white contour lines on a dark blue background. The map shows various elevation levels and geographical features, though the details are somewhat obscured by the dark color and the density of the lines.

Colonial Standards