

Hyper-White Entanglements: A Brief History of Titanium White

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The following paper is a part of the early phase of the research project “Norwegian White: Titanium Dioxide from Mining Modernism to Surface Sustainability” by Marte Johnslie (Associate Professor at the Oslo National Academy of the Arts) and Ingrid Halland. The research project builds on Johnslie’s previous research and the overall argument in the following paper is developed by both Johnslie and Halland.

The inorganic compound titanium dioxide has progressively brightened our world throughout the 20th century. Titanium dioxide (hereafter TiO₂) was invented and patented as a white pigment for the colour industry by Norwegian chemists Peder Farup and Gustav Jebsen in the early 1910s, and the industrial production of TiO₂ for the global market began in the mine Titania and the factory Titan Co (today Kronos Titan), both in Norway, in 1916. TiO₂ as a colour pigment was named Titanium White and the advertisements described the paint as “the whitest white” or “absolute white” due to its pure white colour tone, its stability and resistance against chemical influences, and its maximum ability to hide the substance underneath.

As a result of its ability to also protect materials against the toxic influences of sunlight and weather, the substance was progressively used in combination with other colours (as coating for concrete, glazing for ceramics, and additives in plastic) thereby changing the aesthetics of surfaces in architecture and design. Today TiO₂ is literally present in every part of modern life. Yet although circulating extensively through our material, biological, and economic systems, TiO₂ is most of the time completely unnoticeable: it hides in the food we eat, in the paper we print on, in wall paint and concrete coating, in lipsticks, concealers, sunscreens, pills, and smart phones.

If the European Green Deal is to succeed, new material awareness needs to be implemented, as “increasing material efficiency is a key opportunity to move towards the 1.5° C goal set by the Paris agreement.”¹ We need to know more about how mineral extraction and patterns of consumption are linked. In order to better understand materials and

their properties, and by extension a better oversight of the environmental impact of materials, design students need material knowledge. I argue in this paper that environmental history could be valuable for a better understanding of the environmental impact of materials. In this paper, a brief reading of the historical background and material properties of TiO₂, will bring forth, unpack, and analyze some of the messy entanglements between modernist homogenization, global extraction economy, and our present-day material surroundings.

I. “THE MODERN GIANT FROM BLACK EARTH”

In 1864, the English company “The Norwegian Titanic Iron Ore Company” bought the mining rights to an area close to Jøssingfjorden in Rogaland, Norway. Yet instead of a rich iron ore, the company found ilmenite—a black titanium-iron oxide mineral—and the mine stayed relatively unprofitable until the company Elektrokemisk Industri (today called Elkem) became interested in the mining waste, namely titanium. While conducting experiments for making this unprofitable material profitable, chemist Peder Farup discovered a method for separating iron and titanium that could produce a yellow and red dye with very high covering power.² Together with chemist Gustav Jebsen, Farup filed several patents for the production process of titanium dioxide in the following years, most notably for the sulfate process which still is the most used production process for TiO₂. Although chemists at the National Lead Company in the United States simultaneously developed patents for titanium white, the production for the global market began in Norway in 1916 when Elkem established the factory Titan Co in the city of Fredrikstad, which was the first manufacturing company for titanium white and the start of a world industry: the international pigment industry based on the sulfate process.³

Titanium white had twice the covering power of lead white, consequently, TiO₂ was the new, the bright, and the clean—as such. Yet in the first years of industrialized production, both national and international markets remained skeptical of the allegedly magical properties of the new paint.⁴ Titania and Titan Co turned to advertisements. “Paint is Economy” [“Maling er økonomi”] we can read in an advertisement from 1920 (Figure 1). Titanium white created a surface without cracks that was remarkably durable, the ad affirmed.



Figure 1: “Paint is Economy,” Aftenposten 4 March 1920.

As an effect of increased market demand, extraction and production of TiO_2 commenced also outside Norway and the US,⁵ and by 1945, 80 per cent of the white pigments sold were titanium white.⁶ Yet although progressively circulating, the invisibility of the chemical compound increased when the pigment was transformed into a colouring additive that maximized brightness. During the 1920s and 30s, TiO_2 was introduced as a filler and colorant in metals; plastic items; in linoleum floors, in shoe polishing; in printing ink; in wall paper; in writing paper;⁷ and photographic paper.⁸ Supposedly, anything could be brightened, thereby—the manufacturers claimed—more beautiful, as an ad from Titan Co affirmed: even unclean babies (depicted with black skin) could be whitewashed, turning their sad faces into happy smiles (Figure 2).

Hegel famously defined the beautiful as ‘the sensuous “shining” of the idea’⁹—thereby establishing brilliance and shimmer as an ideal aesthetic category. And when the world shined brighter, the earth lost some of its beauty: A TV advertisement by the American National Lead Company (today NL Industries) from 1954 shows the abundance of uses of the new wonder of tomorrow and juxtaposes “the dingy shades of former times” with “the beauty and brightness of our world.”¹⁰ The ad ends by declaring that “[TiO_2] has become the modern giant from black earth that man has tamed to turn his world lastingly white, lastingly bright.”¹¹ In fact, the ilmenite that is extracted in the Titania mine in South-Western Norway (which is the world’s largest ilmenite ore on land) is shipped to the factory in Fredrikstad as a finely grained black sand.

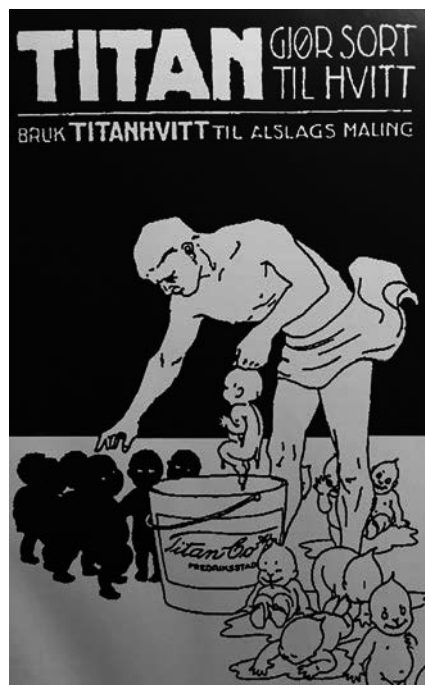


Figure 2: “Titan: Makes Black to White. Use titanium white to all kinds of painting,” advertisement from Titan Co, unknown year.

By means of numerous chemical processes, the black ilmenite is transmuted into white and thereby demonstrates superiority: As seen in the logo of Titan Co; the white giant of our world stretches his arm and celebrates his victorious taming of earth (Figure 3).

II. “THE VIOLENT LAWS OF WHITENESS”

“Whitewash has been associated with human habitation since the birth of mankind,” Le Corbusier noted in 1925: “stones are burnt, crushed and thinned with water—and the walls take on the purest white, an extraordinarily beautiful white.”¹² The pure white of the early modernists, however, was not, in fact, so pure.¹³ Lead was the only white paint used in Europe until the end of the 19th century, when its manufacture finally became restricted.¹⁴ After the ban of lead oxide, a bright white paint didn’t exist. The closest colours were creams or off-whites, made with chalk or lime.

One of the first traces of titanium white in modern architecture was the interior of Josef Frank’s Villa Beer from 1930. Ivo B. Hammer has identified that the color pigment in some rooms was “an early type of titanium white, an opaque, white pigment” namely “KRONOS-titandioxide.”¹⁵ According to Hammer, this was the first use of this pigment in Austria and he proposes that this was “perhaps not mere coincidence.” He claims: “Josef Frank wanted the whiteness to appear as even, regular and ‘pure’ as possible [...]. The use of the highly opaque titanium white is the technical correlate of the aesthetic intention of having a regular ‘white’ surface.”¹⁶



Figure 3: Early advertisement for titanium dioxide from *Farben-Zeitung* 14 (2 January 1926), 819.

In art and architecture history, whiteness has been the theme of numerous aesthetic, stylistic, and societal debates. The topic is entangled in a wide range of issues from the very core of aesthetic debates on beauty to political debates on privilege and systematic exclusions. As is affirmed in ANY's special issue on whiteness from 1996: "Whiteness and architecture already have an internal history." In the context of poststructural deconstruction, the authors in this issue establish white primarily as symptoms of heterogeneous conditions (e.g. "whiteness gains power through its invisibility and our inability even to recognize it as a category."¹⁸) Correspondingly, in the essay "Chronic Whiteness" from 2020 Mark Wigley revisits his renowned book *White Walls, Designer Dresses* in light of the Black Lives Matter global movement and searches for what he calls the violent laws of whiteness in architectural history. Wigley writes that "Architecture's whiteness [...] is not the white surfaces that accentuate any pigment or pattern added to them. The real whiteness of architecture is in its systematic exclusions and subordinations, its regimes of privilege."¹⁹ However, if penetrating the surface of whiteness, Wigley's claim about architecture's whiteness can be expanded. The violent law of whiteness is not only accentuated by the surface pigment, *it is the material pigment as such*.

III. HYPER-WHITE

According to Timothy Morton, a hyperobject is, "something that is so vastly distributed in time and space, relative to the observer, that we might not think it's even an object at all."²⁰ A hyperobject is an object that stretches across different global landscapes and more-than-human timescales, without being anchored in a specific, local context. Often invisible or dematerialized, often intimately entangled in processes of industrial exploitation and corporate globalization, a hyperobject is challenging to make concrete. Climate change is such an object, Morton claims in his influential book *Hyperobjects* from 2013: Because of its measureless size and its universal implications, it is almost impossible to conceptualize climate change, let alone, to visualize it. Arguably, an important task for design education is to find strategies of how to make visible universal hyperobjects. Environmental history can be one such visualization strategy.

Simultaneously a chemical compound and a prolific commodity with numerous applications, titanium dioxide works and travels at both micro and macro level. TiO₂ can be defined as a hyperobject—vastly distributed in our material surroundings. The material opens up the crucial paradox of an invisible material in the age of the Anthropocene; its properties are inextricably related to invisibility, naturalization, durability, and homogenization. The fact that public knowledge about TiO₂ is limited is illustrative of what Jane Bennet has described as the Western societies' lack of ability to read material surroundings.²¹ An environmental history of TiO₂ demonstrates that this material circulates extensively in our contemporary society, and thereby reveals that materiality has come to be taken for granted. When investigating the history of TiO₂ alongside its material properties and its effects as a material agent, the hyper-white planetary entanglements of TiO₂ come to the surface; an historical approach can expose the maximized logic of "absolute white."

ENDNOTES

1. IRP, "Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future." United Nations Environment Programme (2020): 1.
2. "The most interesting result, however, was that during these works we found that pure titanium acid, which is known to be white, turned out to be in possession of a very high covering power unleashed in oil." ["Det mest interessante resultat var imidlertid at vi under disse arbejder fandt, at ren titansyre, der som bekendt er hvid, viste sig at være i besiddelse av en meget stor dækkraft utrevet i olje."] Gustav Jebens, "Den Nye Norske Titanhvidt-Industri," *Tidsskrift for kemi* XVII, no. 5 (1920): 43.
3. The history about titanium dioxide in Norwegian context is utterly unexplored. Apart from a few brief self-produced books by Titania to mark their anniversaries, the only investigation of this history is artist Marte Johnslie's ground-breaking research on TiO₂ which was a part of her PhD in artistic research at Oslo National Academy of the Arts, see Marte Johnslie, *White to Earth* (Oslo: ROM Forlag, 2020).
4. "Once larger quantities became available after World War 1, [TiO₂] was incorporated into ready-made paint; in Europe the first formulation using titanium dioxide was registered in 1919 in Norway. The paint industry remained sceptical into the 1920s of the claims made of these pigments and the general public seemed to be unaware of them." "Titanium Dioxide White" in Nicholas Eastaugh et al., *The Pigment Compendium: A Dictionary of Historical Pigments* (London: Routledge, 2004), 364.
5. "In the 1920s most commercial titanium white pigments are composite pigments from the plant in Fredrikstad or Niagara Falls." B. A. van Driel et al., "The White of the 20th Century: An Explorative Survey into Dutch Modern Art Collections," *Heritage Science* 6, no. 1 (2018).
6. Philip Ball, *Bright Earth: Art and the Invention of Color* (Chicago: University of Chicago Press, 2003), 335.
7. See Marilyn Laver, "Titanium Dioxide Whites," in *Artists' Pigments: A Handbook of Their History and Characteristics*, ed. Elisabeth West FitzHugh (Washington: National Gallery of Art, 1997), 302-05.
8. See Marilyn Laver, "Titanium Dioxide Whites," in *Artists' Pigments: A Handbook of Their History and Characteristics*, ed. Elisabeth West FitzHugh (Washington: National Gallery of Art, 1997), 302-05.
9. Translated in English as "Therefore the beautiful is characterized as the pure appearance [Scheinen] of the Idea to sense." "Concept of the Beautiful as Such" in G.W.F. Hegel, *Aesthetics. Lectures on Fine Art*, trans. T.M. Knox (Oxford: Clarendon Press, 1975), 111.
10. National Lead Company, "The Ninth Element," TV advertisement produced by Wilding Pictures Productions, 1954. Quote from 33:30. Available at: https://archive.org/details/0348_Ninth_Element_The_02_00_56_00 [20.12.2020]
11. National Lead Company, "The Ninth Element," 34:12.
12. Le Corbusier, *The Decorative Art of Today*, ed. James Dunnett (Cambridge, Mass.: MIT Press, 1987), 190.
13. See for instance Barbara Klinkhammer, "Creation of the Myth: "White" Modernism" (paper presented at the 92nd ACSA Annual Meeting, Miami, Florida, 2004).
14. Although lead white indeed is a bright white, titanium white is still significantly brighter. TiO₂ reflects back 97% of the light versus 93-95% for the lead whites.

15. Ivo B. Hammer, "White, Everything White? Josef Frank's Villa Beer (1930) in Vienna, and Its Materiality in the Context of the Discourse on 'White Cubes,'" *Built Heritage* 4, no. 1 (2020).
16. *Ibid.*
17. Ernest Pascucci, "White Forms, Forms of Whiteness," *ANY: Architecture New York*, no. 16 (1996).
18. *Ibid.*
19. "Chronic Whiteness," *E-flux* (2020).
20. *Hyperobjects for Artists. A Reader.* Timothy Morton, Laura Copelin, Peyton Gardner (eds.) Ballroom Marfa, Marfa, TX 2018, 4. PDF: <https://tci-assets.s3.amazonaws.com/pdfs/library/hyperobjects-for-artists.pdf>
21. Jane Bennett, *Vibrant matter: A political ecology of things* (Durham: Duke University Press, 2010).

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