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Rubber Frictions: Material Legacies beyond the 1851 Great Exhibition

Introduction

The notion of "active matter" has gained momentum in a variety of disciplines, ranging from materials science to cultural studies, philosophy, architecture, and design.[1] On the one hand, new digital fabrication technologies and the development of "smart" materials have increased interest in materiality and blurred the boundaries between the biological and the built environment, between analogue and digital structures and production techniques.[2] On the other hand, in relation to these technoscientific developments, neo-materialist movements, especially feminist and post-humanist theories, provided important impulses for a novel understanding and critical investigation of matter.[3] The understanding of "active materials"[4] and "vibrant matter,"[5] as proposed by new materialist scholars, has broadened the focus "to the non-human or more-than-human, and the biological and ecological dimensions of life matters" and has challenged us "to consider how non-human bodies or matters might contribute to their own actualization."[6] Ultimately, questions of material epistemologies and material onto-politics have gained further importance through the far-reaching post- and decolonial critique of the hegemonic Western knowledge system and its attempts of (un)making worlds within and through colonialist-modernist power systems.[7] This in-

1 I thank Michaela Büsse, Sria Chatterjee, and the reviewer of this text, whose valuable comments helped improve my argumentation.

2 On these developments see, e.g., Paola Antonelli, ed., *The Neri Oxman Material Ecology Catalogue* (New York: The Museum of Modern Art, 2020); Seetal Solanki, *Why Materials Matter: Responsible Design for a Better World* (Munich: Prestel, 2019); Skylar Tibbits, ed., *Active Matter* (Cambridge, MA: MIT Press, 2017); Rivka Oxman and Robert Oxman, *The New Structuralism: Design, Engineering and Architectural Technologies* (Hoboken, NJ: Wiley, 2010).

3 For an overview on new materialist writings and positions see, e.g., Iris van der Tuin and Rick Dolphijn, ed., *New Materialism: Interviews & Cartographies* (Ann Arbor: Open Humanities Press, 2012); Diana Coole and Samantha Frost, "Introducing the New Materialisms," in *New Naterialisms: Ontology, Agency, and Politics*, Diana Coole and Samantha Frost, ed. (Durham, NC: Duke University Press, 2010), 1–46.

4 Peter Fratzl, Michael Friedman, Karin Krauthausen, and Wolfgang Schäffner, ed., *Active Materials* (Berlin: De Gruyter, 2021).

5 Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham, NC: Duke University Press, 2010).

6 Astrida Neimanis, "Material Feminisms," in *Posthuman Glossary*, Rosi Braidotti and Maria Hlavajova, ed. (London: Bloomsbury, 2018), 243.

7 Walter D. Mignolo, *The Darker Side of Western Modernity: Global Futures, Decolonial Options* (Durham, NC: Duke University Press, 2011); Aníbal Quijano, "Coloniality and Modernity/Rationality," *Cultural Studies* 21, 2–3 (2007): 168–78.

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cludes the specific ways in which matter—both human and more-than-human bodies—has been treated as "cheap thing" and "raw material."[8]

In this article, I will approach material histories and legacies in a way that understands so-called "raw materials" not just as "naturally" given, passive entities or as starting points for industrial production. Rather, I will consider this complex as "active matter," that is, as frictional socio-material processes of becoming.[9] By revisiting the historical event of the Great Exhibition of 1851 in London and contemplating the vulcanized rubber exhibits on display there, I will discuss and problematize "the conceptual and material apparatuses that *make* matter raw," as historian Adelene Buckland put it.[10] These apparatuses link the vulcanization of rubber, a chemical intervention at the molecular level, not only to industrial commodification and capitalist free trade in the mid-nineteenth century, but even more so to colonial power, forced labor, and the "culture of terror"[11] of the Amazonian rubber boom around 1900. In what follows, I will argue that vulcanized rubber, more than simply being a technically enhanced "raw material," must be seen as a site of conflicted material onto-politics, of exploitation, and oppression, where living bodies are to be transformed into passive industrial commodities. Drawing on my background in cultural history and design, I will pay particular attention to the ways in which the raw material of rubber has been discursively framed in discussions of style and taste to attempt moral comparison and cultural othering.[12] I am less interested, however, in what "new" knowledge or industrial "inventions" were generated by Western rubber technicians or designers at the time than in what *other* Indigenous knowledges were expropriated and marginalized, and how the rubber industry's violent past lives on both in intergenerational trauma and transformative futures.[13]

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8 Patel Raj and Jason W. Moore, A History of the World in Seven Cheap Things: A Guide to Capitalism Nature and the Future of the Planet (London: Verso, 2018).

9 Claudia Mareis, Helen Pinto, Amanda Winberg, and Emile De Visscher, "Rubber Violence," in *Material Legacies. DESIGN LAB #13*, Michaela Büsse, Amanda Winberg, and Helen Pinto, ed. (Berlin: Kunstgewerbemuseum Berlin, 2023), 6–7.

10 Adelene Buckland, "Introduction to Volume 1: Raw Materials," in *Victorian Material Culture. Volume 1: Raw Materials*, ed. Adelene Buckland (London: Routledge, 2023): 18–34, 22–23 (original emphasis).

11 Michael Taussig, "Culture of Terror – Space of Death: Roger Casement's Putumayo Report and the Explanation of Torture," *Comparative Studies in Society and History* 26, no. 3 (1984): 495.

12 Although I examine a somewhat different constellation in my work, I would still like to refer to art historian Debora L. Silverman's important work on Belgian Art Nouveau as "imperial modernism," created with raw materials from the Congo and inspired by the local culture there. See Debora L. Silverman, "Art Nouveau, Art of Darkness: African Lineages of Belgian Modernism," *West 86th: A Journal of Decorative Arts, Design History, and Material Culture*, Part I: 18, no. 2 (2011), 139–81; Part II: 19, no. 2 (2012): 175–95; Part III: 20, no. 1 (2013), 3–61.

13 As a white, Central European scholar, I am aware of my situated perspective and privileged position when it comes to referring to non-Western, Indigenous knowledge in an academic context. Although the reference to this knowledge in what follows is made in order to disrupt the heroic narratives of progress in European and North American industrial history, it still runs the risk of being reappropriated and

Though historical in nature, my text is guided by some conceptual reflections by ethnographer Anna Tsing. In her ethnographic study on the multiple uses of the Indonesian rainforest, she alludes to the conflicted history of rubber by building her argument around the dynamics of what she calls "friction." As she elaborates: "Consider rubber. Coerced out of indigenous Americans, rubber was stolen and planted around the world by peasants and plantations, mimicked and displaced by chemists and fashioned with or without unions into tires and, eventually, marketed for the latest craze in sports utility vehicles. . . . Industrial rubber is made possible by the savagery of European conquest, the competitive passions of colonial botany, the resistance strategies of peasants, the confusion of war and technoscience, the struggle over industrial goals and hierarchies, and much more that would not be evident from a teleology of industrial progress. It is these vicissitudes that I am calling friction."[14]

In essence, Tsing claims that the concept of friction "refuses the lie that global power operates as a well-oiled machine," it rather indicates "where the rubber meets the road."[15] That is to say, friction is the moment when *matter*, both physical and social, collides in a seemingly universal system of both resistance and commodification and leaves its traces behind. In this sense, the introduction of vulcanized rubber at the Great Exhibition of 1851 and its promotion as essential raw material for Western industrialization and mass production is less characterized by the linear logic of techno-scientific progress, or the "smooth operation of global power,"[16] but by the causes and effects of friction. Engaging friction as a tool to navigate material histories and legacies might not only lead to a different way of looking at the sticky matter of rubber, but might also help to unsettle a *transformative* potential that is clinging to the very idea of raw material as incommensurable "active matter."[17]

objectified within the "modernist/colonialist" knowledge-power system that produced these narratives in the first place.

14 Anna Lowenhaupt Tsing, *Friction: An Ethnography of Global Connection* (Princeton: Princeton University Press, 2004), 6.

15 Ibid.

16 Ibid.

17 I owe this thought to Adelene Buckland's great introduction on raw materials in Victorian material culture, which inspired my writing a lot. In this regard I would also like to thank Kaja Ninnis for pointing me to this text. See Buckland, "Introduction to Volume 1: Raw Materials."

Revisiting the Great Exhibition and Its Classification System

The Great Exhibition of the Works of Industry of All Nations of 1851 is considered such a thoroughly researched event that new insights are hardly to be expected.[18] However, nineteenth-century historians Louise Purbrick and Adelene Buckland have recently called for the reexamination of this (and similar) international trade fairs from the perspective of material culture, especially with regard to so-called raw materials. According to Purbrick, "reflecting on raw materials offers an alternative to many of the existing histories of [the] Great Exhibition of 1851" since it allows for "a writing of a world history that re-evaluates the significance of the substances of which the earth itself is comprised and the consequences of their movement across its surface."[19] In doing so, she argues, one might be able to expand and disrupt the imperial, industrial, and capitalist narratives installed by and around this exhibition.[20]

Buckland, on the other hand, deconstructs the category of the "raw material" as such in her highly illuminating text on Victorian material culture. Borrowing from new materialist scholar Karen Barad,[21] she argues that "the raw material is a particularly explicit example of the 'material-discursive' construction of all matter," which "can only *exist as a raw material* through the 'intra-actions' of imperial and industrial networks of power."[22] She thus problematizes the fact that the category of the raw material is usually taken for granted (even in new materialist theories), instead of being revealed as a discursive construct, or more precisely, as the colonial and capitalist "fantasy" of turning living bodies into passive matter. "[The] fantasy of the raw material", she argues, "is a fantasy of the earth and of almost all living things as at least potentially devoid of agency, purpose or narrative of their own, but on the cusp of a narrative transformation into capital – a transformation always to be enacted from without."[23] Before I elaborate further on this point with regard to the raw material of rubber and its frictional material legacies, I would like to briefly introduce the histor-

18 On this point, see Alexander C. T. Geppert, "Welttheater: Die Geschichte des europäischen Ausstellungswesens im 19. und 20. Jahrhundert: Ein Forschungsbericht," *Neue Politische Literatur*, 1 (2002): 10–61, 40.

19 Louise Purbrick, "The Raw Materials of World History: Re-visiting the Great Exhibition's Objects," *World History Connected* 13, no. 1 (2016), https://worldhistoryconnected.press.uillinois.edu/13.3/forum_01_purbrick.html.

20 A recent example of such a re-examination of Victorian material culture along raw materials such as coal is the following article: Colin Fanning, "'The Indispensable Agent': Coal and Its Displacements in Victorian Britain," *Journal of Design History* 34 no. 3 (2020): 212–26.

21 See Karen Barad, Meeting the Universe Half Way: Quantum Physics and the Entanglement of Matter and Meaning (Durham, NC: Duke University Press, 2007).

22 Buckland, "Introduction to Volume 1: Raw materials," 22.

23 Ibid.

ical site of the Great Exhibition by focusing on its symbolic and material configuration.[24]

Organized by the Royal Society for the Encouragement of Arts, Manufactures and Commerce under the patronage of Prince Albert, The Great Exhibition of the Works of Industry of All Nations was the first world trade fair of its kind:[25] a massive effort to showcase the achievements of the industrialized nations of the time while ostensibly promoting free trade, knowledge and cultural exchange, as well as "the unity of mankind."[26] Over six million people came to witness the spectacular event, many of them using the newly built railway system for the first time in their lives.[27] The exhibition, which lasted from May to October 1851, took place in the Crystal Palace: a monumental modular building almost entirely made of cast iron and glass sheets, designed by garden architect Joseph Paxton.[28] Being the largest greenhouse of the time,[29] the Crystal Palace quickly became a symbol for the triumph of modern industry and engineering as well as for Victorian culture and its decay (figs. 1, 2).[30]

Although the exhibition was propagated under the auspices of international pacifism and free trade it was also shaped, according to historian Jeffrey Auerbach, by "strident nationalism and even racism,"[31] "fierce nationalistic competition and xenophobia in international affairs; the persistence of aristocratic power; the increasing division of British society into classes; the beginnings of British economic decline; and, the entrenchment of racial attitudes that would characterize the expanding British em-

24 Overviews on the Great Exhibition include Louise Purbrick, *The Great Exhibition of 1851: New Interdisciplinary Essays* (Manchester: Manchester University Press, 2001); Jeffrey Auerbach, *The Great Exhibition: A Nation on Display* (New Haven: Yale University Press, 1999); John E. Findling and Kimberly D. Pelle, *Historical Dictionary of World's Fairs and Expositions 1851–1988* (Westport: Greenwood Press, 1990). Paul Greenhalgh, *Ephemeral Vistas. The "Expositions Universelles," Great Exhibitions and World's Fairs, 1851–1939* (Manchester: Manchester University Press 1988); Utz Haltern, *Die Londoner Weltausstellung von 1851: Ein Beitrag zur Geschichte der bürgerlich-industriellen Gesellschaft im 19. Jahrhundert* (Münster: Aschendorff, 1971).

25 For the origins and prehistory of the World's Fair, see Auerbach, *The Great Exhibition,* 9–31; Greenhalgh, *Ephemeral Vistas*, 3–26.

26 *Great Exhibition of the Works of Industry of all Nations, 1851: Official Descriptive and Illustrated Catalogue* Vol. 1 (London: Spicer Brothers, 1851), 3, https://www.e-rara.ch/zut/content/structure/6726808.

27 Hermione Hobhouse, "3. The Legacy of the Great Exhibition," *RSA Journal* 143, 5459 (1995): 49.

28 For more details on the Crystal Palace, see Folke T. Kihlstedt, "The Crystal Palace," *Scientific American*, 251, 4 (1984): 132–43; Dustin Valen, "On the Horticultural Origins of Victorian Glasshouse Culture," *Journal of the Society of Architectural Historians*, 75, 4 (2016): 403–23.

29 "It covered 772,824 square feet (about 19 acres) in plan. It was 1,848 feet long by 408 feet wide and had an addition on the north side measuring 936 by 48 feet. Its longitudinal central aisle, the 'main avenue,' was 72 by 66 feet high, and its vaulted transept was 72 by 108 feet high." See: Kihlstedt, "The Crystal Palace," 133.

30 On the changing reception and memory culture of the Great Exhibition and the Crystal Palace, see Jeffrey Auerbach, "The Great Exhibition and Historical Memory," *Journal of Victorian Culture* 6, 1 (2001): 89–112.

31 Ibid., 99.

Fig. 1: Inside the Great Exhibition of 1851 in London. *Dickinsons' Comprehensive Pictures of the Great Exhibition of 1851.* Dickinson Brothers, Her Majesty's Publishers, 1852, https://doi.org/10.5479/sil.495268.39088008102741.

pire."[32] Moreover, with the strong presence of British colonies and dependencies, the Great Exhibition has been characterized as an "imperial display,"[33] a battleground for cultural othering and moral comparison. In particular, the large Indian court highlighted the importance of the colonies to British success in trade and industry (fig. 3).[34] The Great Exhibition presented itself as a dynamic, yet conflicted site, to quote cultural historian Catherine Hall, where "identities were . . . constructed in a process of mutual constitution" and "the making of self" was realized "through the making and marking off of others."[35]

At the center of these cultural negotiations were the material exhibits—how they were produced, selected, classified, displayed, and evaluated. But more importantly—

32 Ibid., 107–108.

33 See: Greenhalgh, *Ephemeral Vistas*, 52–81.

34 On the Indian representation at the Great Exhibition, see Carol A. Breckenridge, "The Aesthetics and Politics of Colonial Collecting: India at World Fairs," *Comparative Studies in Society and History* 31, 2 (1989): 195–216; Saloni Mathur, *India by Design: Colonial History and Cultural Display* (Berkeley: University of California Press, 2007), 14–17.

35 Catherine Hall, "Culture and Identity in Imperial Britain," in *The British Empire: Themes and Perspectives*, ed. Sarah E. Stockwell (Oxford: Blackwell Publishing, 2008), 203.

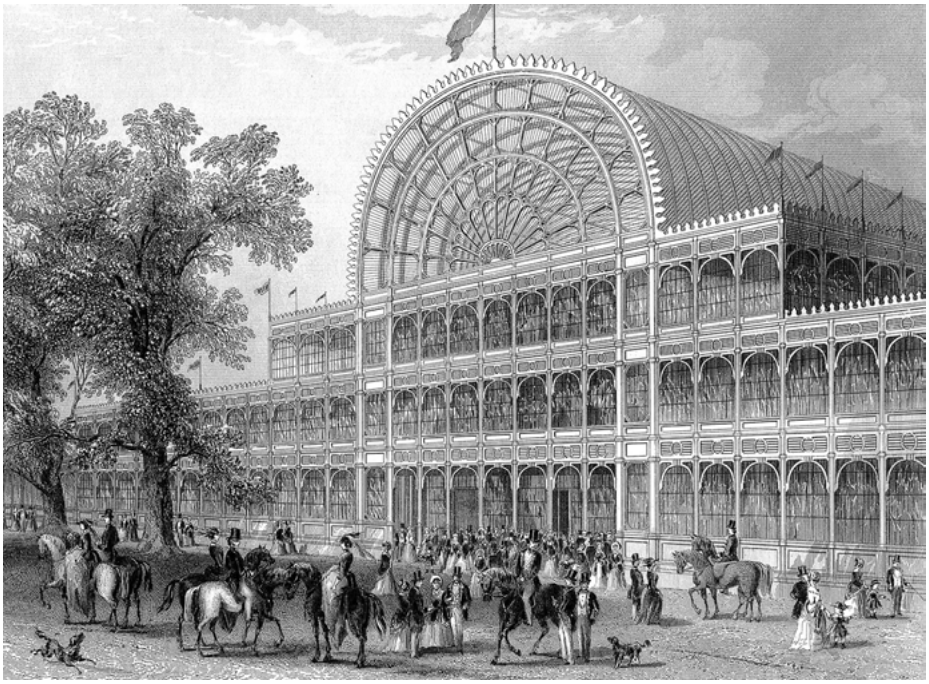


Fig. 2: Exterior of the north transept of the Crystal Palace, London, built for the Great Exhibition, 1851, artist unknown.

what was not shown, suppressed, marginalized, or hidden from the glittering halls of the Crystal Palace. In bringing together almost 14,000 exhibitors and more than 100,000 exhibits from commerce, industry, arts, and science,[36] the Great Exhibition introduced a new perceptual regime for the eye and the senses.[37] It created a "phantasmagoria of capitalist culture,"[38] to use Walter Benjamin's words. While linked to an educational idea,[39] a new form of public sphere emerged, in which the gesture of exhibiting was intended to prepare the visitors for their role as consumers in the industrial modernity that was to come. In terms of design history, the Great Exhibition had a lasting impact on how de-

36 Auerbach, The Great Exhibition of 1851, 91.

37 On this point, see Monika Wagner, "Die Erste Londoner Weltausstellung als Wahrnehmungsproblem," in *Ferrum: Nachrichten aus der Eisenbibliothek 66* (Schaffhausen: Stiftung der Georg Fischer AG, 1994), 38. See also the basic text on this subject: Tony Bennett, "The Exhibitionary Complex", *New Formations*, 4 (1988): 73–102.

38 Walter Benjamin, "Paris, the Capital of the Nineteenth Century," in *Walter Benjamin: The Writer of Modern Life. Essays on Charles Baudelaire,* ed. Michael W. Jennings (Cambridge, MA: The Belknap Press of Harvard University Press, 2006), 37.

39 On public accessibility of institutions such libraries, museums, and world fairs in the nineteenth century, see Jürgen Osterhammel, *The Transformation of the World: A Global History of the Nineteenth Century* (Princeton: Princeton University Press, 2014), 7–15.

Fig. 3: Exhibition gallery representing India. *Dickinsons' Comprehensive Pictures of the Great Exhibition of 1851.* Dickinson Brothers, Her Majesty's Publishers, 1852.

sign was conceived as an aesthetic practice and commercial activity. It introduced, for the first time, "a broader lay audience to the industrial arts of the globe" and made design a site for "enchantment, edification, and entertainment," design historian Lara Kriegel says.[40] Being called "a lesson in taste" by contemporary observers,[41] the event sparked controversial discussions on the aesthetic and material quality of the manufactured products on display and helped set the standards of modern Western design education.[42]

The exhibits included industrial and agricultural machinery (such as steam engines, hydraulic presses, looms), technical instruments and pharmaceutical procedures, weapons, sculptures, domestic appliances, furniture, textiles, furs, stuffed animals, plant seeds, food, and many more things. Also shown were specimens of so-called raw materials, such as rubber pieces, coal lumps, cotton bales, or limestones, which

40 Lara Kriegel, *Grand Designs: Labor, Empire, and the Museum in Victorian Culture* (Durham, NC: Duke University Press, 2007), 87–88.

41 Ralph Nicholson Wornum, "The Exhibition as a Lesson in Taste," in *The Art Journal Illustrated Catalogue: The Industry of All Nations 1851* (London: George Virtue, 1851), I–XXII.

42 One direct legacy of the Great Exhibition was the founding of the South Kensington Museum in 1852, which later became the Victoria and Albert Museum, one of the world's leading museum of crafts and design today. It also set the standards for modern Western design education in Great Britain and beyond.

were considered the starting point for various industrial products and processes (fig. 4).[43] While this mixture of exhibits might appear random at first glance, the organizers, together with scientists, had worked out a more or less coherent classification system for a large part of the objects on display (fig. 5).[44] It consisted of thirty classes of objects, allocated to four main sections, that were Raw Materials, Machinery, Manufactures, and Fine Arts. It applied to the exhibits from Great Britain and its colonies and dependencies at the time, which together formed by far the largest part of the exhibition.[45] All the other national courts, however, did *not* follow this system (apparently for reasons of feasibility and logistics), but were individually organized and set up by local committees according to their own aesthetic and pragmatic criteria. Thus, although the classification system did not affect the exhibition as a whole, due to British nationalist and imperialist dominance of the event it played an important role in defining hegemonic material culture in terms of its industrial-commercial usefulness, cultural value, and moral superiority. In doing so, it "went far beyond the older classifications of natural history to unify nature, culture, and industry in one grand system," as historian Jürgen Osterhammel states.[46] It is therefore worth taking a closer look at its basic assumptions and modes of operation.

First of all, the classification system used for Great Britain and its colonies depicted the logic of the ideal manufacturing process: beginning from the raw materials of the earth to their mechanical treatment by machines, the skilled manufacturing process and the artistic refinement.[47] It thus symbolized the material and moral transformation of crude nature into refined cultural objects and industrial commodities. According to Purbrick, raw materials, such as metals, minerals, vegetable and animal substances, belonged "to the most lowly category" within the classification system, since "they begin, and remain behind the event of industrialization."[48] They transcend the logic of industrialization in a peculiar way, given their different geological or biological ontologies and temporalities, and had to be made fit through numerous epistemic, technical, and logistical maneuvers. However, as Purbrick states, the act of creating such a classification system placed its authors in an omniscient position for identifying and mastering the various stages from "the earth's simple substances transformed into sophisticated objects."[49]

The classification system of Great Britain and its colonies also reflected the great enthusiasm for scientific taxonomy typical of the Victorian age. It was a clear reminiscent of earlier universalist projects of the eighteenth century, such as the taxonomy

43 See Auerbach, The Great Exhibition of 1851, 92.

44 Ibid.

45 *Great Exhibition of the Works of Industry of all Nations, 1851: Official Descriptive and Illustrated Catalogue* Vol. 1 (London: Spicer Brothers, 1851), 89–106, https://www.e-rara.ch/zut/content/structure/6726808.

46 Osterhammel, The Transformation of the World, 14–15.

47 See Auerbach, The Great Exhibition of 1851, 92.

48 Purbrick, "The Raw Materials of World History", unpaginated.

49 Ibid.

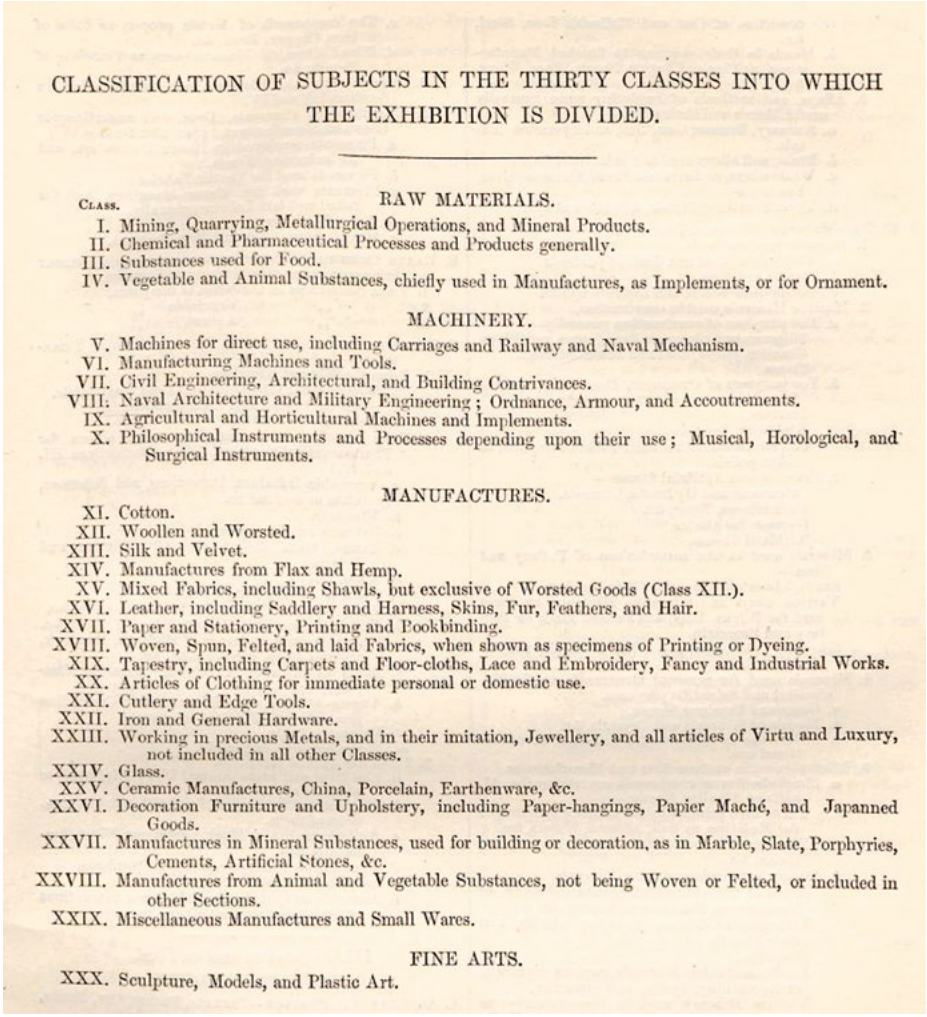
Fig. 4: The exterior of the Great Exhibition, Hyde Park, London. *Dickinsons' Comprehensive Pictures of the Great Exhibition of 1851.* Dickinson Brothers, Her Majesty's Publishers, 1852.

Swedish botanist and zoologist Carl Linnaeus, accused today for laying the grounds of scientific racism,[50] or the *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers* by French philosophers Denis Diderot and Jean d'Alembert. With the main difference, however, that the classification system of a large part of the Great Exhibition served above all commercial interests, as Auerbach argues. To him, it was "a testament to the power and status of commerce" and showed "that everything in the world could be organized along commercial lines."[51] The colonies in particular served a variety of commercial interests: as source of cheap 'raw material' and human labor, as inspiration for new styles and aesthetic expressions, and as market for products manufactured in the Northern Hemisphere. Paul Greenhalgh summarizes the strong imperial-commercial nexus as following: "Like everything else at the *Great Exhibition*, Empire was a commodity, a thing more important than but not dissimilar to shawls, ironwork, flax, or indeed, sculpture."[52]

50 On this point, see Mary Louise Pratt, *Imperial Eyes: Travel Writing and Transculturation* (London: Routledge, 2003), 24–37.

51 Auerbach, The Great Exhibition of 1851, 94.

52 Greenhalgh, *Ephemeral Vistas*, 54.



CLASSIFICATION OF SUBJECTS IN THE THIRTY CLASSES INTO WHICH THE EXHIBITION IS DIVIDED.

CLASS.

RAW MATERIALS.

I. Mining, Quarrying, Metallurgical Operations, and Mineral Products.
II. Chemical and Pharmaceutical Processes and Products generally.
III. Substances used for Food.
IV. Vegetable and Animal Substances, chiefly used in Manufactures, as Implements, or for Ornament.

MACHINERY.

V. Machines for direct use, including Carriages and Railway and Naval Mechanism.
VI. Manufacturing Machines and Tools.
VII. Civil Engineering, Architectural, and Building Contrivances.
VIII. Naval Architecture and Military Engineering; Ordnance, Armour, and Accoutrements.
IX. Agricultural and Horticultural Machines and Implements.
X. Philosophical Instruments and Processes depending upon their use; Musical, Horological, and Surgical Instruments.

MANUFACTURES.

XI. Cotton.
XII. Woollen and Worsted.
XIII. Silk and Velvet.
XIV. Manufactures from Flax and Hemp.
XV. Mixed Fabrics, including Shawls, but exclusive of Worsted Goods (Class XII.).
XVI. Leather, including Saddlery and Harness, Skins, Fur, Feathers, and Hair.
XVII. Paper and Stationery, Printing and Bookbinding.
XVIII. Woven, Spun, Felted, and laid Fabrics, when shown as specimens of Printing or Dyeing.
XIX. Tapestry, including Carpets and Floor-cloths, Lace and Embroidery, Fancy and Industrial Works.
XX. Articles of Clothing for immediate personal or domestic use.
XXI. Cutlery and Edge Tools.
XXII. Iron and General Hardware.
XXIII. Working in precious Metals, and in their imitation, Jewellery, and all articles of Virtu and Luxury, not included in all other Classes.
XXIV. Glass.
XXV. Ceramic Manufactures, China, Porcelain, Earthenware, &c.
XXVI. Decoration Furniture and Upholstery, including Paper-hangings, Papier Maché, and Japanned Goods.
XXVII. Manufactures in Mineral Substances, used for building or decoration, as in Marble, Slate, Porphyries, Cements, Artificial Stones, &c.
XXVIII. Manufactures from Animal and Vegetable Substances, not being Woven or Felted, or included in other Sections.
XXIX. Miscellaneous Manufactures and Small Wares.

FINE ARTS.

XXX. Sculpture, Models, and Plastic Art.

Fig. 5: Classification of subjects in the thirty classes into which the exhibition was divided. *Great Exhibition of the Works of Industry of all Nations, 1851: Official Descriptive and Illustrated Catalogue, Vol. 1* (London: Spicer Brothers, 1851), 89.

Perhaps more than anything, the classification system introduced to present the material culture of Great Britain and its colonies served as an epistemological apparatus for demonstrating Western superiority and effecting colonial power. It not only played a key role in the attempt to organize, systematize, compare, and evaluate the various national exhibits in terms of their industrial usefulness and advancement, but also in measuring and making (supposed) cultural progress evident on a global scale. After all, a cultural evolutionist view prevailed at the Great Exhibition, according to which the various cultures of the world were still at different stages of civilization—with

the industrialized countries, in particular, the British Empire at the forefront.[53] This view, which also applied to the category of the raw materials, was linked to a moral mandate, as Buckland explains: "If Britain was the most successful empire in the world, this was precisely because . . . it had learned to unleash the raw materials of the earth on a scale that had never yet been witnessed and to the supposed benefit of all mankind. In this sense, the raw material as concept materialised an imaginative fusion of both industry and empire, grafting them into a shared narrative of the transformation of the earth to its highest potential."[54]

In the new industrial and capitalist world order, which the Great Exhibition both manifested and enacted, the classification of material culture was shaped through a complex interplay of commercial interests and moral comparison, cultural evaluation, and colonial power. According to anthropologist Arturo Escobar, this was made clear by the exhibition design: "As visitors made their way through the glass cathedral, it became clear to them that not all peoples in the world had achieved the same level of 'development,' for there was no way the arts from 'the stationary East' nor the handicrafts from 'the aborigines' could ever match the 'progress' of the West."[55] In that sense, to him, the Great Exhibition must be seen, not just as an epistemological apparatus, but as a machine "for effecting . . . *coloniality.*"[56]

Rubber as Projection Site for Cultural Othering

Universal epistemologies, such as the Great Exhibition's classification system, are powerful tools in rendering invisible other modes of knowing and being that have no place within them. In this sense, the exhibition itself not only symbolized the triumph of Western industry and technology, but contributed with its quasi-scientific setup to the exclusion of "other, non-scientific forms of knowledges and . . . the subaltern social groups whose social practices were informed by such knowledges," as Boaventura de Sousa Santos, João Arriscado Nunes, and Maria Paula Meneses remind us.[57] To elaborate on this point, it is worth considering *rubber* as a particularly exclusive raw material and a site of exploitation and oppression. Although it attracted the attention of many visitors, retailers, and the council's jury members at the Great Exhibition, the

53 On this point see, e. g., Paul Young, "Mission Impossible: Globalization and the Great Exhibition," in *Britain, the Empire, and the World at the Great Exhibition of 1851*, Jeffrey A. Auerbach and Peter H. Hoffenberg, ed. (Hampshire/Burlington: Ashgate, 2008), 3–25.

54 Buckland, "Introduction to Volume 1: Raw materials," 19.

55 Arturo Escobar, *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds* (Durham, NC: Duke University Press, 2018), 31.

56 Ibid. (original emphasis).

57 Santos, Boaventura de Sousa, João Arriscado Nunes, and Maria Paula Meneses, "Opening Up the Canon of Knowledge and Recognition of Difference," in *Another Knowledge Is Possible: Beyond Northern Epistemologies,* ed. Boaventura de Sousa Santos (New York: Verso, 2008 [2007]), xviii.

way this material was staged and received represented only a very limited part of the "pluriversal" material knowledge and ontologies that came with it.[58]

Rubber seemed to be everywhere at the Great Exhibition.[59] The Crystal Palace's exhibition halls were literally flooded by products made out of rubber and ebonite, a hardened form of rubber that served as substitute for the more expensive ebony and ivory.[60] At the time, natural rubber, also known as *caoutchouc* or *India rubber*, was not yet cultivated in plantations in Southeast Asia or Africa, as this was the case at the end of the nineteenth century, but was still harvested from wild rubber trees in the Amazon basin. It was gained from the milky sap of the Pará rubber tree, the *Hevea brasiliensis*, native to the Amazon rain forest by cutting the trunk of the rubber tree and collecting the escaping sticky fluid, called latex, in a vessel. Rubber then is basically a coagulated form of the latex, formed into lumps on site and transported to Europe and North America for further processing and production purposes (fig. 6).

According to the *Official Descriptive and Illustrated Catalogue* these exhibits included, for instance, water taps made of rubber, various wheels and tires, buffers for railway carriages, water-pillows for hot and cold water, waterproof coats and mackintoshes or rubber boats and pontoons (fig. 7). It was "such a general collection of rubber manufactures as the world had never before seen," British rubber manufacturer Thomas Hancock attested.[61] In addition, visitors could also see objects made of gutta percha, a material quite similar to rubber, yet endemic in Malaya.[62] What made rubber so attractive for manufactures, designers, and retailers at the time were its material properties, in particular its elasticity and impermeability to water. Also, rubber proved to be a poor conductor of energy and heat, which is why it was used at the time for the in-

58 On the topic of pluriversality, see Blaser, Mario and Marisol de la Cadena, "Pluriverse: Proposals for a World of Many Worlds," in *A World of Many Worlds,* Marisol de la Cadena and Mario Blaser, ed. (Durham, NC: Duke University Press, 2018), 6. See also: Arturo Escobar, *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds* (Durham, NC: Duke University Press, 2018); idem, *Pluriversal Politics: The Real and the Possibl*e (Durham, NC: Duke University Press, 2020). On the topic of pluriversal politics see also Arturo Escobar, Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds (Durham, NC: Duke University Press, 2018).

59 John Tully, *Devil's Milk: A Social History of Rubber* (New York: Monthly Review Press, 2011), 43.

60 It should be noted, however, that the terms "India rubber" or "caoutchouc" were not explicitly mentioned in the classification system under the section Raw Materials, only "Gum Elastics and Gutta Percha" were listed there. See *Great Exhibition of the Works of Industry of all Nations, 1851: Official Descriptive and Illustrated Catalogue,* Vol. 1 (London: Spicer Brothers, 1851), 91, https://www.e-rara.ch/zut/content/structure/6726808.

61 Quoted in John Loadman, *Tears of the Tree. The Story of Rubber: A Modern Marvel* (Oxford: Oxford University Press, 2005), 70.

62 See John Tully, "A Victorian Ecological Disaster: Imperialism, the Telegraph, and Gutta-Percha," *Journal of World History* 20, 4 (2009): 559–79.

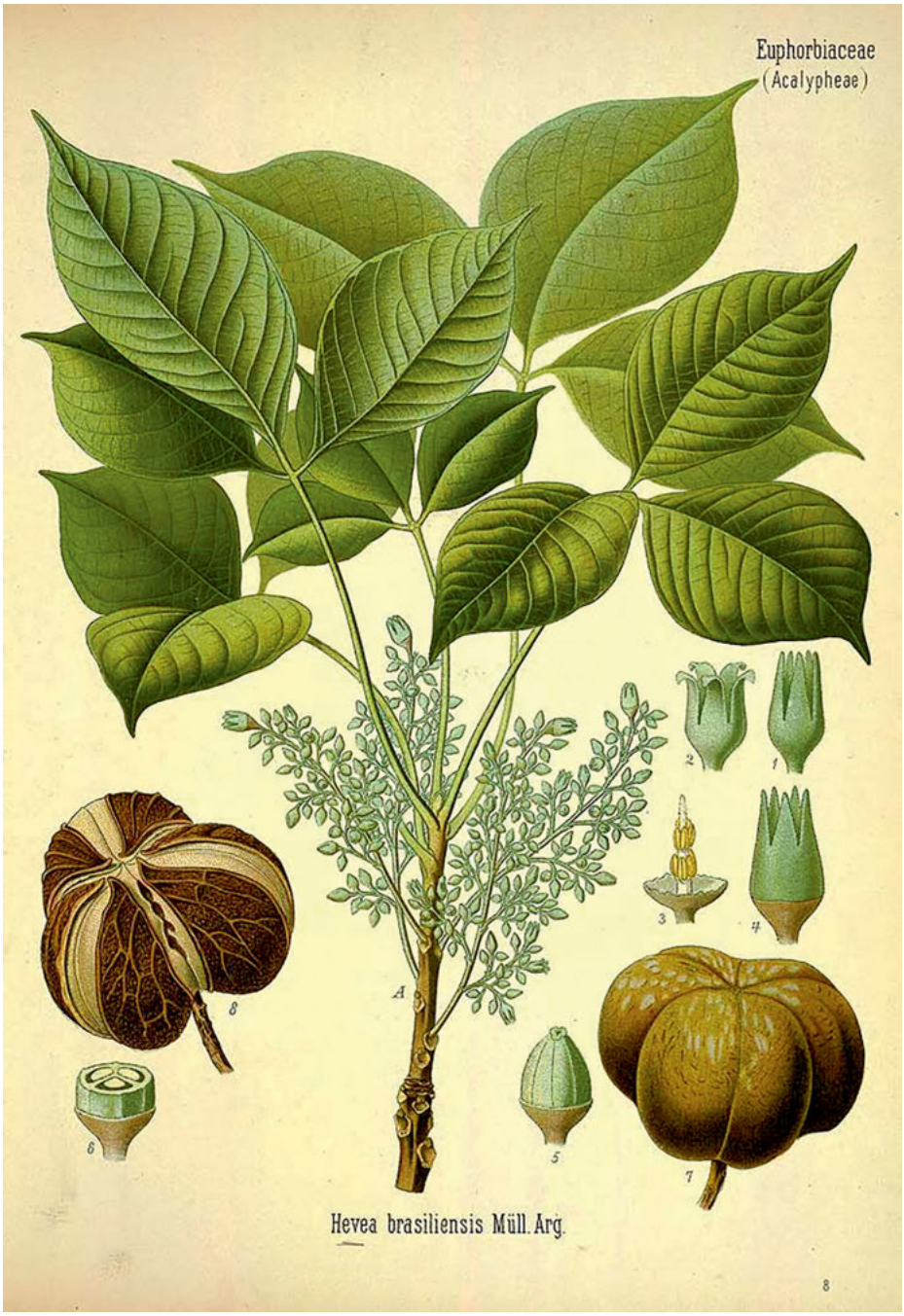


Fig. 6: Hevea Brasiliensis, color lithography after a botanical illustration of Hermann Adolph Koehler medicinal plants, 1887. Published by Gustav Pabst, Koehler, Germany.

sulation of submarine telegraph cables.[63] Last but not least, it seemed to be almost infinitely shapeable and applicable with regard to potential designs and commercial uses.

From an arts and crafts perspective, many Western visitors unfamiliar with rubber wrongly perceived it as a "raw material" without history and tradition. Since rubber came from the so-called New World, to them it was not charged with any known historic Western style or established arts or crafts tradition, but offered allegedly "universal" design possibilities instead. Rubber thus became a surface for ambiguous cultural and moral projections and imaginings. Against the background of industrialization and the associated social and ecological problems in the Northern Hemisphere, discourses around rubber on the one hand reflected a longing for an intact pre-industrial world and a healthy nature. On the other hand, these discourses also created and perpetuated problematic stereotypes about the supposedly pristine, uncultivated state of the rainforest and the Indigenous people's lack of culture and history. Construed as the antithesis of the "civilized," "modern" Western world, rubber became the material embodiment of the "foreign," "wild," "primitive," and "unknown."

Especially for art critics visiting the Great Exhibition, rubber was a material that fascinated and irritated them at the same time. Although rubber proved extremely valuable to Western industry and commerce, and was valued for its many uses, it was not considered a sublime or superior material, like marble, for example, but rather as crude and inferior, amorphous and compliant. Famous German architect Gottfried Semper, who reported on the Great Exhibition from his London exile, called rubber the "monkey among useful materials," and criticized the "peculiar submissiveness" with which this elastic material gives itself away for all purposes, especially for imitations.[64] Semper was probably referring to the expression "the art as the monkey of nature," an old metaphorical figure from the early modern period, which symbolizes the mimetic function of poetry.[65]

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63 Rolf E. Hummel, *Understanding Materials Science: History, Properties, Applications* (New York: Springer 2004 [1998]), 271.

64 "Ein wichtiger Naturstoff hat erst in neuester Zeit auf dem ganzen weiten Gebiete der Industrie eine Art von Umwälzung hervorgebracht, und zwar vermöge seiner merkwürdigen Gefügigkeit, mit welcher er sich zu allen Zwecken hergibt und leiht. Ich meine das Gummi elasticum oder den Kautschuk, wie er auf Indisch benannt wird, dessen stilistisches Gebiet das weiteste ist, was gedacht werden kann, da seine fast unbegrenzte Wirkungssphäre die Imitation ist." Gottfried Semper, "Die textile Kunst für sich betrachtet und in Beziehung zur Baukunst," *Der Stil in den technischen und tektonischen Künsten oder praktische Ästhetik: Ein Handbuch für Techniker, Künstler und Kunstfreunde*, vol. 1 (Frankfurt: Verlag für Kunst und Wissenschaft, 1860), 112, https://digi.ub.uni-heidelberg.de/diglit/semper1860/0157. The quotes in the text are translated by the author.

65 See: Roland Borgards, "Affenpoesie: Literatur und Wissen in der Frühen Neuzeit," in *Animali: Tiere und Fabelwesen von der Antike bis zur Neuzeit*, Luca Tori and Aline Steinbrecher, ed. (Milan: Skira, 2012), 261–62. See also Horst Bredekamp, "Der Affe der Natur: Zur Utopie des Spiels," in *Spielwissen und Wissensspiele: Wissenschaft und Game-Branche im Dialog über die Kulturtechnik des Spiels,* Thomas Lilge and Christian Stein, ed. (Berlin: transcript Verlag, 2018), 24.

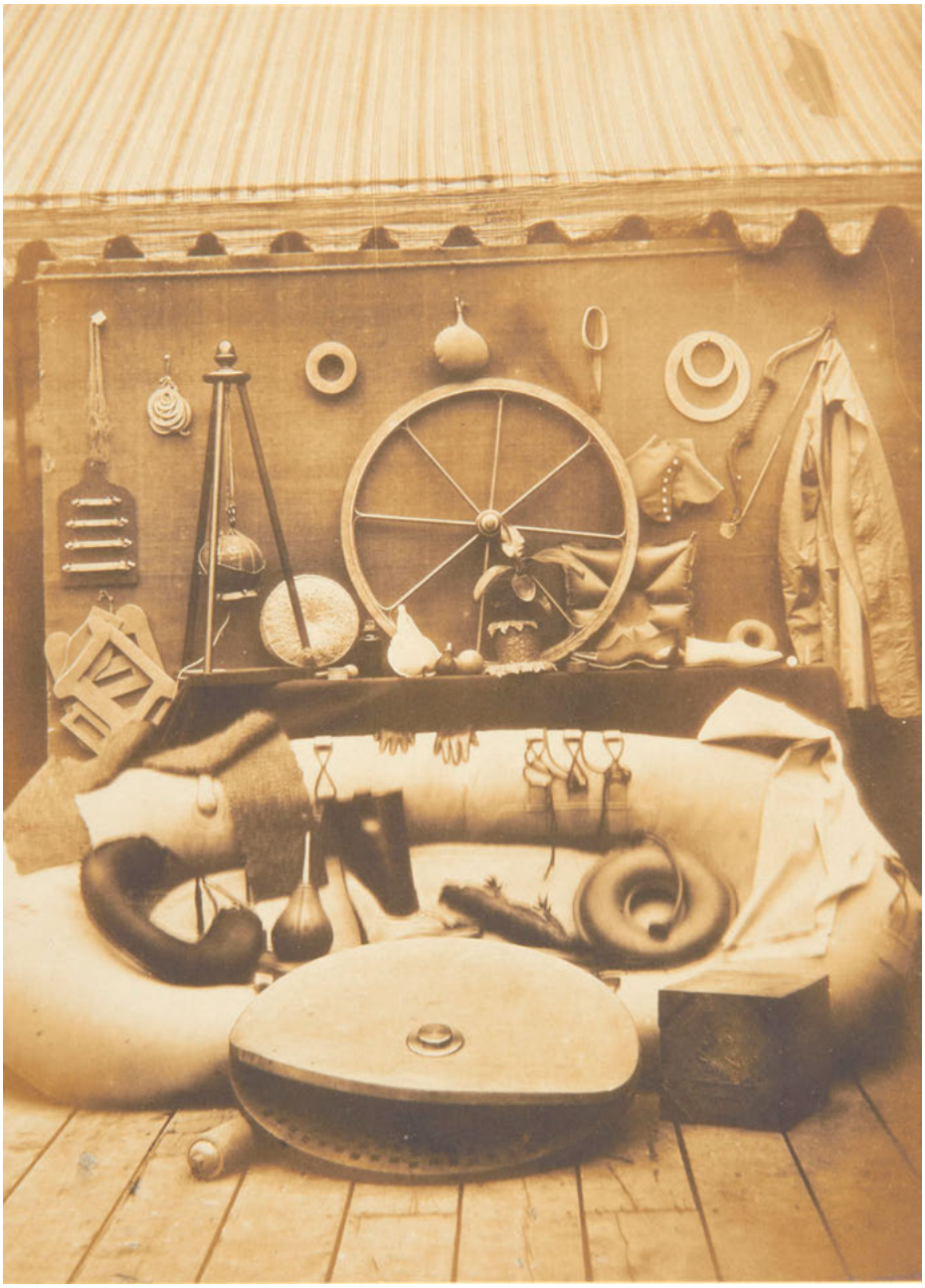

Fig. 7: Articles in Indian rubber by Mackintosh, The Great Exhibition, 1851, salted paper photoprint by Claude-Marie Ferrier.

However, from a cultural history perspective, the image of the monkey—understood as an uncanny borderline creature—also functions as "a strategic element of a differentialist anthropology," as a way to maintain the divine boundary between humans and animals.[66] In this sense, Semper's statement about rubber being the "monkey among useful materials," along with its exoticizing undertone, could well be read as the negotiation of anthropological boundaries and cultural othering, where the monkey as the uncanny "wild other" ensures one's own "civilized humanity."

After having visited the Great Exhibition, Semper was especially concerned about the trend to imitate precious materials, such as ebony and ivory, with cheaper surrogate materials such as rubber: "Rubber and gutta-percha are vulcanized and utilized in a thousand imitations of wood, metal, and stone carvings, exceeding by far the natural limitations of the material they purport to represent," he wrote.[67] Rubber did not come off well in this reading either, as it did not stand for high quality and originality, but rather for inferior imitation and bad taste. However, discussions about the proper artistic handling of a particular material were not limited to rubber but reflected a general interest in the subject of materiality and material culture at the time. A key question in the material debates of the mid-nineteenth century was whether mankind in the age of industrialization—like other important historical epochs before—was able to develop an own epochal style, a distinctive aesthetic language of form and use of material.

Based on aesthetic theories that saw in every material an inherent "gestalt," a predestined form, many artists, architects, and critics searched for an artistic and industrial style that would do "justice" to the laws of the material. Belgian architect and designer Henry van de Velde, for instance, argued that things were beautiful only if they "were made according to logic, according to reason, according to the principles of the rational being of things and according to the exact, necessary and natural laws of the material used for this purpose."[68] Also the German discussion around the term *Materialgerechtigkeit*, which can be translated as "truth to material," arose from the criti-

66 "Der Mensch setzt den Affen als Grenze, mittels derer er sich von den Tieren unterscheidet. Der Affe als Grenzwesen ist demnach ein strategisches Element einer differentialistischen Anthropologie, in der sich der Mensch gegenüber den Tieren seiner selbst versichert." Borgards, *Affenpoesie*, 261–62. The quote in the text is translated by the author.

67 Gottfried Semper, "Science, Industry, and Art," in *The Four Elements of Architecture and Other Writings*, trans. Harry F. Mallgrave and Wolfgang Herrmann (Cambridge, UK: Cambridge University Press, 2010), 134.

68 "Ich . . . bemerke, dass es Menschen in unserer Zeit gibt, die Schönes geschaffen haben, einzig deshalb schön, weil die Dinge nach der Logik, nach der Vernunft, nach den Prinzipien des vernünftigen Seins der Dinge und nach den genauen, notwendigen und natürlichen Gesetzen des dazu verwandten Materials hergestellt wurden." Henry van de Velde, "Kunstgewerbliche Laienpredigten (1902)," in *Materialästhetik: Quellentexte zu Kunst, Design und Architektur,* Dietmar Rübel, Monika Wagner, and Vera Wolff, ed. (Berlin: Reimer, 2005), 169. The quote in the text is translated by the author.

cism of the lack of an "appropriate" style for the industrial age and the search for more honest and rational design criteria.[69]

Against the historical backdrop of industrialization, nationalism, and imperialism, material became a "dazzling battle term," according to art historians Dietmar Rübel, Monika Wagner, and Vera Wolff: "In the name of material, both artisanal working methods and more 'honest' machine work or purist ornamentlessness could be fought for."[70] These debates were often linked to a normative pedagogical impetus, in that questions of material were simultaneously used to negotiate questions of national identity, moral superiority, and cultural progress. Especially non-Western raw materials, such as rubber, had a strong symbolic dimension in those material debates. Similar to the way the concept of *Terra nullius*, the supposedly "unowned" and "lawless" land, was used to justify colonization,[71] also the raw materials deported from the colonies were often described this way: as having no considerable history, no Indigenous ownership, no proper cultural or aesthetic characteristics, and no material qualities. Rubber was treated as if it were *Materia nullius*, if you will.[72] Stripped off its Indigenous histories, knowledges, and territories, of its cultural and aesthetic attributions, and even of its material properties it seemed to be just a lawless, passive matter waiting to be "discovered" and made morally and commercially "productive" through Western ingenuity.

From Vulcanization to a "Culture of Terror"

The commercial use of rubber in the Northern Hemisphere and its activation as essential raw material for the era of industrialization was only made possible, to recall Adelene Buckland, through "conceptual and material apparatuses that *make* matter raw."[73] This process, however, was not at all a linear process, or a "smooth operation of global power," as Anna Tsing argues, but emerged from frictions caused by slavery, resistance,

69 On this point, see Monika Wagner, "'Materialgerechtigkeit': Debatten um Werkstoffe in der Architektur des 19. und frühen 20. Jahrhunderts," in *Historische Architekturoberflächen: Kalk – Putz – Farbe,* ed. Jürgen Pursche (Munich: ICOMOS – Hefte des Deutschen Nationalkomitees 39, 2003), 135–38; Nadine Rottau, *Materialgerechtigkeit: Ästhetik im 19. Jahrhundert,* Forschungsberichte Kunst + Technik, Vol. 2 (Aachen: Shaker, 2012).

70 Dietmar Rübel, Monika Wagner, and Vera Wolff, "Vorwort," in *Materialästhetik: Quellentexte zu Kunst, Design und Architektur*, Dietmar Rübel, Monika Wagner, and Vera Wolff, ed. (Berlin: Reimer, 2005), 10. The quote in the text is translated by the author.

71 See: Stuart Banner "Why Terra Nullius? Anthropology and Property Law in Early Australia," in *Law and History Review* 23, 1 (2005): 95–131.

72 In contrast to the Aristotelian concept of *Materia prima*, the unformed matter, which still contains all the possibilities of becoming form, I would like to use this term *Materia nullis* to emphasize colonialized, racialized modes of material becoming.

73 Buckland, "Introduction to Volume 1: Raw materials," 22–23 (original emphasis).

assertive power, and interpretive hierarchies.[74] Proof of all this is the technology of rubber vulcanization, which is the subject of the following section. In the Crystal Palace, among all rubber manufacturers one stood out in particular. It was inventor Charles Goodyear, who contributed to the exhibition court of the United States of America with a small array of award-winning rubber and ebony products, consisting of black boats and pontoons.[75] They were set up on the middle of an iron bridge constructed by engineer Nathaniel Rider,[76] draped in the shape of a black mountain, and adorned by a red flag (figs. 8, 9). What the visitors were supposed to see, with a little imagination, was a volcano made out of rubber goods with a little flame on top. More important than the rubber goods themselves, however, was a specific chemical treatment of the material, called "vulcanization," which Goodyear presented on the Great Exhibition's world stage.

Fig. 8: Exhibition gallery representing America. *Dickinsons' Comprehensive Pictures of the Great Exhibition of 1851.* Dickinson Brothers, Her Majesty's Publishers, 1852.

Vulcanization technology, named after the Roman god of fire, proved to be a veritable game changer in the industrial use of rubber. Before the "invention" of vulcanization

74 Tsing, *Friction*, 6.
75 Marcus Cunliffe, "America at the Great Exhibition of 1851," *American Quarterly* 3, no. 2 (1951): 122.
76 Victor C. Darnell, "The Pioneering Iron Trusses of Nathaniel Rider," *Construction History* 7 (1991): 69–81.

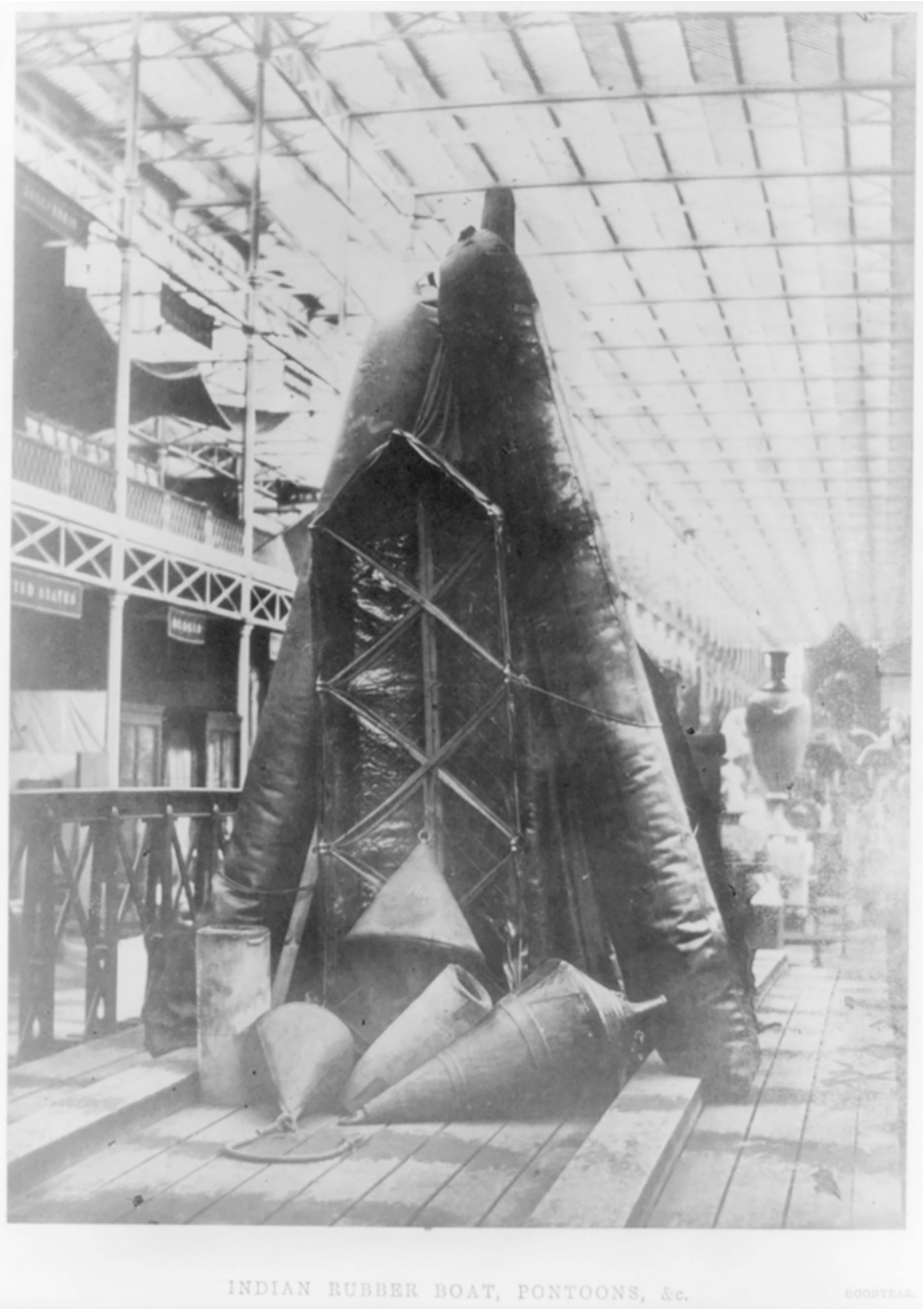

Fig. 9: Charles Goodyear exhibit of vulcanized India rubber products (boat, pontoons, and buoys), 1851, salted paper photoprint by Claude-Marie Ferrier or Hugh Owen.

most attempts to process rubber for larger industrial and commercial purposes in Europe and North America from the mid-eighteenth century onward failed. Although there had been a few rubber applications in the early nineteenth century, such as erasers, elastic bands, mackintoshes or rubber boots, the commercial production and use of this foreign material remained complicated.[77] Despite the fact that latex had been successfully used for thousands of years by the Indigenous peoples in Mesoamerica and South America to make boats and shoes waterproof.[78]

What proved to be challenging for European and North American manufacturers, however, was the inherent activity of this material, or more precisely, their unfamiliarity in handling this material. Due to its active thermoplastic properties, rubber becomes soft and sticky in hot temperatures and brittle in cold. Goods manufactured of untreated rubber thus tended to change their consistency in rather unwanted and unpleasant ways: they became sticky or leaking, started to stink, or even rotted in warehouses. After a series of previous experiments by Friedrich Lüdersdorff in Germany and Nathaniel Hayward in the United States, in 1839 Goodyear eventually found a way to successfully treat rubber with sulfur and heat to eliminate unwanted material properties.[79]

Vulcanization technology was the key to control material activity and transform rubber into a stable, manageable commodity essential to Western industrialization and mass production (fig. 10). In the process of vulcanization, the polyisoprenes of the rubber crosslink with the help of sulfur molecules. Compared to the original material, after vulcanization rubber has permanent elastic properties, this means, it will return to its original position after mechanical stress (fig. 11). In addition, it has a higher tensile strength, can be stretched more easily and is more resistant to weathering and ageing. What vulcanization does to rubber, is in short, that it "increases elasticity while it decreases plasticity."[80] Another name for vulcanization, that is still in use in material science and engineering today, is to "cure" or "curing." To me, this term seems to refer to the idea that the material's inherent natural activity is seen as an "illness" or a "defect" that needs to be "cured" by modern man.

In combination with the masticator, a machine invented by Thomas Hancock in 1821 for shredding rubber waste, and other rubber-related technologies, the technology of vulcanization helped to launch the rubber industry on a large scale in Europe and

77 See Tully, *Devil's Milk*, 36–38.

78 Ibid., 29–33; Harp, *A World History of Rubber*, 12–13, Furthermore, see Dorothy Hosler, Sandra L. Burkett, and Michael J. Tarkanian, "Prehistoric Polymers: Rubber Processing in Ancient Mesoamerica," *Science* 284, 5422 (1999): 1988–91; Joan C. Long, "The History of Rubber—A Survey of Sources about the History of Rubber," *Rubber Chemistry and Technology* 74, no. 3 (2001): 493–508.

79 On the genealogy of vulcanization see Tully, *Devil's Milk*, 40; Loadman, *Tears of Trees*, 232–33. On the material science of vulcanization see A. Y. Coran, "Vulcanization," in *The Science and Technology of Rubber*, fourth edition, James E. Mark, Burak Erman, and Mike Roland ed. (Amsterdam: Elsevier, 2013), 337–81.

80 A. Y. Coran, "Vulcanization," 338.

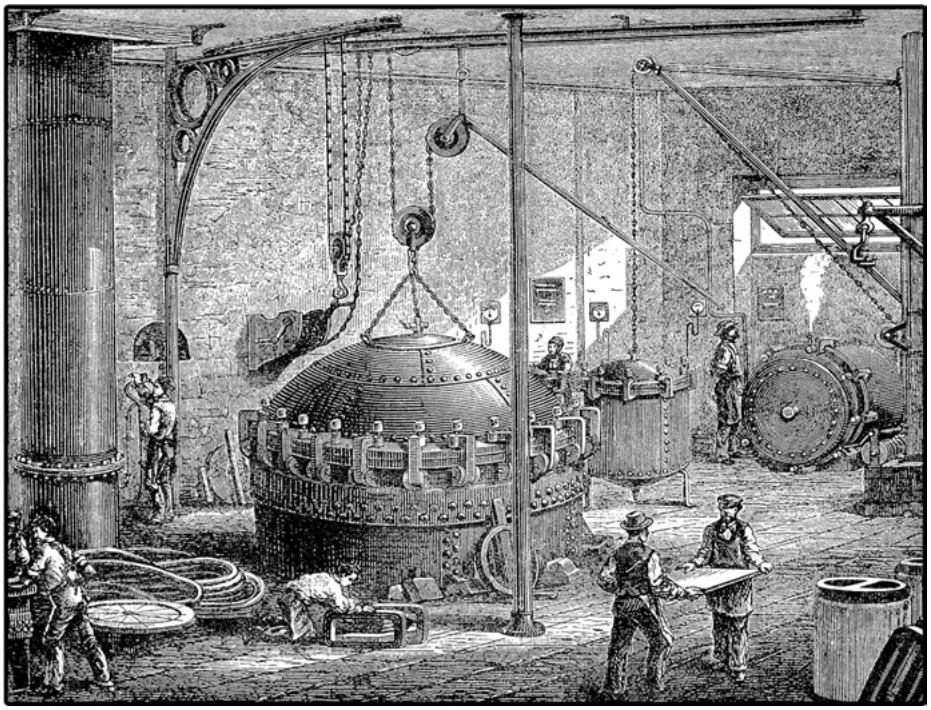

Fig. 10: Historical French illustration from the nineteenth century of a rubber vulcanization machine to convert rubber into durable material through a chemical process.

North America and made rubber the backbone of industrialized Western societies. "Up to this point, the latex had generally been smoke-cured into objects, such as boots or balls, on site in South America, then shipped to Europe or North America," historian of rubber Stephen L. Harp explains.[81] "Now, however, solid balls of smoked rubber could be broken down, easily dissolved, and made into objects in the Northern Hemisphere. Like cotton manufacture, which the British empire largely removed from India over time and installed in Britain, the base of rubber manufacture would similarly move from South America to Europe and the United States."[82]

Over time, the rubber industry radically transformed the modern Western world of consumption, communication, and transportation from submarine cables to pneumatic tires and rubber condoms. Also in the Amazon basin, home to the Pará rubber tree, rubber industry changed everything it came in touch with: it shaped entire habitats and ecologies, caused the rise and decay of extensive networks of modern infrastructure, including splendid trade cities such as Manaus or Belém. It brought fabulous wealth to those who ruled the rubber market and unspeakable suffering to those who

81 Harp, *A World History of Rubber*, 13.
82 Ibid.

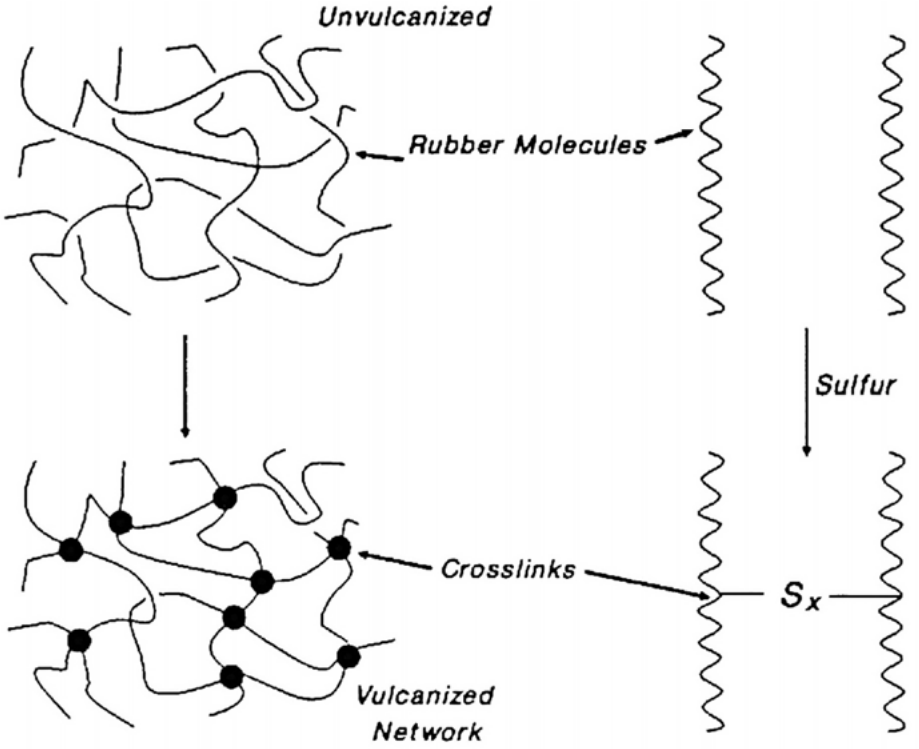

Fig. 11: Molecular network formation through vulcanization. A. Y. Coran, "Vulcanization," in *The Science and Technology of Rubber*, ed. James E. Mark, Burak Erman and C. Michael Roland (Amsterdam et al.: Elsevier, 2013), 337–381, 338.

did the dirty work of manually tapping latex in the forests or processing rubber in factories.[83] The emergent automobile industry, in particular, generated such an enormous demand for natural rubber, that it could only be met by forced labor and exploitative cultivation. In the period from 1860 to 1910, the insatiable greed for rubber in Europe and North America led to the infamous speculative "rubber boom,"[84] with the Amazon rain forest being "the primary source of the finest grades of crude rubber in the world."[85] The interest in Amazonian rubber, however, ended by World War I when Bra-

83 Tully, *Devil's Milk*, 23.

84 Barbara Weinstein, *The Amazon Rubber Boom, 1850–1920* (Stanford: Stanford University Press, 1983). See also Tully, *Devil's Milk*, 65–76.

85 Bradford Barham and Oliver Coomes. "Wild rubber: Industrial Organisation and the Microeconomics of Extraction During the Amazon Rubber Boom (1860–1920)," *Journal of Latin American Studies* 26, no. 1 (1994): 40.

zil lost its rubber monopoly to the British colonies in Southeast Asia due to illegally deported rubber seeds, among other reasons.[86]

The "great transformation"[87] brought about by the rubber industry would not have been possible without an extremely violent regime of slavery and forced labor, dispossession, torture and killing.[88] Within the colonial-imperial system of forced labor and slavery, the flesh and the bodies of Black and Indigenous people in particular were treated "as the raw material for infinite forms of use."[89] (This is not to say, however, that in the midst of violence there were not also incommensurable acts of Black and Indigenous resistance as well as spaces of evasion.) Anthropologist Michael Taussig has described the brutal regime of the Amazon rubber industry as "culture of terror. It aimed not only at exploiting the labor of enslaved Indigenous and Black rubber tappers but was fueled by a mutual mimesis of cultural othering and fear. Taussig speaks in this context of a "colonial mirror which reflects back onto the colonists the barbarity of their own social relations, but as imputed to the savage or evil figures they wish to colonize"[90] (fig. 12).

Under the brutal regime of *Peruvian Amazon Rubber Company* alone in the Putumayo area, a conflicted site between now Peru and Colombia, estimated 30,000 Indigenous people, mostly Boras and Witotos, died in the late nineteenth and early twentieth century of disease and abuse.[91] Colombian ethnohistorian Juan Alvaro Echeverri recalls how rubber affected the Putumayo as follows: "The total Indian population was reduced to perhaps less than a tenth between 1900 and 1930, and the surviving ones were forcefully resettled on the Putumayo River and further south. A few managed to escape north or to hide in the forest. Their social, political and ceremonial organization was severely shattered, and their territory was depopulated, as the forest regrew in what had been a densely populated region."[92] Also in the Congo Free State, ruled by Belgium's King Leopold II, estimated ten million people died due to rubber violence between 1885 and 1908.[93]

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86 See: Tully, *Devil's Milk*, 72.

87 Ibid., 41–44.

88 On the interplay of race, migration, and labor within the rubber industry, see Harp, *A World History of Rubber*, 10–39.

89 On this point, see Tiffany Lethabo King, "The Labor of (re)reading Plantation Landscapes Fungible(ly)," *Antipode*, 48, no. 4 (2016): 1022–39, 1028. I owe this reference to Adelene Buckland's introduction to "raw materials" in *Victorian Material Culture.*

90 Taussig, "Culture of Terror," 495.

91 Luisa Abad González, *Etnocidio y resistencia en la Amazonía peruana* (Cuenca: Ediciones de la Universidad de Castilla-La Mancha, 2003), 177 On the rubber related genocides in the Putumayo area as well as in the Congo Free State see, e.g., Tully, *Devil's Milk*, 77–121.

92 Juan Alvaro Echeverri, "The Putumayo Indians and the Rubber Boom," *Irish Journal of Anthropology* 14, no. 2 (2011): 13.

93 An important, albeit controversial, account of the Congo atrocities is Adam Hochschild, *King Leopold's Ghost: A Story of Greed, Terror, and Heroism in Colonial Africa* (Boston: Houghton Mifflin, 1999). A more recent critical discussion of this book is Sarah De Mul, "The Holocaust as a Paradigm for the Congo Atrocities: Adam Hochschild's 'King Leopold's Ghost'," *Criticism* 53, no. 4 (2011): 587–606.

Fig. 12: Historical photograph from the Peruvian Amazon, in Walter Ernest Hardenburg, *The Putumayo: The Devil's Paradise. Travels in the Peruvian Amazon Region and an Account of the Atrocities Committed upon the Indians Therein* (London: Fischer Unwin, 1913), 74.

The transformation of natural rubber into a useful raw material for Western industries must be seen as the result of a long process of effecting colonial power and the displacement of Indigenous knowledge, starting already in the late fifteenth and sixteenth centuries. "Columbus and other Europeans 'discovered' rubber, much as they 'discovered' so much of the flora of the Western Hemisphere and sub-Saharan Africa," Stephen Harps notes, rather "Indigenous people introduced it to them."[94] Indigenous rubber knowledge always encompassed many more aspects and different types of knowledge than just its mere utilization. Based on a holistic and spiritual understanding of the living, animated nature,[95] it included precise botanical expertise, biogeological knowledge of the location of latex-bearing trees in the jungle, and a vast technical knowledge of handling latex and producing high-quality latex products.[96] Many of the commercial goods later produced by the European rubber industry, such as raincoats, rubber boots, and rubber toys were "invented" first by Indigenous people in Mesoamerica and South America and only later adopted by Europeans and North Americans.[97] Until the mid-nineteenth century, the Amazon region hosted a sophisticated local rubber industry that in many ways surpassed its European counterpart. At the time of the Great Exhibition, hundreds of thousands of rubber boots were still manufactured in the Pará region and exported to Europe and North America, as they were superior in quality to the products manufactured there.[98]

Long before the invention of vulcanization by Goodyear, there also existed an Indigenous, that is, biological method of curing rubber, comparable in its antibacterial and stabilizing effects.[99] This method consisted of smoking dry latex over a smoldering fire made of tropical branches and nuts: "Smoked Indigenous rubber products were both highly elastic and durable. They did not have the 'diseases' that the rubber products made in Europe and North America had," chemist and historian Jens Soentgen says.[100] In fact, many of the material problems that the rubber industry in the Global North had struggled with, such as the stickiness of rubber, resulted from a lack of knowledge in handling this delicate organic material.[101] Moreover, the long shipping to Europe and North America meant that rubber had to be conserved in a way that made further processing much more difficult, compared to the direct handling of fresh latex onsite. In other words, vulcanization was not so much a "cure" for a defective "raw material," but an answer to a problem created by industrialization itself. Seen in this light, vulcanization technology, much-praised at the Great Exhibition of 1851 in London, was less of "a

94 Harp, A World History of Rubber, 11.
95 Tully, *Devil's Milk*, 32.
96 Jens Soentgen, "Die Bedeutung indigenen Wissens für die Geschichte des Kautschuks," *Technikgeschichte* 80, no. 4 (2013): 301.
97 Ibid., 306, 321.
98 Ibid., 313.
99 Ibid., 311–19.
100 Ibid., 315. The quote in the text is translated by the author.
101 Ibid., 319.

grand exemplification of the present state of human industry, and of the efforts of mind."[102] Instead, it was simply a site-specific solution to a problem that had already been solved elsewhere before, with disastrous consequences however.

On the Baskets of Darkness and Light

The case of vulcanization clearly shows that Western rubber technology needed both the appropriation and degradation of non-Western, Indigenous knowledge to stabilize its supposed superior state of cultural progress and civilization. In this regard, Santos, Nunes, and Meneses remind us, that the "production of the West as hegemonic knowledge required the creation of an Other," which was "constituted as an intrinsically disqualified being . . . available for use and appropriation."[103] With the introduction of vulcanization technology in Europe and North America and the industrial rubber boom, Indigenous rubber knowledge and technologies seemed to fade into the background, despite it having been crucial for its rise in the beginning. But this conception is misleading. While the "High-Tech Plundering" and destruction of the Amazon rainforest has continued on a grand scale to this day,[104] Indigenous rubber knowledge has been preserved on site and further developed in the direction of alternative, cooperative and sustainable models of production.[105] The initiative Couro Vegetal da Amazônia, for instance, "brought together more than 200 local and indigenous families in three forest communities, providing training in an innovative processing method to produce sheets of vulcanized rubber."[106] Worth mentioning is also the work of Brazilian feminist environmentalist Bia Saldanha, who engaged over the last decades with local producers in the Chico Mendes reserve in the production of ethically and sustainably sourced rubber. Her work resulted, most famously, in a collaboration with the French company Veja for an eco-friendly vegan sneaker.[107]

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102 Robert Hunt, "Introduction," in *Hunt's Hand-book to the Official Catalogues: An Explanatory Guide to the Natural Productions and Manufactures of the Great Exhibition of the Industry of all Nations, 1851* (Cambridge, UK: Cambridge University Press 2011 [1851]), vi.

103 Santos, Nunes, and Meneses, "Opening Up the Canon of Knowledge and Recognition of Difference," xxxv.

104 See, e. g., Laymert Garcia dos Santos, "High-Tech Plundering, Biodiversity, and Cultural Erosion: The Case of Brazil," in *Another Production Is Possible: Beyond the Capitalist Canon*, ed. Boaventura de Sousa Santos (London: Verso, 2007), 151–81.

105 For a more comprehensive approach on this topic, see Boaventura de Sousa Santos, ed., *Another Production Is Possible: Beyond the Capitalist Canon* (London: Verso, 2007).

106 "Couro Vegetal da Amazônia," Equator Initiative, https://www.equatorinitiative.org/2017/05/28/couro-vegetal-da-amazonia/.

107 Anna Schnuck, "Der Regenwald ist kurz davor seine Regenerationsfähigkeit zu verlieren," VIERTEL \ VOR (August 23, 2019), http://viertel-vor.com/2019/08/23/regenwald-brand-bia-saldanha-rubber-veja-klima/.

However, in the prevailing Western narratives of rubber, the people who crafted and cared about this "proto-biocapital" in Mesoamerica and South America in the first place,[108] long before the Europeans even knew about it, are still reduced to either primitive savages," "submissive rubber tapers," or "victims" of the rubber industry. But that is just another devaluation of Indigenous knowledge and memory. "In all those tales," Juan Alvaro Echeverri argues, Indigenous people "are not actual subjects but objects of compassion, fear or observation," they "do not have voice but are the objects of disputes among Whites."[109] In contrast, Echeverri attempts to capture the traumatic memory of the genocide perpetrated in the Putumayo region during the rubber boom through the voices of the surviving Indigenous Muinane people and their struggle to heal from the violent past.[110]

To the them, their and their ancestor's territory "is not just a tract of land that can be mapped or legally titled," Echeverri says, but it's a source of memory that "had remained amputated" ever since the rubber industry with its slaughters and massacres hit.[111] From the perspective of Muinane's older and younger generations, Echeverri reflects on how the rubber violence of the past had condensed into a transgenerational trauma, where memory and healing collide. In remembering the rubber violence, the older generation distinct between a "Basket of Darkness," full of locked away painful memories, and a "'Basket of Life," "where the seeds of the future are placed, looking forward to the growing of new generations and leaving behind the dangerous memories of violence and sorcery of the past."[112] However, with the locking away of trauma comes shame and silence, too. The difficulty of not even knowing how to think or talk about the traumas of the past is complicated by the fact that the Indigenous culture is still confronted with the enduring power of the colonial apparatus. The younger generation, Echeverri says, "functions like a mirror – a reflective space that allows them to face the past in an indirect way"; however "[this] reflective space is configured paradoxically by purely foreign devices: writing, schooling, use of the Spanish language, state recognition, and so forth."[113] So, it's a vicious colonial cycle from which there seems to be no escape—and yet it's the new generation that needs to be trusted

108 This expression comes from Quito-based Ecuadorian artist Adrián Balseca. "White Wake: On the Trail of 'Rubber Fever' in the South American Amazon," Colleción Cisneros, https://coleccioncisneros.org/editorial/featured/white-wake-trail-rubber-fever-south-american-amazon.

109 Echeverri, "The Putumayo Indians and the Rubber Boom," 13. See also Juan Alvaro Echeverri, "To Heal or to Remember: Indian Memory of the Rubber Boom and Roger Casement's 'Basket of Life'," *ABEI Journal* 12 (2010): 49–64.

110 The legal restitution of territory in the 1980s by the Colombian government to the indigenous groups of the region, including the Witoto, Bora, Muinane, Miraña, Ocaina, Nonuya, and Andoque Indians was a moment of confrontation, since it became necessary "to revisit the territory and to face its memories." See: Echeverri, "The Putumayo Indians and the Rubber Boom," 13–14.

111 Ibid., 14.

112 Ibid., 13.

113 Ibid., 14.

with hope and healing: "[It] is to them we owe true truth and true justice. They are our actual true mirrors of memory."[114]

Sticky Rubber Matters

The Great Exhibition of 1851 in London, which was the starting point of this text, aimed to capture the industrial knowledge of its time in a supposedly universal gesture. And yet, much of the diversity and dignity of human ingenuity has remained untold and unseen. A closer look at the exhibits in the glittering halls of Crystal Palace, especially at the "raw materials" sections, reveals that things were much gloomier than promised at first sight. The very constellation, in which vulcanized rubber was staged at the exhibition, makes apparent the friction: To get to the Goodyear's rubber volcano in the US sections, visitors had to pass two sculptures. These were Hiram Power's well received sculpture the *Greek Slave* and Peter Stephenson's *Dying Indian.*[115] Although these two sculptures were intended at the time as symbols of humanity and freedom, in retrospect they appear as cynical comments on the cruel reign of terror of the rubber industry as well as the violent system of oppression that settler colonialism introduced to the Americas.

Obviously, there was no straight path, no "smooth operation of global power,"[116] leading from the milky sap of the Amazon Pará tree to the manufactured rubber pieces on display at the Crystal Palace in London. Rather, there were fierce collisions and contested battlefields fought in resistance by Indigenous and Black bodies, from which rubber emerged as a passivated and naturalized raw material for Western industries and mass production. However, it is important to understand that the very concept of 'raw material was never limited to the exploitation of vegetable or mineral materials, such as rubber or coal, but always depended on the degradation and exploitation of human bodies. Being a "raw material," as Adelene Buckland put it, was less about being "in a state of nature," but rather about politicizing or racializing "a hitherto meaningless plant or rock or animal or person," imagining them "as actualised by the mighty intellectual, physical and spiritual powers of industry and empire."[117]

The distinction between *active* and *passive* matter that I want to bring into play here has been constitutive of the entangled systems of colonialism, extractivism, slavery, and their racist legitimation. Racialization, according to inhuman geographer Kathryn Yusoff, "belongs to a material categorization of the division of matter (corporeal and mineralogical) into active and inert. Extractable matter must be both passive (awaiting extraction and possessing of properties) and able to be activated through

114 Ibid., 18.
115 Cunliffe, "America at the Great Exhibition of 1851," 119.
116 Tsing, *Friction*, 6.
117 Buckland, "Introduction to Volume 1: Raw Materials," 20.

the mastery of white men."[118] "Historically, both slaves and gold have to be material and epistemically made through the recognition and extraction of their inhuman properties," she concludes.[119] The distinction of *active* and *passive* matter thus lies at the very heart of a racialized "historical regime of material power."[120]

However, engaging friction as a tool to navigate material histories and legacies not just reveals exploitation, oppression, and trauma, but might also help to unsettle a *transformative* potential that is always already clinging to the very idea of "raw material" as incommensurable "active matter," as Adelene Buckland suggests.[121] Building on Tiffany Lethabo King's thoughts on "Black fungibility,"[122] that is, the speculative reimagination of "Black flesh and Black spaces . . . as counter-sites where new possibilities for (more than) humanness and freedom are articulated,"[123] Buckland urges for reframing "the raw material as itself a sign of 'fungibility . . . that cannot be contained' by the violently intertwined histories of empire, industrialisation and labour."[124] Read against the grain, the very logics of commodification and extraction may thus open up other-than-exploitative ways of thinking through the violent repression of colonial and imperial raw material politics and the narratives and futurities that emerge from them. "What other histories and stories have been 'cut' from their materials the moment they are conceptualised as 'raw'?" she then asks.[125] This is precisely what we should be asking about the frictional material legacies of rubber and its inhumane appropriation as naturalized "raw material" for Western industrialization and mass production: What other incommensurable, resistant histories and stories of bodies, people, animals, plants, landscapes, habitats, and ecologies are attached to the sticky matter of rubber instead or beyond? What other futures might (or might not) be kneaded out of its formless mass yet?

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118 Kathryn Yusoff, *A Billion Black Anthropocenes or None* (Minneapolis: University of Minnesota Press, 2018), 2–3.

119 Ibid., 3.

120 Ibid., 4.

121 Buckland, "Introduction to Volume 1: Raw Materials," 28.

122 Building on the foundational thoughts of Hortense Spillers and Saidiya Hartman, Tiffany Lethabo King frames "Black fungibility" as "the treatment of the Black enslaved body as an open sign that can be arranged and rearranged for infinite kinds of use". However, in her/their speculative reading, "Black fungibility . . . is conceptualized as the capacity of Blackness for unfettered exchangeability and transformation within and beyond the form of the commodity, thereby making fungibility an open-ended analytic accounting for both Black abjection and Black pursuits of life in the midst of subjection." See: King, "The Labor of (re)reading Plantation Landscapes Fungible(ly)," 1023–1025. See also Hortense Spillers, "Mama's baby, papa's maybe: An American grammar book," *Diacritics 17*, no. 2 (1987): 65–81; Saidiya Hartman, *Scenes of Subjection: Terror, Slavery, and Self-making in 19th Century America* (New York: Oxford University Press, 1997).

123 King, "The Labor of (re)reading Plantation Landscapes Fungible(ly)," 1036.

124 Buckland, "Introduction to Volume 1: Raw Materials," 29.

125 Ibid., 28.