City in the Cloud Data on the Ground

Exhibition Information 2026

Architekturmuseum der TUM in der Pinakothek der Moderne

General Info

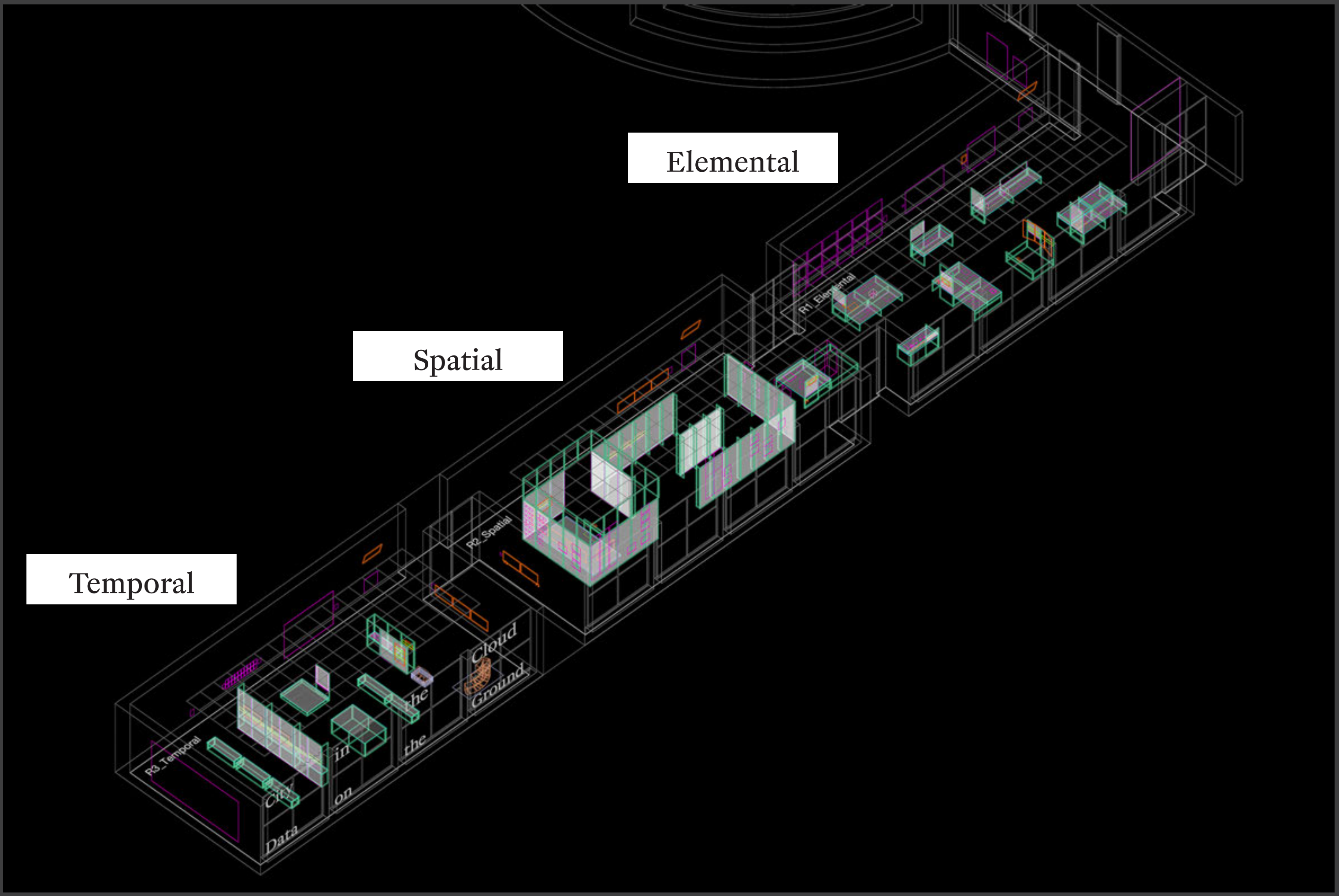
City in the Cloud – Data on the Ground is an exhibition at the Pinakothek der Moderne in Munich. It looks beneath the surface of the digital world: how data is stored, how it circulates, and how its infrastructure shapes our reality.
Data feels immaterial, yet it relies on vast physical systems—raw material extraction, undersea cables, and ever-growing, energy-hungry data centers. These infrastructures don't just affect economies and politics; they reshape landscapes, labor, and everyday life, often along (neo-)colonial lines. Despite their impact, data infrastructures are rarely examined from architectural or political perspectives. Architectural research can make these hidden material and power structures visible. The exhibition aims to demystify the cloud—from its historical foundations to future possibilities—and argues for embedding the design and planning of data infrastructure more firmly within public, social, and political discourse.

The exhibition is structured around three themes: Elemental, Spatial, and Temporal, unfolding through a series of guiding questions.

An accompanying catalogue brings together voices from architecture, art, and theory to expose the real costs of our connected world and to imagine digital futures grounded in transparency, justice, and care.

Duration: October 16, 2025 – March 8, 2026
Curator: Damjan Kokalevski
Exhibition Design: CPWH
Graphic and Motion Design: WVH–Wiegand von Hartmann
Interactive Exhibits: 3e8 Studio
Research & Photography: Giulia Bruno
Photography: Catherine Hyland
Research Advisor: Marina Otero Verzier

Facade



Spatial Layout

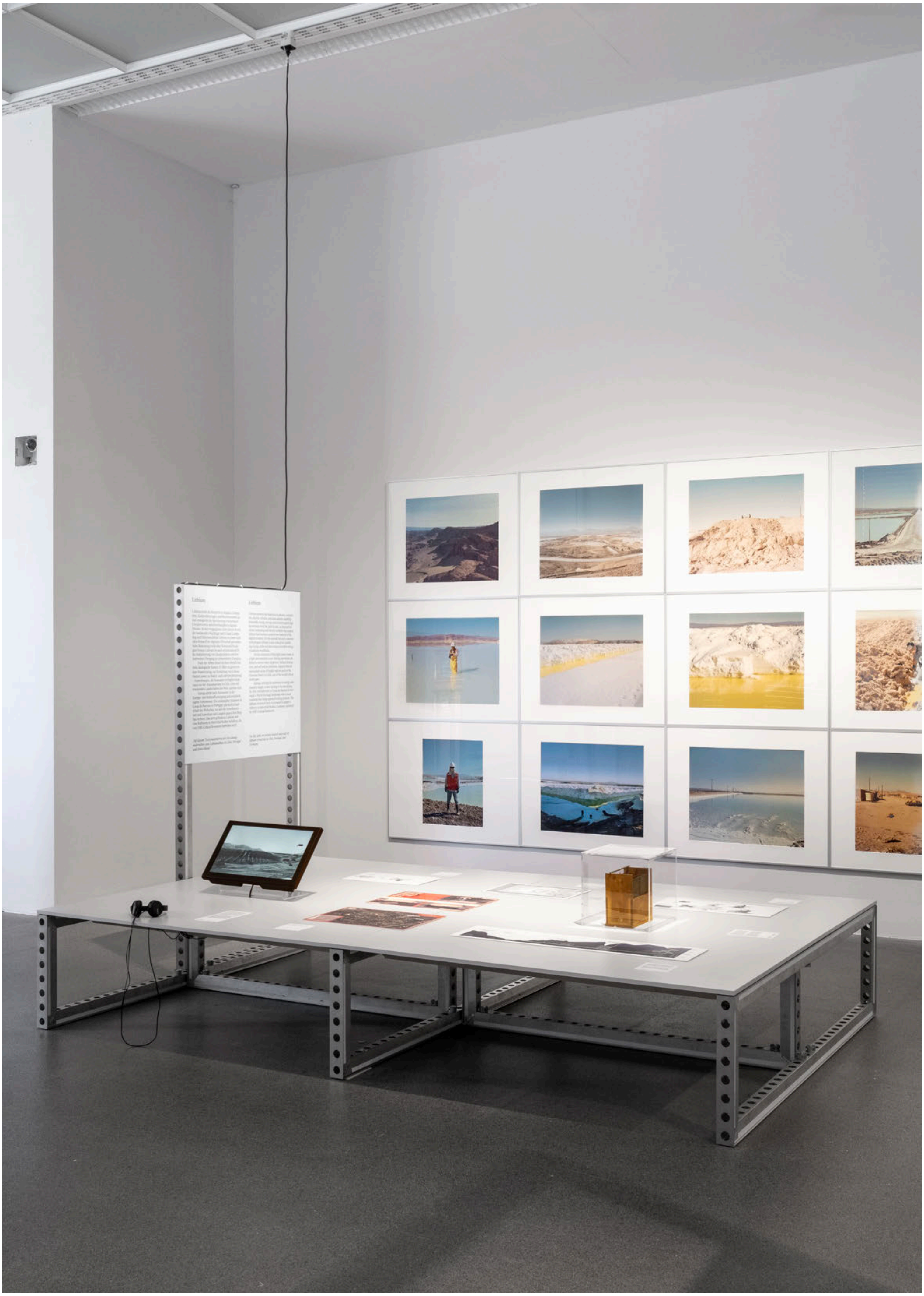
Spatially, the exhibition follows the thematic chapters, dedicating one of the three gallery spaces to each. The same modular frame system is used throughout the exhibition, but takes on a distinct configuration in each chapter.

The first space draws on the idea of a *Wunderkammer*. A diverse range of exhibits—minerals, cable segments, tools, paintings, and various storage media—is displayed across a sequence of primarily horizontal vitrines. Daylight is partially screened by roll-down shutters, creating a controlled atmosphere that focuses attention on the objects and their material qualities.

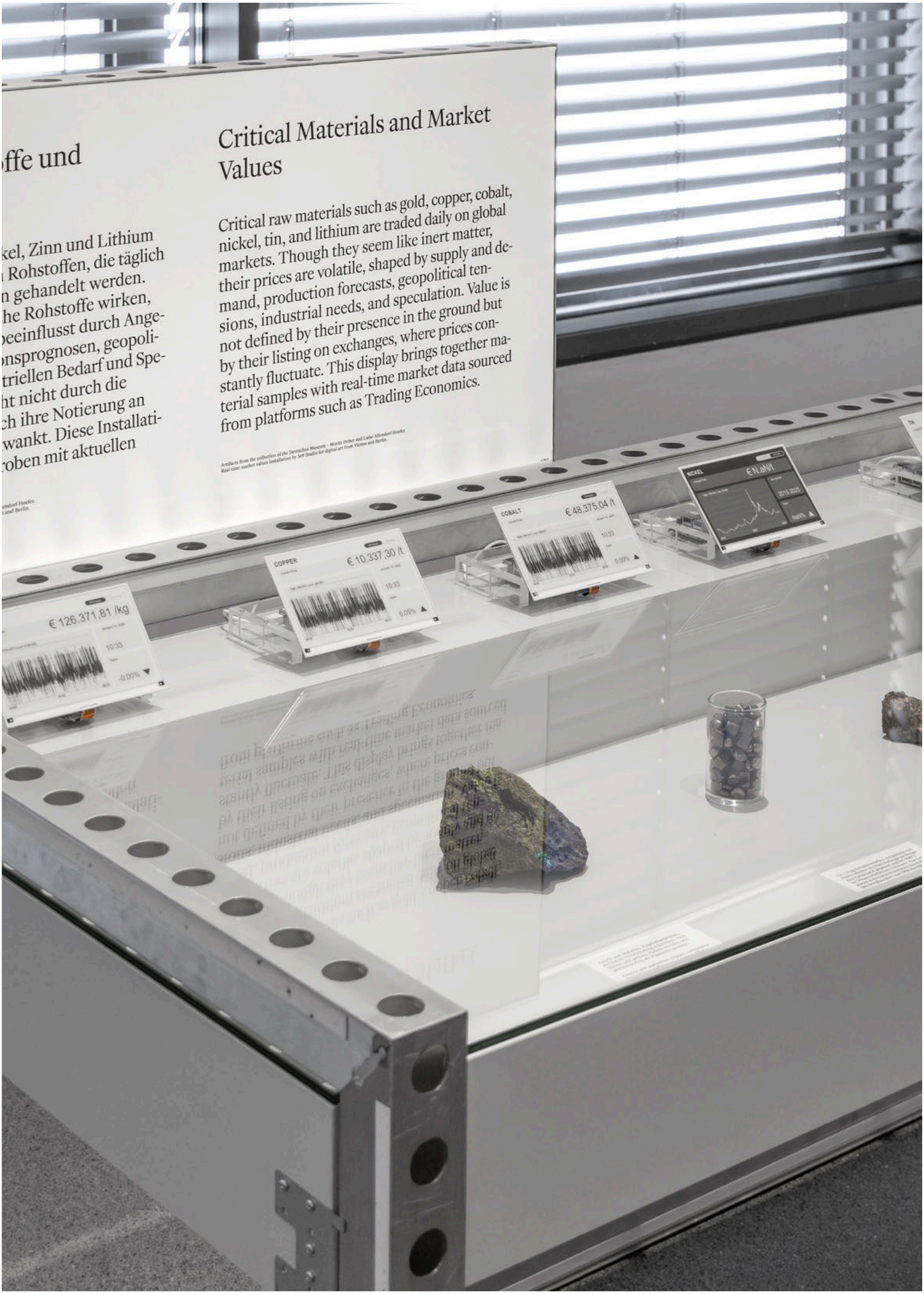
The second gallery refers directly to the architecture of data centres, with their densely arranged server racks. Here, the frame system creates an enclosed space within the gallery, composed of a sequence of walls sub-divided into bays that showcase graphic material. The exterior-facing sides of this structure display a photo project, benefiting from natural light and providing passers-by outside the museum with views inside. At one end of the “server room,” a darkened space is separated off to house an interactive installation.

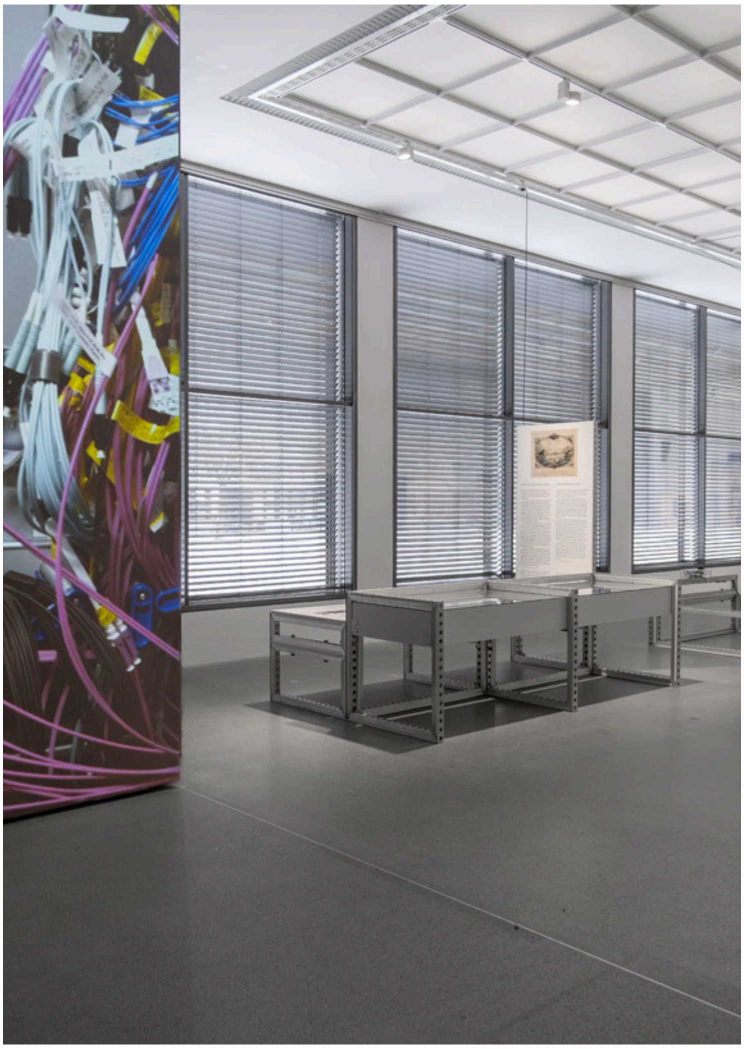
In the third space, the frame system is arranged into a set of modular elements that accommodate a variety of exhibits. This room also provides an area for individual engagement, with a reading table, reference materials, and seating. Toward the back of the gallery, a partitioned zone is dedicated to the projection of a film, concluding the exhibition.

Entrance to Exhibition




Guttapercha
Der Erfolg des ersten transatlantischen Kabels war nur durch eine einzige Pflanze möglich: den Guttaperchabaum. Sein milchiger Saft, der durch das Einschneiden der Rinde gewonnen wird, gerinnt beim Trocknen zu einer festen Substanz – Guttapercha. Dieses Material ließ sich erhitzen und formen und eignete sich hervorragend zur Ummantelung von Unterseekabeln. Im Gegensatz zu Kautschuk war Guttapercha das einzige damals bekannte Material, das dem langfristigen Kontakt mit Salzwasser standhielt – und wurde dadurch für die frühe Infrastruktur globaler Kommunikation unverzichtbar.
Bis Anfang des 20. Jahrhunderts waren etwa 370.000 Kilometer Unterseekabel verlegt worden, wofür schätzungsweise 27.000 Tonnen Guttapercha benötigt worden waren. Der Großteil davon stammte aus der kolonialen Ausbeutung der Wälder auf der malaiischen Halbinsel und der Insel Borneo. Ein gefällter Baum lieferte im Schnitt nur 312 Gramm des Materials. Als die britische Regierung 1883 das Fällen der Bäume verbot, war die Pflanze in vielen Regionen der Halbinsel bereits nahezu ausgerottet.
Die Kolonialmächte reagierten mit Expeditionen, um neue Vorkommen des wertvollen Materials zu erschließen. Zwischen 1907 und 1909 entsandte das Deutsche Kaiserreich eine Expedition unter der Leitung des Botanikers Dr. Rudolf Schlechter in seine Kolonien nach Papua-Neuguinea. Zwar wurde dort Guttapercha gefunden wurde, doch es erwies sich als ungeeignet für den industriellen Einsatz.
Die Abholzung von schätzungsweise 88 Millionen Bäumen für die Guttapercha-Gewinnung markierte den Beginn der massiven kolonialen Ausbeutung der Regenwälder Südostasiens – eine Praxis, deren ökologische und politische Folgen bis heute bis heute nachwirken.[1]
Auf diesem Tisch wird die Geschichte von Guttapercha anhand von Objekten, Karten und Archivmaterialien erzählt – aus dem Deutschen Museum und dem Bildarchiv der Deutschen Kolonialgesellschaft.
Gutta-Percha
The success of the first transatlantic cable was made possible by a single plant: the Palaquium gutta tree. Its milky sap, harvested by cutting the bark, was left to coagulate and dry, forming a solid substance known as gutta-percha. This material could then be heated and molded, and was uniquely suited for coating undersea cables. Unlike rubber, gutta-percha was the only known material at the time that could withstand long-term exposure to salt water, and thus became essential to the construction of the early infrastructure of global communication.
By the early 20th century, around 370,000 kilometers of undersea cables had been laid, requiring an estimated 27,000 tons of gutta-percha. Most of it was extracted through colonial plunder from forests on the Malay Peninsula and the island of Borneo. A single felled tree yielded just 312 grams. By 1883, when the British finally banned tree felling, gutta-percha was already extinct on the peninsula.
Colonial powers responded by launching expeditions to source the material elsewhere. Between 1907 and 1909, the German Empire sent an expedition—led by botanist Dr. Rudolf Schlechter—to its colonies in Papua New Guinea. Though gutta-percha was found, it proved unsuitable for industrial use.
The felling of an estimated 88 million trees for gutta-percha marked the beginning of widespread colonial exploitation of Southeast Asia's rainforests—a legacy that continues today.[1]
On this table, the story of gutta-percha is told through objects, maps, and archival materials from the Deutsches Museum and the Bildarchiv der Deutschen Kolonialgesellschaft.
FARADAY

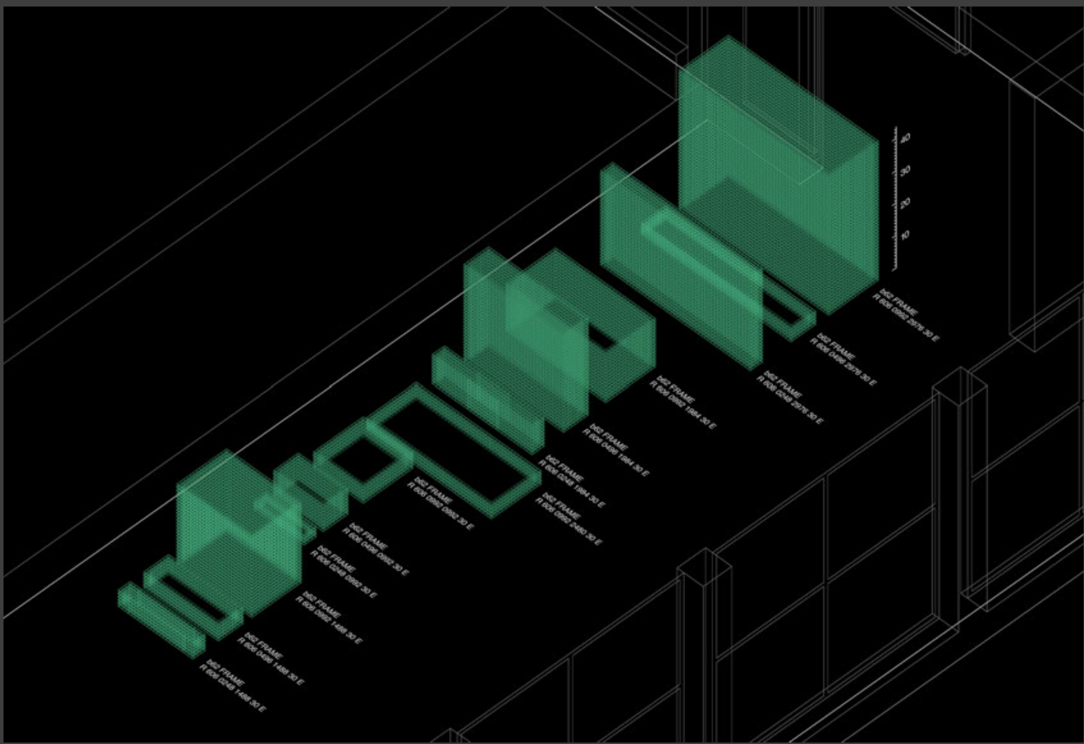

Critical Materials and Market Values
Critical raw materials such as gold, copper, cobalt, nickel, tin, and lithium are traded daily on global markets. Though they seem like inert matter, their prices are volatile, shaped by supply and demand, production forecasts, geopolitical tensions, industrial needs, and speculation. Value is not defined by their presence in the ground but by their listing on exchanges, where prices constantly fluctuate. This display brings together material samples with real-time market data sourced from platforms such as Trading Economics.
€ 126.371,81 /kg
COPPER
€ 10.337,30 /t
COBALT
€ 48.375,04 /t
NICKEL
€ N.aN/t

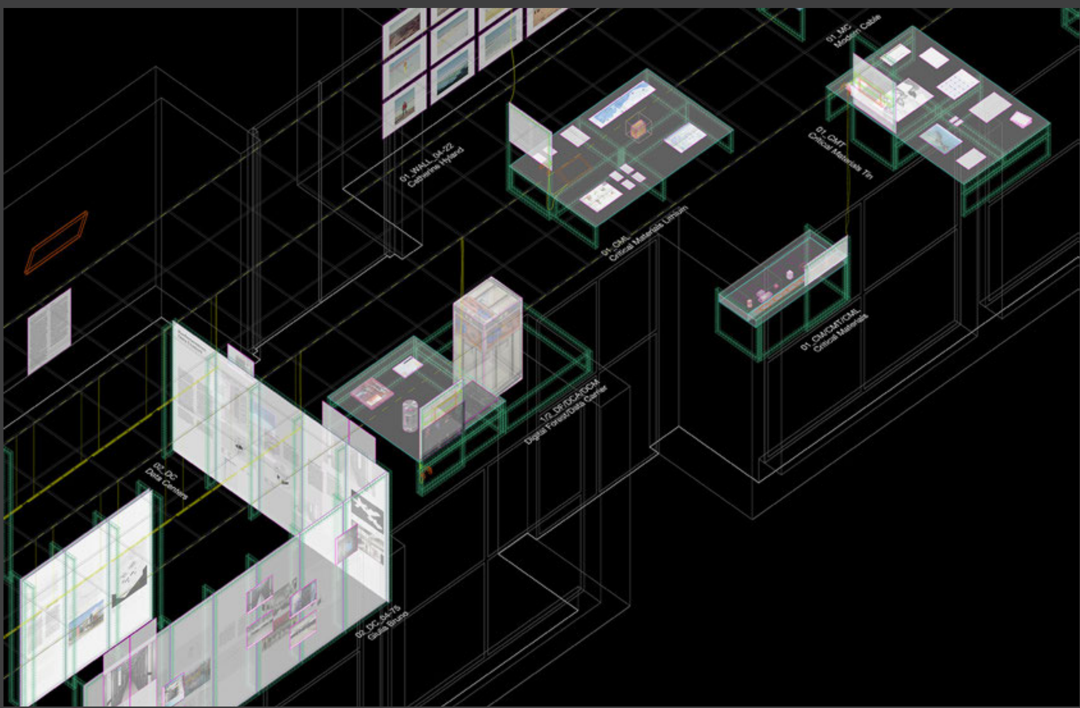


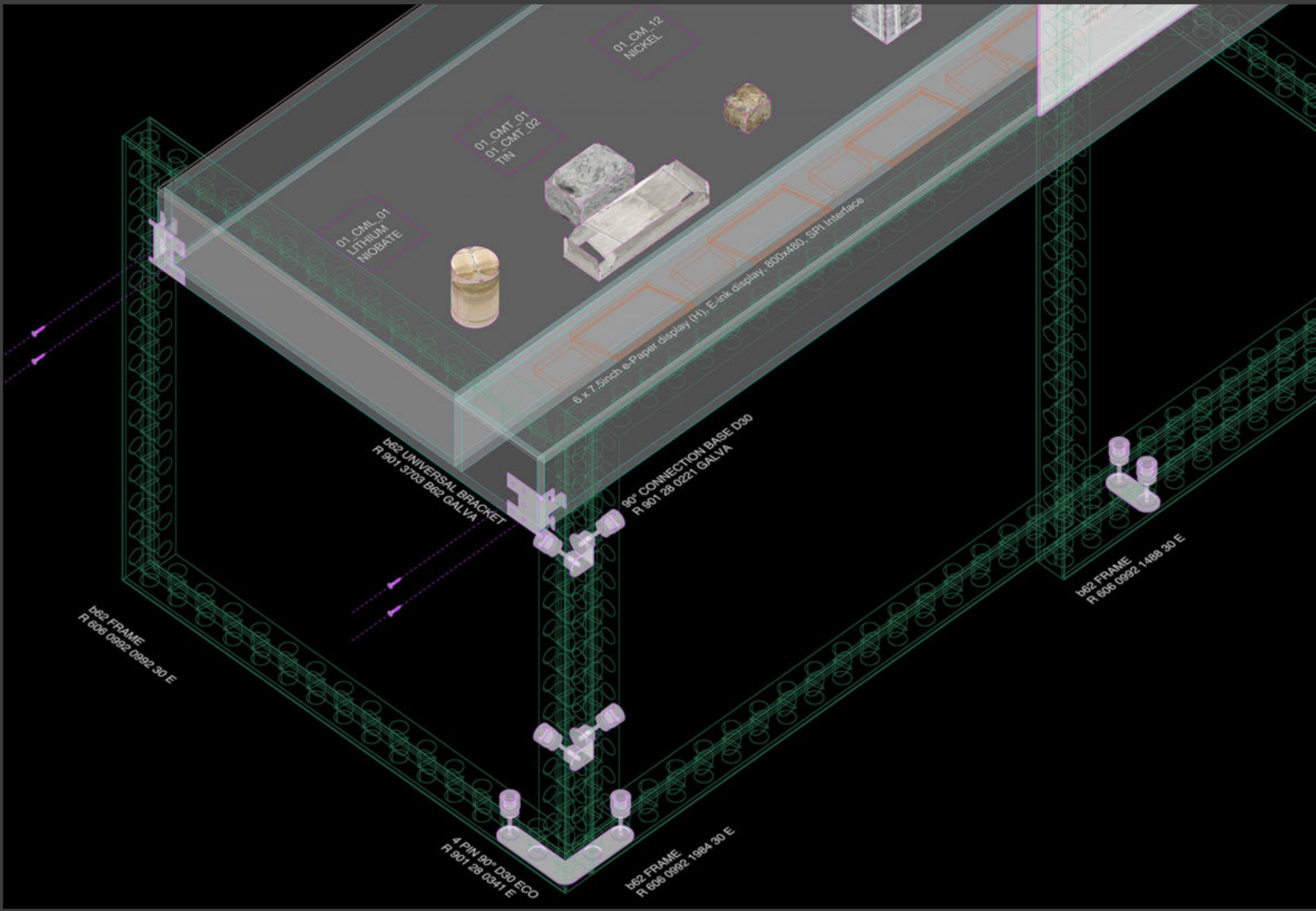

ENTDECKEN

Exhibition Design

The exhibition's design draws on the utilitarian aesthetics of data infrastructure. A rented modular frame system commonly used for trade fair stands forms the backbone of the display. Unlike typical trade fair setups, the frames are left exposed: metal frameworks, cabling, and screens remain fully visible, becoming an integral part of the exhibition's spatial language. In this way, the design emphasizes its reversible assembly, relying on standardized connectors and visible fittings. Accompanying text, illustrations, and graphics are printed on large cardboards and attached directly to the frames using Velcro tape. These cardboard sheets also form the walls that divide the spaces. After the exhibition closes in March 2026, just as the exhibits return to their lenders, the frames will be collected by the company and reused at future trade shows and events. Little more than a few sheets of cardboard will remain.






01_CML_01
LITHIUM
NIOBATE
01_CMT_01
01_CMT_02
TIN
01_CM_12
NICKEL
6 x 7.5inch e-Paper display (H), E-ink display, 800x480, SPI Interface
b62 UNIVERSAL BRACKET
R 901 3703 B62 GALVA
90° CONNECTION BASE D30
R 901 28 0221 GALVA
b62 FRAME
R 606 0992 0992 30 E
4 PIN 90° D30 ECO
R 901 28 0341 E
b62 FRAME
R 606 0992 1984 30 E
b62 FRAME
R 606 0992 1488 30 E

Cable Explorer

This interactive installation invites visitors to explore the global network of underwater cables that connect continents, data centers, and the services we rely on every day. Supported by infographics that visualize relevant, publicly available metadata, the installation sheds light on the vast yet often invisible infrastructure behind our digital world.

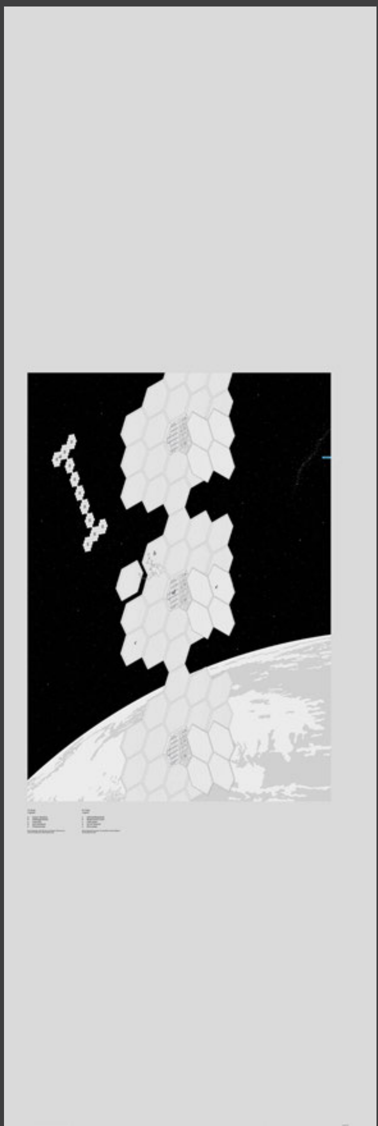
Three core thematic areas, developed in close collaboration with students from the Technical University of Munich (TUM), offer deeper insight into the history, materiality, and geopolitical dimensions of submarine data cables. Use the control panel in front of the installation to navigate this intricate system, or dive into one of the three focus stories for a closer look at the narratives shaping this critical global infrastructure.

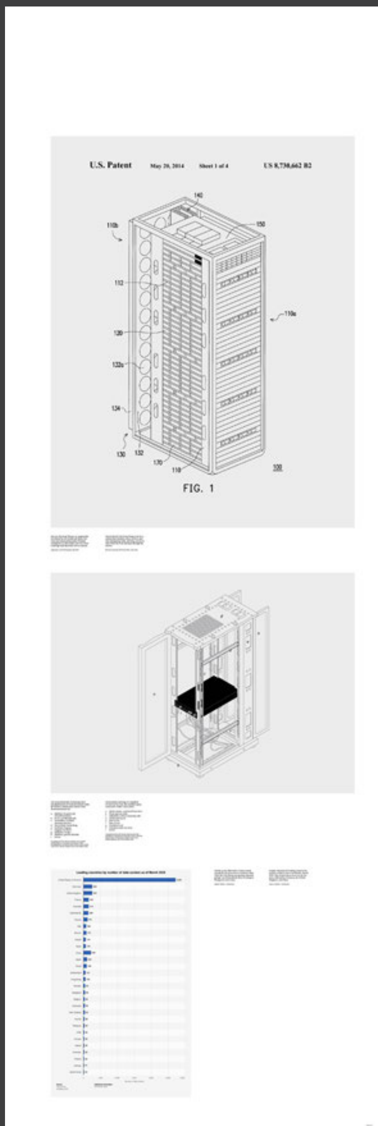
3e8 is a Viennese studio for digital art, interactive exhibits, and productions with creative technologies, with offices in Vienna and Berlin. With a strong focus on user experience and emotional storytelling, we design and develop projects for exhibitions, events, public spaces, and the web.

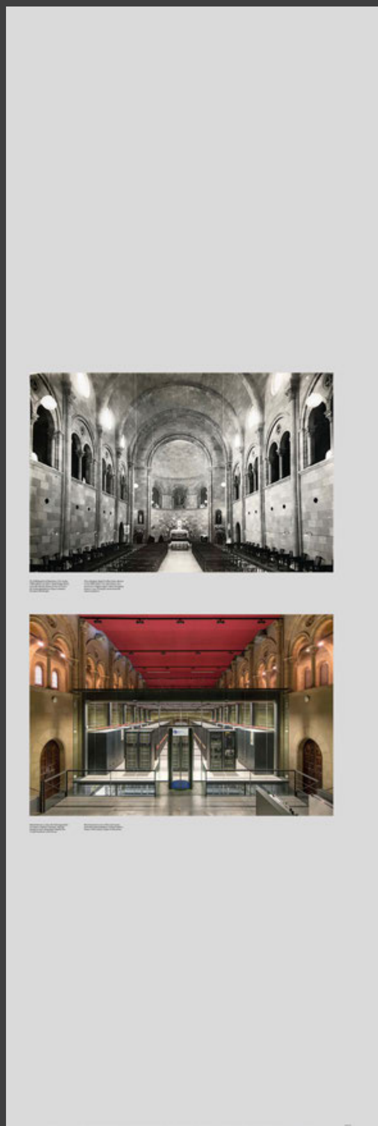
Felix Betzenbichler (Production), Thomas Geisl (Software Development), Christoph Ignaz Kirmaier (Production, Software Development), Ilina Kokaleska (Art Direction), Bessie Normand (Graphic Design), Philipp Partoder (Software Development)

Content & Data: Paula Löffler, Bruno Heringer, Günter Merk

The graphic design is showcased in a radically reduced visual language: clear, direct, and informative. It mirrors the exhibition's architecture: both minimal and revealing, exposing the structures that usually stay unseen. A modern serif font (Kleisch by Lineto) is the main protagonist of the exhibition identity. Hot metal typesetting was one of the earliest forms of technical data transmission. Building on this, a classic French Renaissance Antiqua is used: one of the most widely used typefaces. The serif font lends the design an editorial, clear character. It stands in deliberate contrast to the digital theme, making the design feel less tech-driven and more reflective. The design follows the logic of digital grid systems. Every element—image, text, supplementary information—is precisely embedded in the grid. This creates visual clarity, order, and calm, making a complex subject more accessible while giving the images enough space to resonate in the intervals between elements.







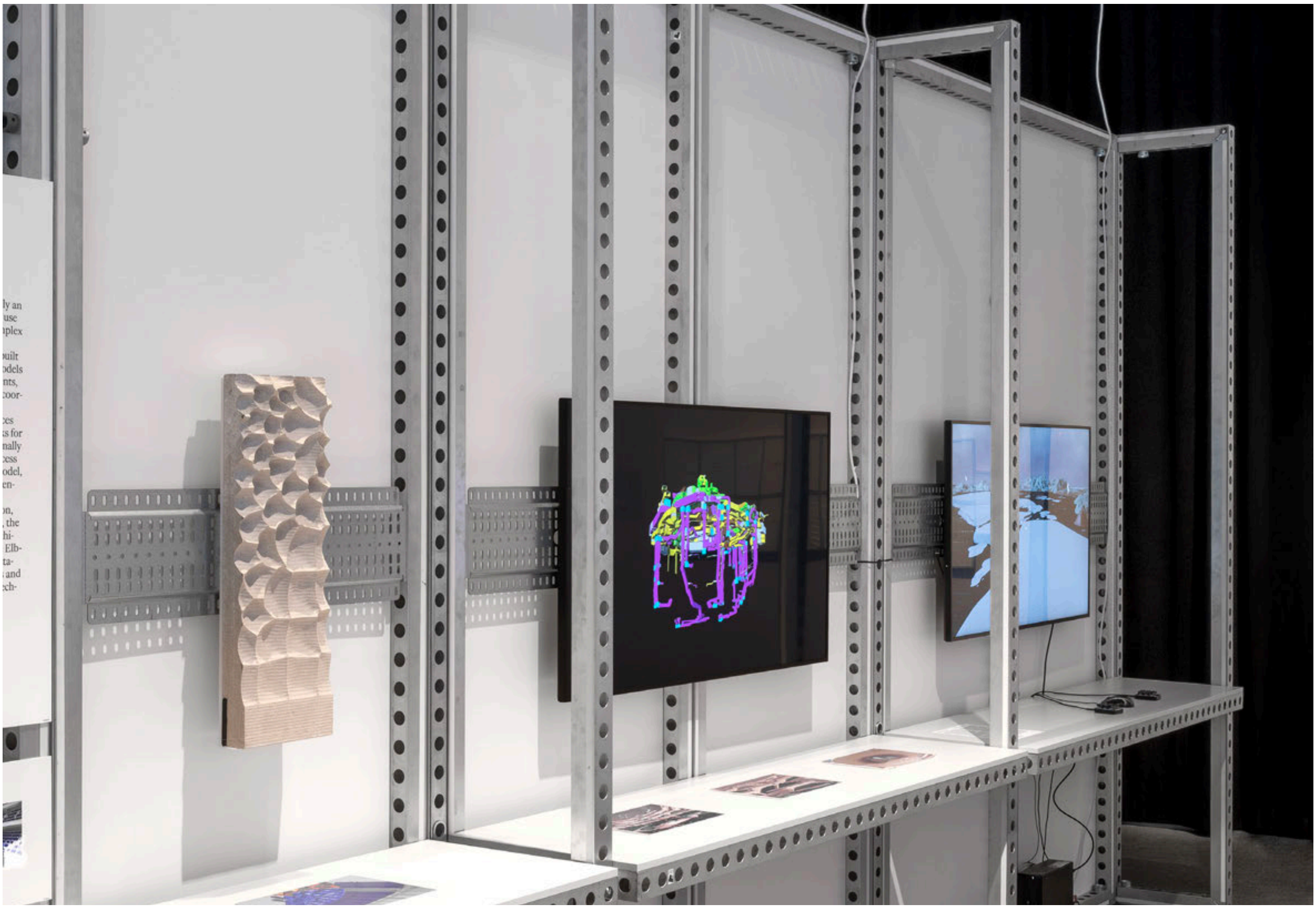

STEP
Der neue Stadtentwicklungsplan (STEP) ist der Plan für die Zukunft von München. Sieben Handlungsfelder enthalten Ziele für eine nachhaltige Stadtentwicklung, die in dieser schematischen Karte räumlich dargestellt werden.
BODENVERSIEGELUNG 2023
Der Versiegelungsgrad pro Baublock der Landeshauptstadt München in Prozent. Früher waren dafür aufwendige, manuelle Kartiermethoden notwendig. Heute lässt sich Landbedeckungsklassifizierung (LCC) in einem effizienten, automatisierten Ansatz nutzen.
RGB ORTHOFOTO 2023
Aus den alle zwei Jahre stattfindenden Luftbildbefliegungen wird ein Echtfarben-Orthofoto der Landeshauptstadt München erzeugt. Das Orthofoto ist ein geometrisch entzerrtes Luftbild, das maßstabsgetreu die Erdoberfläche darstellt.


Smart Homes
Smart homes do provide security, comfort, and efficiency, offering new ways to organize daily life and manage the home. Devices such as smart speakers and voice assistants, doorbells with cameras, adaptive thermostats, and app-controlled lighting are already widely used. At the same time, these technologies reshape how we live and relate to our surroundings. By outsourcing daily tasks to connected devices, households become dependent on infrastructures that remain largely invisible and beyond their control. Vulnerabilities—from data leaks to technical failures—expose the fragility behind the promise of seamless living. Moreover, the rhetoric of "smartness" often masks questions of power: Who owns the data? Who benefits from automation?
Ramona Lutz is pursuing a Master's in Architecture at the Technical University of Munich, where she also completed her Bachelor's degree.
Nora Maleh is studying for a Master's in Architecture at the Technical University of Munich, following her Bachelor's at Frankfurt University of Applied Sciences. The project presented was developed in a seminar held in preparation for this exhibition.
Kameras, Sensoren
Sicherheit & Überwachung
Safety & Surveillance
Stirnrunzelnd kl
SONY


Datenmodelle in der Architekturpraxis
Data Models in Architecture Practice


Zeitlich
PARIS, FRANCE
GEORGETOWN, GUYANA
Prompts & Provenienz: Raum in Text-zu-Bild-Modellen verorten
Prompts & Provenance: Re-situating Place in Text to Image Models
2. Computational Sight OpenAI GPT 4 (2024)
Tell me what you see?


Anatomy of an AI system
Monsters and Ghosts
of the Far North

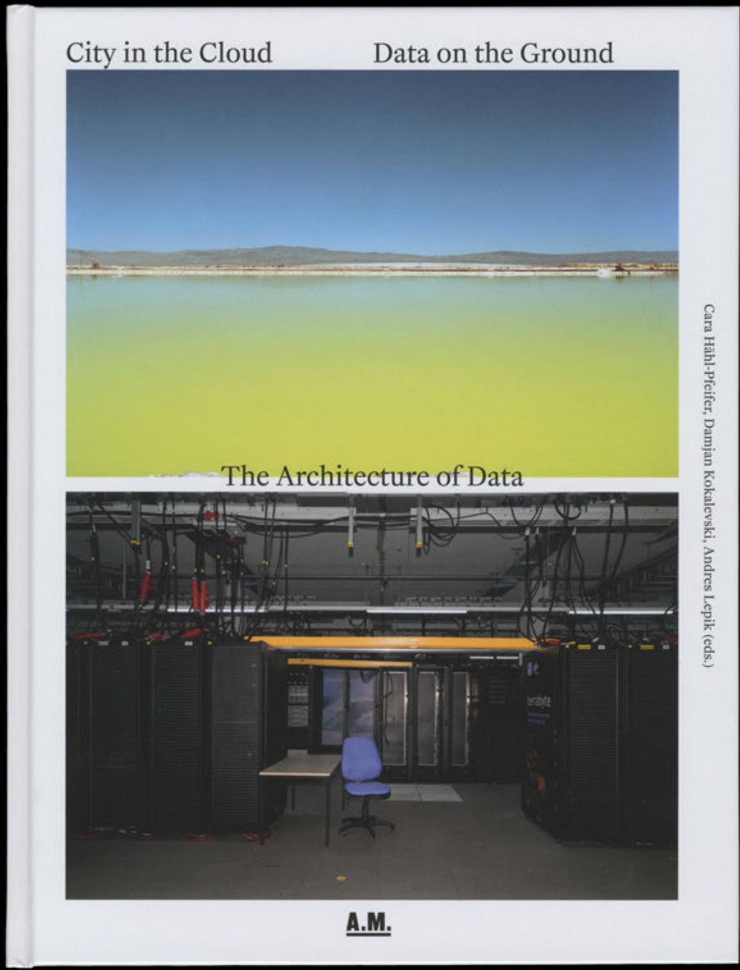


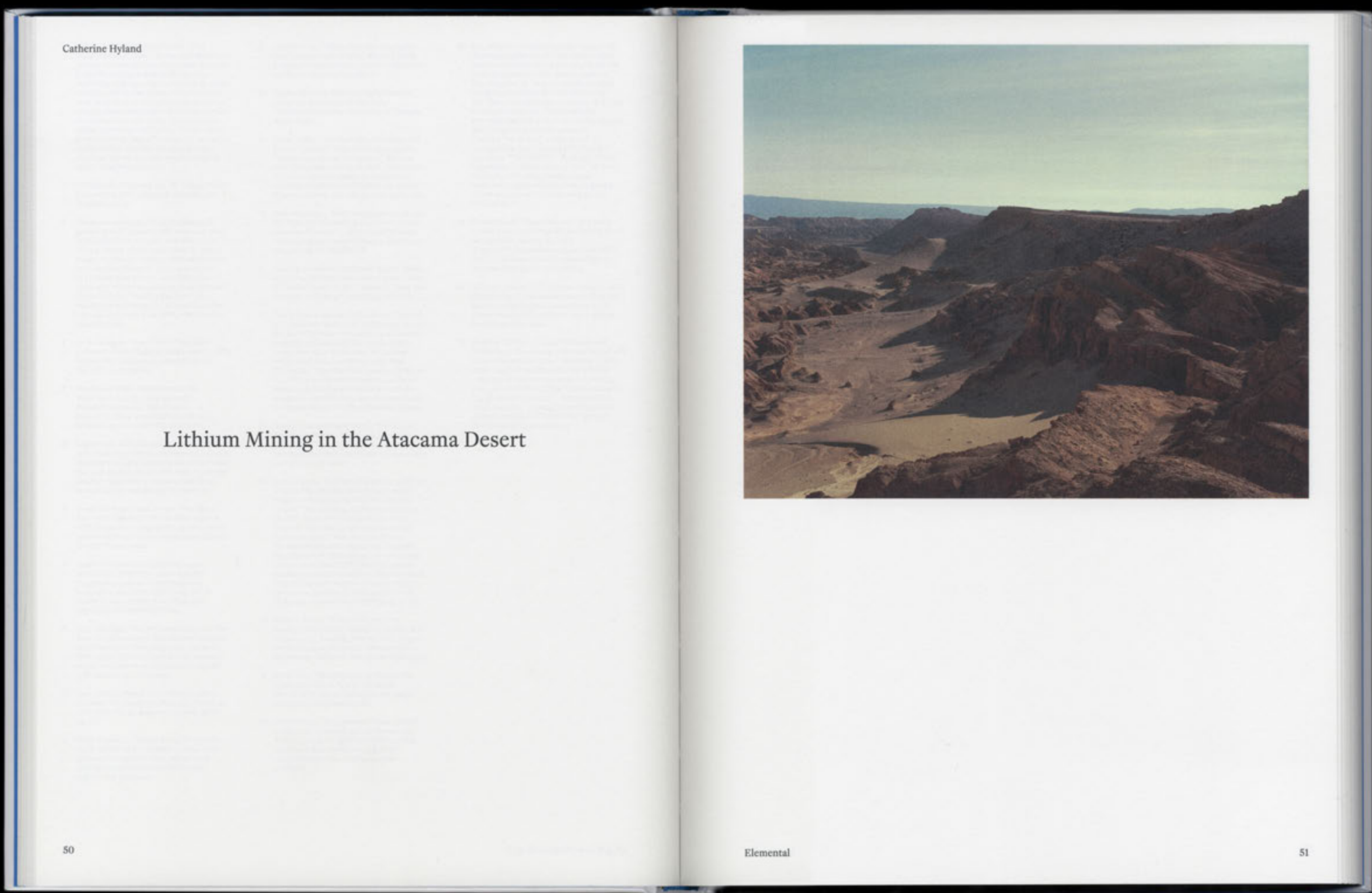
City in the Cloud – Data on the Ground
The Architecture of Data
German / English Edition
23 × 30 cm; 208 pages

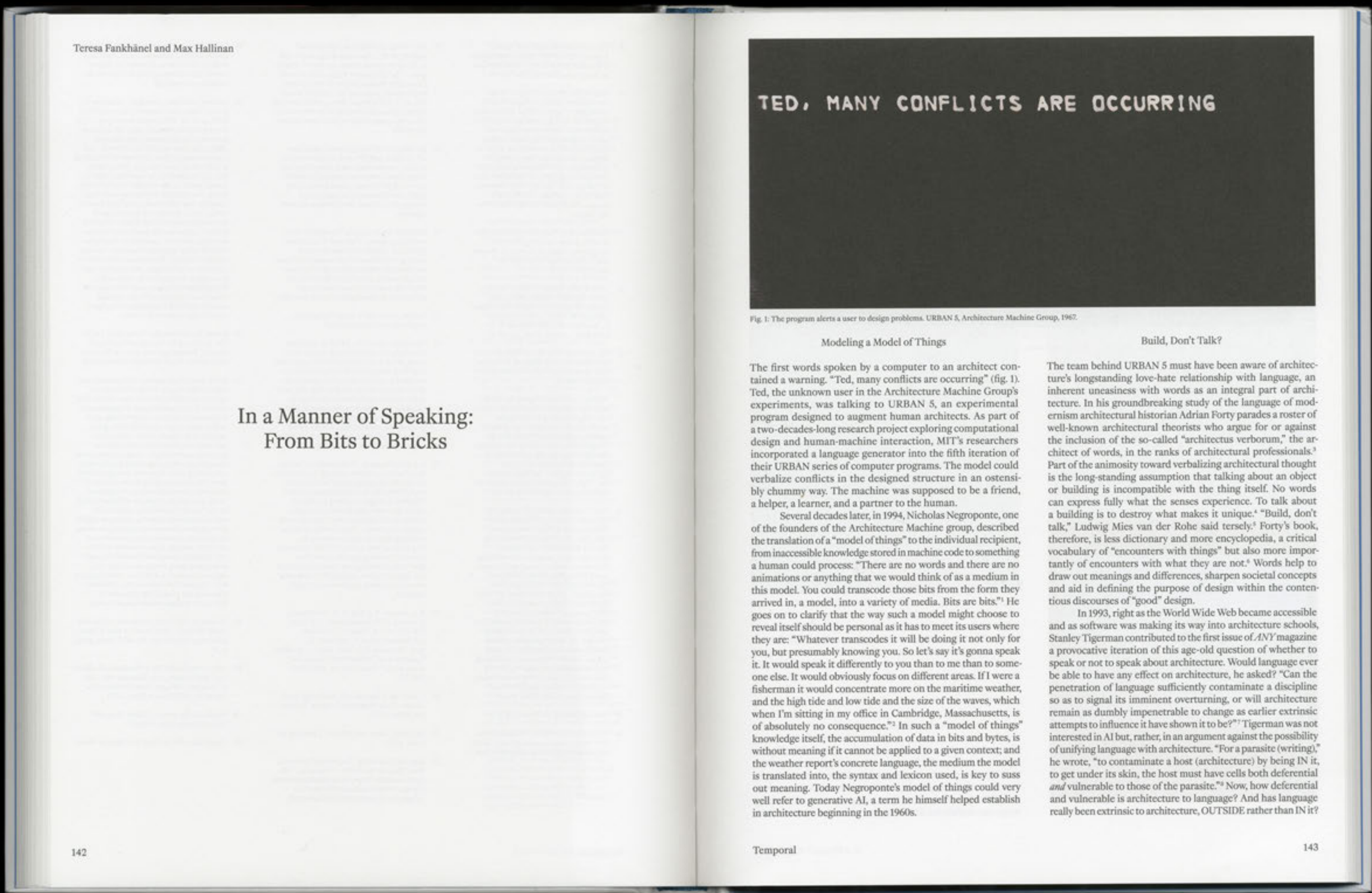
The contributions in this volume call for greater transparency, critical awareness, and care toward the material foundations of the data economy—as essential conditions for more equitable and accountable digital futures.

Edited by Cara Hähl-Pfeifer, Damjan Kokalevski, and Andres Lepik
Designed by WVH – Wiegand von Hartmann
Published by Architangle

With contributions by James Bridle, Giulia Bruno, Teresa Fankhänel, Cara Hähl-Pfeifer, Max Hallinan, Mél Hogan, Catherine Hyland, Damjan Kokalevski, Andres Lepik, Niklas Maak, Marija Marić, Anna-Maria Meister, Marina Otero Verzier, Trevor Paglen, Godofredo Enes Pereira, Andra Pop-Jurj, Alison Powell, Māra Starka, and Rafael Uriarte






Teresa Fankhänel and Max Hallinan
In a Manner of Speaking: From Bits to Bricks
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TED, MANY CONFLICTS ARE OCCURRING
Fig. 1: The program alerts a user to design problems. URBAN 5, Architecture Machine Group, 1967.
Modeling a Model of Things
The first words spoken by a computer to an architect contained a warning. "Ted, many conflicts are occurring" (fig. 1). Ted, the unknown user in the Architecture Machine Group's experiments, was talking to URBAN 5, an experimental program designed to augment human architects. As part of a two-decades-long research project exploring computational design and human-machine interaction, MIT's researchers incorporated a language generator into the fifth iteration of their URBAN series of computer programs. The model could verbalize conflicts in the designed structure in an ostensibly chummy way. The machine was supposed to be a friend, a helper, a learner, and a partner to the human.
Several decades later, in 1994, Nicholas Negroponte, one of the founders of the Architecture Machine group, described the translation of a "model of things" to the individual recipient, from inaccessible knowledge stored in machine code to something a human could process: "There are no words and there are no animations or anything that we would think of as a medium in this model. You could transcode those bits from the form they arrived in, a model, into a variety of media. Bits are bits." He goes on to clarify that the way such a model might choose to reveal itself should be personal as it has to meet its users where they are: "Whatever transcodes it will be doing it not only for you, but presumably knowing you. So let's say it's gonna speak it. It would speak it differently to you than to me than to someone else. It would obviously focus on different areas. If I were a fisherman it would concentrate more on the maritime weather, and the high tide and low tide and the size of the waves, which when I'm sitting in my office in Cambridge, Massachusetts, is of absolutely no consequence." In such a "model of things" knowledge itself, the accumulation of data in bits and bytes, is without meaning if it cannot be applied to a given context; and the weather report's concrete language, the medium the model is translated into, the syntax and lexicon used, is key to suss out meaning. Today Negroponte's model of things could very well refer to generative AI, a term he himself helped establish in architecture beginning in the 1960s.
Build, Don't Talk?
The team behind URBAN 5 must have been aware of architecture's longstanding love-hate relationship with language, an inherent uneasiness with words as an integral part of architecture. In his groundbreaking study of the language of modernism architectural historian Adrian Forty parades a roster of well-known architectural theorists who argue for or against the inclusion of the so-called "architectus verborum," the architect of words, in the ranks of architectural professionals. Part of the animosity toward verbalizing architectural thought is the long-standing assumption that talking about an object or building is incompatible with the thing itself. No words can express fully what the senses experience. To talk about a building is to destroy what makes it unique. "Build, don't talk," Ludwig Mies van der Rohe said tersely. Forty's book, therefore, is less dictionary and more encyclopedia, a critical vocabulary of "encounters with things" but also more importantly of encounters with what they are not. Words help to draw out meanings and differences, sharpen societal concepts and aid in defining the purpose of design within the contentious discourses of "good" design.
In 1993, right as the World Wide Web became accessible and as software was making its way into architecture schools, Stanley Tigerman contributed to the first issue of ANY magazine a provocative iteration of this age-old question of whether to speak or not to speak about architecture. Would language ever be able to have any effect on architecture, he asked? "Can the penetration of language sufficiently contaminate a discipline so as to signal its imminent overturning, or will architecture remain as dumbly impenetrable to change as earlier extrinsic attempts to influence it have shown it to be?" Tigerman was not interested in AI but, rather, in an argument against the possibility of unifying language with architecture. "For a parasite (writing)," he wrote, "to contaminate a host (architecture) by being IN it, to get under its skin, the host must have cells both deferential and vulnerable to those of the parasite." Now, how deferential and vulnerable is architecture to language? And has language really been extrinsic to architecture, OUTSIDE rather than IN it?
Temporal
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FUNCTIONALISM
HEROIC
BEAUX-ARTS
FASCIST
UTOPIAN
FOLK
REVIVAL
WAR MINIMAL
CONSUMER MODERN
PARAMETRIC
MEGAFORM
SPACE-COLONIAL
CYBERNETIC
SEMIOLOGICAL
BUREAUCRATIC
NEO-FASCIST
BIOMORPHIC
REVOLUTIONIST
ADHOCIST
MOBILE
SERVICE-STATE ANONYMOUS
Fig. 2: Evolutionary Tree to the Year 2000, Charles Jencks, 1969. With revisions and notes, ca. 1999.
There are ubiquitous metaphors that seek to establish some kind of kindred spirit between architecture and language—references to architecture as grammar or syntax—that have pervaded architectural thinking such as Christopher Alexander's aptly named Pattern Language or the more thesauric approach of Charles Jencks's Language of Postmodern Architecture. Language here is not just a medium of instruction and communication; it is a code. A number of modern architects have been vocal about their dislike for rendering, perhaps most famously Adolf Loos who, in 1924, declared he had no need for it because
BEVERLY HILLS VARIEGATED
Fig. 3: Daydream Houses of Los Angeles, Charles Jencks (New York: Rizzoli, 1978).
"[g]ood architecture, how something is to be built, can be written. One can write the Parthenon." Loos's example highlights how an architectural practice that depends exclusively on the execution of established rules (in ancient Greece, at a time when there were no architects in the modern sense of the word) could be written out or encoded in language. Such a practice of describing a structure procedurally could also be called programming. If we can call the Parthenon's written architecture expounded by Loos algorithmic, Charles Jencks's work, by contrast, could be considered as the equivalent of an ever-shifting database. His continuous revisions of his Evolutionary Tree of the Year 2000 (fig. 2) were an iterative labeling process of a vector field that started to detach from the linear relations of traditional repositories of architectural knowledge such as dictionaries or databases. And while the structures subsumed in his evolutionary construct were part of an academic discourse surrounding the canon of architecture, even if they took the idea of a contemporaneous canon ad absurdum, his Daydream Houses of Los Angeles achieved something altogether more riveting. Driving around the suburbs of LA Jencks recorded chance encounters while house-chasing local vernacular architecture that "bastardized" traditional styles such as ranch houses or haciendas. In a tongue-in-cheek name game, he churned out labels for the kitschy and the excessive he encountered based on iterations of historical references (fig. 3).
Daydreaming with AI
New technologies, especially generative artificial intelligences, revive the age-old discussion about text-text, image-text, and object-text pairs in architecture. They now enable a bi-directional, seemingly automatic, conversion of written descriptions into images and found images to texts. With large language models (LLMs) computers have learned to mimic
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In a Manner of Speaking
human speech beyond URBAN 5's limited preprogrammed responses. And with advances in computer vision, neural networks—approximations of the inner workings of firing neurons inside a human brain—have learned to discern between representations of real-world things in images. Unlike in humans such learning only happens with the help of preexisting vast collections of processable data, be it in the form of textual sources, images, or videos that allow an extrapolation of similarities and conventions. Without the millions and now billions of datasets collected by services like WordNet, ImageNet, Common Crawl, or LAION, computers would toddle on. That the makeup and interpretation of these datasets is not without pitfalls is by now widely recognized through these systems' built-in biases and a propensity to hallucinate, that is, to invent information they do not contain without making such fabulations apparent. Some earlier image generators such as DeepDream (many of the early neural networks consciously leaned into a somnambulist language, from Deep Daze to the Raymond Chan-
Fig. 4: "Nightmare beast" created using DeepDream. Alexander Mordvintsev, 2015.
dleresque Big Sleep) tended to limit their creations to clearly definable groups of images that exposed a system's underlying database as much as the way it was parsed. If the data's classification contained mostly pictures of dogs, dogs is what the generated images skewed toward (fig. 4).
This means that there are no Platonic ideals in AI, no models of eternal truths or forms to refer back to. Rather, AI's "model of things" is a dynamic vector space that plots adjacencies and calculates probabilities based on what it has ingested. As Mario Carpo put it, every raw, unstructured, and unlabeled collection of images scraped from the internet and used for training is a potential canon of architecture. Mapping one system of knowledge onto the other, jointly training to align a text encoder and an image encoder, for example using Contrastive Language-Image Pre-training (CLIP), is a relatively new method. Much of this learning happens as
self-supervised learning, which is, if at all, only grounded in a small sample set that contains a so-called ground truth, that is, information and meaning verified by humans. Everything else is inferred by continuous adversarial comparison. Like a kid on a long car ride, one part of the network keeps asking "are we there yet" and the other keeps responding "no" until the destination, a final image-text pair, is reached.
A recent quantitative study of such natural language encoding in Midjourney, arguably the text-to-image platform most widely used by architects, tries to pry open the black box of such a joint learning process. Leaning heavily on the idea of "style" as an already encoded knowledge system in architecture with defined design "rules," the researchers asked ChatGPT, a text-to-text generator, for a description of a generic Art Deco interior: "Geometric shapes bold colors luxurious materials streamlined forms symmetrical patterns decorative motifs plush interiors lavish embellishments glamorous aesthetics modernist design." Whereas modernist writing had preferred abstractions and generalizations, including a limited number
Fig. 5: "Art Deco interior" created using Midjourney. Joern Ploennigs and Markus Berger, ca. 2024.
of nouns, discarding adverbs, attributes or metaphors, the new architectural language of some AI generators seems to thrive on the use of experiential qualities of spaces and an overabundance of descriptive imagery. In a second step, after they had prompted Midjourney to create the image (fig. 5), the study's principal investigators asked the same program for an image-to-text conversion back that revealed how deeply the idea of "style" is encoded in the makeup of generative AI such as Midjourney. All of Midjourney's generated descriptions featured the key phrases "Art Deco" and "geometric patterns" rather than ChatGPT's more descriptive keywords used as input by the researchers.
Temporal
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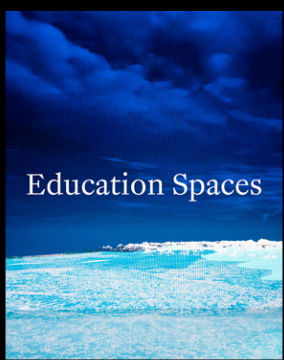
City in the Cloud
Data on the Ground
16. Oktober 2025 – 8. März 2026
Architekturmuseum der TUM in der Pinakothek der Moderne


City in the Cloud
Save the Date – 15th October 2025
Data on the Ground


Data Centers


Education Spaces


Digital Tools


City in the Cloud
The Architecture of Data
Architektur und Daten
Data on the Ground

CPWH

CPWH is a collaborative design practice formed by Caroline Perret and Winston Hampel. Established at the intersection of architecture and design, the studio operates across disciplines, scales and contexts.

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WVH – Wiegand von Hartmann

WVH – Wiegand von Hartmann is a creative office shaping identity and design systems—turning complex ideas into ordered signals, driven by creative expression and cultural instinct.

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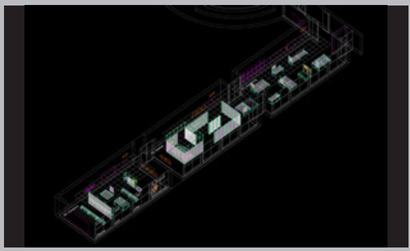
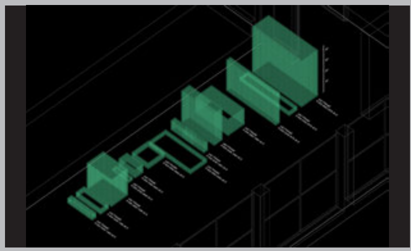
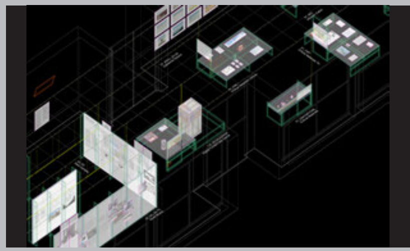
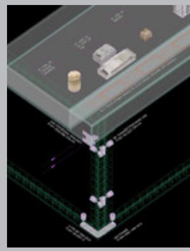
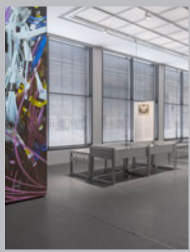
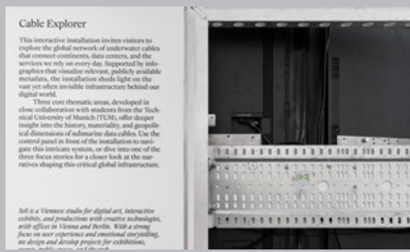
Photos by Jan Gutjahr and CPWH. File names indicate the respective photo credits.

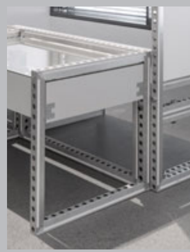









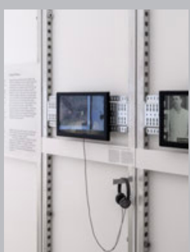







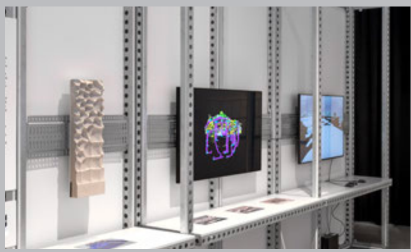












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