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Berliner Blau/Prussian Blue. Strategies of Naming and Dyeing

Abstract

Our contribution investigates the fabrication, naming, and merchandising of the first synthetic color in Europe: a deep blue made of iron sulfate and blood liquor salt, first produced haphazardly in 1706. In 2021, we experimentally re-created the color ourselves in the Objektlabor of the Helmholtz Zentrum für Kulturtechnik at the Humboldt University. Following the dividing strategies of Friedlieb Ferdinand Runge, we used chromatogram paper to re-seperate the color components of so-called Berlin Blue – "Berliner Blau" in German or "Prussian Blue" in English. Our experiments resulted in "Farbblüten" (Kerstin Stoll). Our text pursues these experimental practices and the epistemological dimensions on the one hand, while tracing, on the other hand, strategies of naming the color – from Prussian blue to Paris blue to Chinese blue – and the colonial merchandising between Europe and the so-called Orient from the 17th to the 19th century.[1]

[1] Many thanks to: Christian Kassung and Sebastian Schwesinger (HU Berlin); Felix Sattler, Caspar Pichner, Anna Szöke and Gisela Schmidbauer (Helmholtz Zentrum für Kulturtechnik der HU Berlin, Objektlabor). A different version of this lecture in German language (">Berliner Blau<. Zu den https://www.kulturtechnik.hu-berlin.de/wp-content/uploads/2021/06/Ringvorlesung_Politiken_der_Farben_2021.pdf (latest access 24-02-2023).

1. Making Berlin Blue

In April 2021, we were able to carry out experiments with the color "Berlin blue" in the object lab of the Helmholtz Zentrum für Kulturtechnik at Humboldt University of Berlin.[2] The color "Berlin Blue" was discovered by chance in 1706 and consists of equal parts of blood lye salt and iron II sulfate – the today used chemical formula is blood liquor salt, yellow: K_4 [$Fe(CN)_6$] + ferrous (II) sulfate: $FeSO_4$ 7 H_2O. Berlin blue: $Fe_4[Fe(CN)_6]_3$ is a lightfast, deep blue, inorganic pigment that does not occur in nature in this form - unlike the previously used blue dyes from the waod or indigo plant used by dyers, or the pigment ultramarine used by painters, which was obtained from ground lapis lazuli. Berlin blue made a meteoric rise, as it was cheap and easy to produce and was used intensively by painters during the 18th and 19th century as it allowed to illuminate large surfaces.[3] It is still used today as a pigment and dye, but also as a medicine against radioactive poisoning. As working on colors in history comes with methodological problems[4] and usually relies on conveyed texts or on the own actual perception, we decided to work on the materiality and the procedural developing of the Berlin blue. To better understand the historical practices of producing, the aesthetic effects and the epistemological questions involved, we were interested to mix Berlin blue ourselves. In this essay, we will first elaborate on how we carried out the experiments and explain the connection to Runge, then illustrate the history of Berlin blue as well as economic and Orientalist entanglements with China, and finally come to some conceptual reflections.

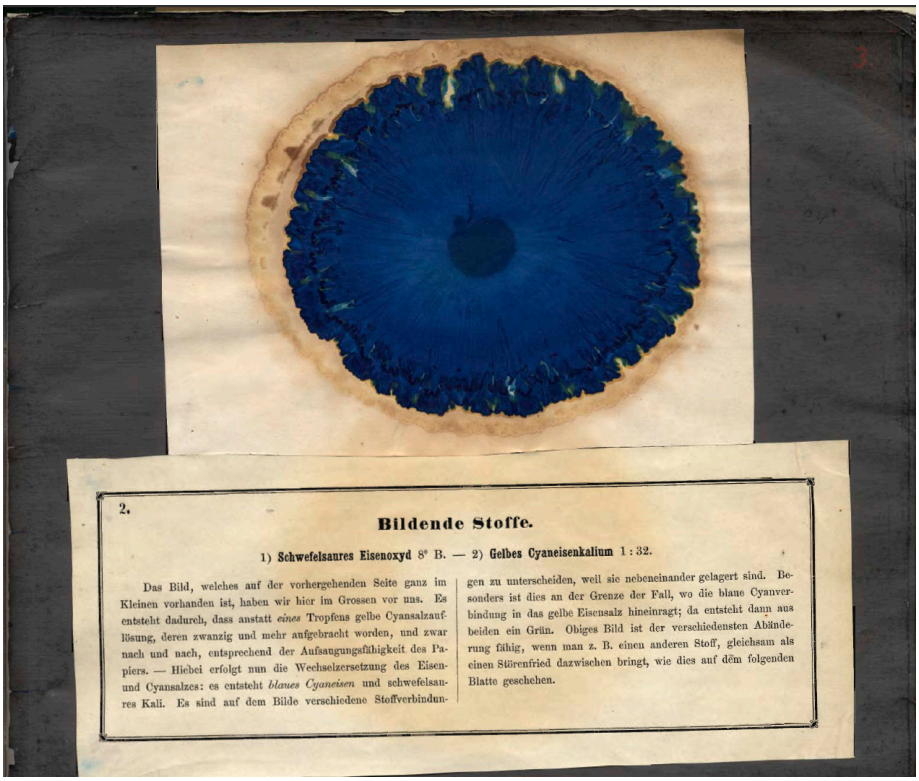
In the object lab, we dissolved the two components of Berlin blue separately in water - this resulted in 1. an aqueous solution with blood liquor salt, almost transparent, and 2. an aqueous solution with ferrous (II) sulphate, colored orange. To drop on the individual components we used chromatogram paper, which is used for chemical detection and has a capillary effect, i.e. it can separate substances according to their running distance (flow velocity) and solubility. Thus, in our case, the Berlin blue was – unlike in the historical discovery in 1706 – created on the paper. In the development of the color, an image took shape that we only influenced by the moment of time: by the temporally graduated dripping of ferrous (II) sulphate onto a large spot of blood liquor, amorphous blue-green formations/blobs grew, which Kerstin Stoll calls "color

[2] https://www.kulturtechnik.hu-berlin.de/en/central-institute/object-lab/ (30.1.2022)
[3] Cf. Michel Pastoureau, Blau. Die Geschichte einer Farbe (translated by Antoinette Gittinger, 4th edition, Berlin: Wagenbach, 2018, pp. 106-109.
[4] Ibid., pp. 7-9.

blossoms" a – term that developed out of the concept during the process of making the color.

In a second approach, we reversed the sequence and dripped blood liquor salt onto prepared iron sulfate stains. In the process, we repeatedly observed different effects with different time gradations - whereupon we came up with the idea of changing the prepared stains in turn as well: We allowed the stains to act on the chromatogram paper for different lengths of time: from one hour to 24 hours and longer. Time was a decisive element in our experiments: the reaction time of the color blossoms which change colors and forms until today, the intervals for our observation, and the different points in time: the chance find of Berlin blue in 1706 and our re-creation in 2021. Our reflections lead to the decision to use time, time spans and speed - as conceptual means – slow motion and fast motion – for the film “Farbblüten” (2021): **https://www.youtube.com/watch?v=rlVdfx_sioM**

2. Bildungstrieb der Stoffe / “formation instinct of substances“



2.

Bildende Stoffe.

1) **Schwefelsaures Eisenoxyd** 8° B. — 2) **Gelbes Cyaneisenkalium** 1 : 32.

Das Bild, welches auf der vorhergehenden Seite ganz im Kleinen vorhanden ist, haben wir hier im Grossen vor uns. Es entsteht dadurch, dass anstatt *eines* Tropfens gelbe Cyansalzauflösung, deren zwanzig und mehr aufgebracht worden, und zwar nach und nach, entsprechend der Aufsaugungsfähigkeit des Papiers. — Hiebei erfolgt nun die Wechselzersetzung des Eisen- und Cyansalzes: es entsteht *blaues Cyaneisen* und schwefelsaures Kali. Es sind auf dem Bilde verschiedene Stoffverbindungen zu unterscheiden, weil sie nebeneinander gelagert sind. Besonders ist dies an der Grenze der Fall, wo die blaue Cyanverbindung in das gelbe Eisensalz hineinragt; da entsteht dann aus beiden ein Grün. Obiges Bild ist der verschiedensten Abänderung fähig, wenn man z. B. einen anderen Stoff, gleichsam als einen Störenfried dazwischen bringt, wie dies auf dem folgenden Blatte geschehen.

The chemist Friedlieb Ferdinand Runge (1794-1867) had already been using the method we adopted since 1840 to separate substances and make them interact on absorbent and capillary paper. He had studied natural sciences in Berlin and Göttingen and also listened to lectures by Johann Friedrich Blumenbach (1752-1840). Runge examined various chemical substances for their properties, not by mixing them in a glass cylinder as was customary, but by dripping several substances at a time onto filter and blotting paper in different combinations and time intervals - including the citations for Berlin blue. These experiments gave rise to what Runge called the "Musterbilder" (sample pictures), which his assistants also jokingly called "Professorenkleckse" (professorial blobs). They combine scientific research with a specific aesthetic - both were the goal of Runge, who in this sense also understood chemistry as art.

The respective picture arises from chemical reactions, which are based on natural laws. It shows therefore not the subjective creation of an artist, but nature seems to record itself in its truth and beauty. In his experiments, Runge shows that the same process always produces similar results i.a. color blots, even if they were not quite identical, and thus drew conclusions on fundamental properties of the substances and their mixing ratios. Runge called this the "formation instinct of substances"

(*Bildungstrieb der Stoffe*), which is also the title of his book published in 1855.[5] Unlike Blumenbach, who located the "instinct of formation" in biology, i.e. in living beings, Runge placed it as a property of chemical substances:

> „After all I believe to be able to pronounce now the assertion that in the formation of these pictures a new, up to now unknown force is active. It has nothing in common with magnetism, electricity and galvanism. It is not excited and kindled by an external force, but originally resides within the substances and shows itself effectively when they balance each other in their chemical opposites, i.e. combine and separate by elective attraction and repulsion. I call this force 'formation instinct' and consider it as the model of the life force active in plants and animals.“[6]

Runge saw an analogy not only between biology and chemistry, but also between the "formative instinct" of inanimate substances and the aesthetic definition of the "formative instinct" – term used by authors like Immanuel Kant (1724-1804), Johann Gottfried Herder (1744-1803), Friedrich Schiller (1759-1805) and not least Justinus Kerner (1786-1862) for man's image-creating, self-active imaginative faculty.[7] Runge as a chemist who was familiar with the philosophy of the time deliberately established a link between natural science and aesthetics, and did so on the level of his experiments. He is considered a master of the chemical separation process, which can also be used for analytical purposes, i.e. to prove the presence of certain substances in mixtures. This procedure is known to us, for example, from urine tests on chromatogram paper as well as from the antigen Covid tests in the near past.

Only after the completion of our own mixing experiments with Berlin blue on chromatogram paper we found out in our re-reading that also Runge had changed the drop heights and drop speeds as well as the exposure times of the substrate in his experiments. This change of the components arises from the momentum of the

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[5] See: https://www.digi-hub.de/viewer/fullscreen/BV041482058/4-5/

[6] „Nach allem glaube ich nun die Behauptung aussprechen zu können, dass bei der Gestaltung dieser Bilder eine *neue,* bisher *unbekannt gewesene Kraft* thätig ist. Sie hat mit Magnetismus, Electricität und Galvanismus nichts gemein. Sie wird nicht durch ein Aeusseres erregt und angefacht, sondern wohnt den Stoffen ursprünglich innen und zeigt sich wirksam, wenn diese sich in ihren chemischen Gegensätzen ausgleichen, d.h. durch Wahlanziehung und Abstoßung verbinden und trennen. Ich nenne diese Kraft ›*Bildungstrieb*‹ und betrachte sie als das *Vorbild* der in den Pflanzen und Thieren thätigen *Lebenskraft*.“ *Der Bildungstrieb der Stoffe. Veranschaulicht in selbstständig gewachsenen Bildern*, by Dr. F.F. Runge, Oranienburg 1855 (Selbstverlag), closing words, paragraph 6.

[7] Cf. Friedrich Weltzien: „Friedlieb Ferdinand Runges chromatografischer Bildungstrieb“, in Friedlieb Ferdinand Runge, Der Bildungstrieb der Stoffe (Naturkunden No. 12, Berlin: Matthes und Seitz, 2014), pp. 102-115.

experiments themselves and connects our project also on a processual level with Runge's production of "sample pictures" (Musterbilder).[8]

The aesthetics of our works on paper changed over the course of the experiment. At the beginning, the drops were applied delicately in the middle, in line with Runge's intentions, but later we became courageous and didn't just always drip onto one point at different time intervals. For instance, we put drops next to each other, waited and put two small drops on top of it, washed over it with one big drop, and so on. We alternated between the two liquid components of the Berlin Blue. Perhaps Runge, too, was carried away by the immanent instinct of substances during experimentation and, as a result, mixed more and more substances together. This was actually not his starting point.

3. History of Berlin blue

Runge, using the mixing and separating process around 1850, was driven by an analytical interest. He wanted to prove things and analyzed properties scientifically, thus acting within the horizon of the scientific disciplines established since the second half of the 18th century, in particular chemistry. This perspective clearly distinguishes him from those individuals who, as alchemists, were involved in the accidental discovery of Berlin blue around 1700. The interest of the alchemists and the apothecaries - who did not yet know separate scientific disciplines – was the mixing and transforming of substances to produce new substances which promised salvation and profit: i.e., gold that meant wealth or the philosopher's stone that made one live forever and thus promised unimagined power and a miracle medicine that could cure of all diseases.

The latter tried around 1700 Johann Conrad Dippel (1673-1734) in his laboratory in Berlin: he developed “Dippel’s animal oil” (“Dippels Tieröl”) from animal waste like blood, bones, and horn. This tincture was promoted as a panacea. From 1701, the Swiss dye manufacturer Johann Jacob Diesbach worked for him, and he produced

[8] In 2019, the Austrian artist Josef Schwaiger repeated Runge’s experiments with the same substrates focusing on the observation that Runge left his systematic approach more and more. Cf. Josef Schwaiger, Runge Revisited (Wien: Galerie druck und buch, 2019). We, in contrast, have imitated Runge’s method of separation via chromatogram paper and its aesthetic effects, but have changed the question and the substrates.

Berlin blue for the first time by accident in 1706.[9] Johann Leonhard Frisch (1666-1743) of the Brandenburgische Societät der Wissenschaften reported this in a letter to Gottfried Wilhelm Leibniz, who had made Frisch the curator of the silk production project of the academy. Frisch was involved in the later marketing of the color. Diesbach virtually wanted to produce the so-called "Florentine varnish" (i.e. carmine red) in the usual way by precipitating a solution of cochineal lice with alum, ferrous (II) sulphate and potash. When he once ran out of potash, he used contaminated potash with which Dippel had previously cleaned his animal oil. Instead of red paint, Diesbach unexpectedly and unintentionally received a bright deep blue color.[10] It turned out to be non-toxic, easy to produce, standardizable in color quality, and quite cheap compared to the very expensive painting color ultramarine, which was made from ground lapis lazuli that had to be imported from Afghanistan. Therefore, the color, initially called Prussian blue in Frisch's letters, was a sensation: in Berlin, it was used at the Academy of Arts soon after its discovery, and Leibniz sent color samples to various painters in Europe and Russia.

Although Frisch had not discovered the pigment, he developed it further by acid treatment, among other things, and made it ready for marketing. He published about it briefly for the first time in 1710 in the *Miscellanea* of the Berlin Academy[11] without naming the formula. In this Latin article the color, which had been called Prussian blue until then, was renamed Berlin blue. Frisch reported to Leibniz briefly before publication, on 9th November 1709, that the color was getting more and more famous and was commissioned in large quantities. The name, he wrote, could be changed easily to "Berlinisch Blau" – Berlin blue.[12] It can be assumed that this renaming of the

[9] The chemist Alexander Kraft has extensively researched and published on the history of Berlin blue. Cf. Alexander Kraft, „On the discovery and history of Prussian Blue", *Bulletin for the History of Chemistry* 33 (2008), pp. 61-67; Alexander Kraft, „Alchemie in Berlin: Erfindung und Verbreitung des Berliner Blau", *Mitteilungen des Vereins für die Geschichte Berlins* 105 (2009), pp. 234-245; Alexander Kraft, Berliner Blau. Vom frühneuzeitlichen Pigment zum modernen High-Tech-Material (Diepholz/Berlin: GNT-Verlag, 2019).

[10] Cf. Georg Ernst Stahl, Experimenta, observationes, animadversiones, CCC numero, chymicae et physicae (Berlin: Haude, 1731), pp. 280-284.

[11] Cf. [Johann Leonhard Frisch:] „Notitia Coerulei Berolinensis nuper inventi", *Miscellanea Berolinensia ad incrementum Scientiarum* 1 (1710), pp. 377-378. Ee also: Alexander Kraft, „Notitia Coerulei Berolinensis Nuper Inventi: On the 300th Anniversary of the first publication on Prussian Blue", *Bulletin for the History of Chemistry* 36 (2011), pp. 3-9.

[12] „Hiermit kommet eine lateinische relation von der bauen farb, welche anfängt sehr bekannt zu werden. Herr Querfurt zu Wolffenbüttel und andere im Braunschweigischen lassen sie in quantität hohlen. Wer sie einmahl gebraucht, kommt ordinär wider und hohlt mehr. Wegen des Titels kan leicht eine änderung geschehen und kann das Berlinisch Blau genannt werden." Letter dated 9th November 1709 by Frisch to Leibniz; Joh. Leonh. Frisch's Briefwechsel mit Leibniz. Ein Beitrag zur Geschichte des geistigen Lebens in Berlin am Anfang des 18. Jahrhunderts, ed. by Dr. L.H. Fischer (Berlin: P. Stankiewiz, 1896), p. 23.

color goes back to Leibniz' ideas.[13] It might have been a reaction to identity questions: the developing city of Berlin, a reference to the local academia as well as a reference to a deep past which could rather be made via the name Berlin than the name of the newly founded kingdom of Prussia with King Frederic I. of Prussia crowned in 1701.[14]

In the following years, Frisch marketed the color together with Diesbach which turned out to be a commercial success story. They produced the blue in Berlin until at least 1716. Since there was no patent law yet, the recipe was kept secret, but was presumably copied quickly: In 1724, John Woodward finally published it in England, and thereafter it could in principle be produced by anyone.[15] In the first half of the 18th century, the politics of naming the color – complex from the beginning on – went in very different directions. It was traded under a wide variety of names, such as Paris blue or Milori blue or Saxony blue, Diesbach blue, Chinese blue and others.[16] Some of the names referred to their creator or traders, like Diesbach and Milori. Others referred to the region where it was produced or with which it was attributed, like Paris blue or Chinese blue. And yet others referred to cultural traditions: Saxony blue alluded to the color of the Saxonian military uniforms and Chinese blue alluded to the white and blue porcelain. These politics of naming promised to function as a quality sign. For the export, it could not only have an identifying aspect – Berlin blue produced and sold in Berlin – but also an exoticizing effect: Berlin blue sold in China, Chinese blue sold in Berlin.

4. Dyeing – Stowaways of Orientalism

Politics of naming also came along with politics of dyeing and vice versa. Our experiments with Berlin blue in the context of the politics of color lead to a focus on the strategies of dyeing rather than on politics of coloring. More specifically, we confronted Orientalist politics of coloring. In the European discourse on Orientalism, Said sees the "style of thought based upon an ontological and epistemological

[13] Cf. Kraft 2019, p. 106.
[14] These are considerations by PD Dr. Stefan Laube shared with us generously.
[15] Cf. [Caspar Neumann], „Praeparatio Caerulei Prussiaci ex Germania missa ad Johannem Woodward", *Philosophical Transactions of the Royal Society* 33 (1724), pp. 15-17; John Brown, „Observations and experiments upon the foregoing preparation", *Philosophical Transactions of the Royal Society* 33 (1724), p. 17-24. See also Kraft 2019, p. 151-159.
[16] Cf. Kraft, Berliner Blau, pp. 207-210.

distinction between 'the Orient' and (most of the time) 'the Occident'"[17], and which imagines the Orient on the basis of narrative patterns, pictorial and spatial stereotypes. From a Western perspective, as he elaborates, also China and India were regarded as „Orient" in the Middle Ages and the beginning of the Modern Era. Thus, European narrations on China and the Chinese in the 17th and 18th centuries fit into the broader frame of Orientalism. The term Chinese Blue (for Berlin blue) the 18th century probably promised to increase sales in Europe, since it served precisely the Orientalist and exotic projections.

But Berlin blue was also suitable for export outside Europe, reversing the colonial trade routes through which lapis lazuli and indigo, for example, came to Europe. In the 18th century, only the Dutch United East India Company (VOC) was allowed to export Berlin blue to Japan and China which in Japan led to the dawn of a blue phase in the art of woodblock printing. From about 1820, however, China finally produced Berlin blue itself and exported it to Japan as well.[18] This led to inquiries on the European side about the trade stop with China, which meant a loss of profit.

The gardener Robert Fortune (1812-1880) traveled to China several times from 1846 on to find out the secret of tea production. Especially the British East India Company was interested in using the tea plants in other regions. In the process, Fortune illegally exported tea plants from China and imported them into India, which was in the interest of the British Empire. According to his statement, he found during his investigations in China, that inferior tea leaves were often used for export to Europe. In his book on his first travel to China, commissioned by the Royal Horticultural Society, he had observed tea production and relied on the details given by Sir John Francis in his work *The Chinese* from 1840 – reporting that Berlin blue, gypsum and turmeric root were used to colour green teas for export trade.[19] During his fourth journey to East Asia, Fortune observed the dyeing process himself in the "Hwuy-chow green-tea country" in China quoting from his own note-book to enhance the authenticity of his observations: The powder of Prussian Blue and the powder heatened gypsum were mixed 3:4 by to obtain a light-blue powder – the powder of turmeric root was only used in the Canton district according to Fortune. When the tea

[17] Edward W. Said, Orientalism (London/Henley: Routledge and Kegan, 1978), p. 10.
[18] Cf. e.g. Kate Bailey: "A note on Prussian blue in nineteenth-century Canton", *Studies in Conservation*, vol. 57, no. 2 (April 2012), pp. 116-121; Kraft, Berliner Blau, pp. 207-210.
[19] Robert Fortune, Three Years' Wanderings in the Northern Provinces of China. Including a Visit to the Tea, Silk, and Cotton Countries: with an Account of the Agriculture and Horticulture of the Chinese, New Plants, etc. (London: John Murray, 1847). On the use of Prussian Blue for the dyeing of tea: pp. 223f. – quotation from: John Francis Davis, The Chinese. A general description of China and its inhabitants (London: Knight, 1840).

leaves were roasted for the last time and before they were rolled, the "superintendant" scattered a portion in each pan and the workers rapidly turned the leaves with their hands:

> "During this operation the hands of the workmen were quite blue. […] It seems perfectly ridiculous that a civilised people should prefer these dyed teas to those of natural green. No wonder that the Chinese consider the natives of the west to be a race of >barbarians<."[20]

Even if this observation again is reported by a European, it shows how complex the entanglements between the "East" and the "West" and the discourses in it were: Europeans considered the "Chinese" as inferior as the had different religions, cultures and power relations and told themselves that the "Chinese" considered the Europeans as uncivilized because they colored a natural product to suit European and American fashions: "to make it look uniform and pretty"[21]. The explanation why "the Chinese" dyed the tea while they knew that the natural product was better and the would never drink dyed teas – "[…] as these ingredients [Prussian blue and gypsum] were cheap enough, the Chinese had no objection to supply them [the Englishmen], especially as such teas always fetched a higher price!"[22] – fits into the very early discourse and "Chinese trash" that was produced for export trade lacking taste but being concentrated on profit.[23] This Western myth on China and Chinese business is underlined by the fact that Fortune, according to his own account, had sent samples home that were exposed at the Great Exhibition in London 1851 which were then analyzed by the British chemist Robert Warington (1807-1867). He confirmed with these samples[24] what he had shown already some years before: Warington had used the chemical methods known at the time, including separation methods on paper as used by Runge, in 1843 and 1844 and proved that the tea leaves had been adulterated with Berlin blue and yellow turmeric powder.[25] In 2021,

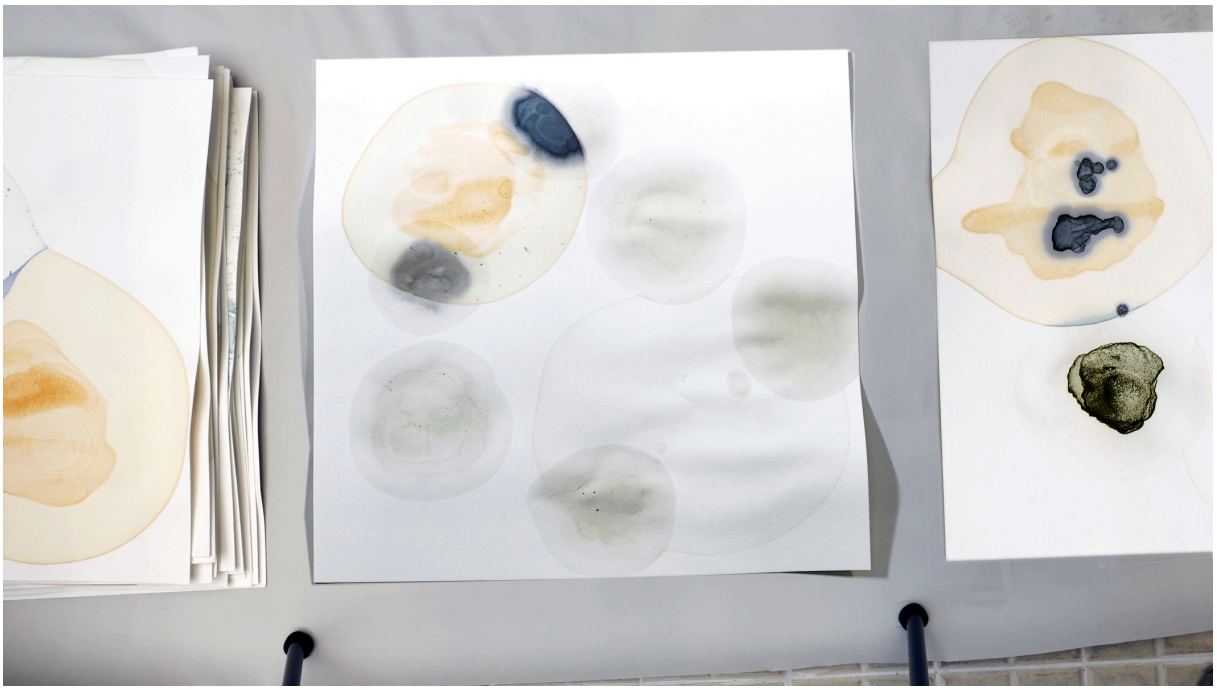
[20] Cf. Robert Fortune, A Journey to the Tea Countries in China Including Sung-Lo and the Bohea-Hills. With a short notice of the East India's Tea Plantation in the Himalaya Mountains (London: John Murray, 1852). On dyeing green teas: pp. 92-95, here p. 93.
[21] Ibid., p. 94.
[22] Ibid..
[23] On the recent debates around Chinese "fakes" see e.g. Jeroen de Kloet and Yiu Fai Chow, „Shanzai Culture, Dafen Art and Copyrights", in Routledge Handbook of East Asian Popular Culture, ed. by Koichi Iwabuchi, et al. (Taylor and Francis, 2016), pp. 229-242. ProQuest Ebook Central, http://ebookcentral.proquest.com/lib/hkbu-ebooks/detail.action?docID=4756204
[24] Fortune, A Journey, p. 95.
[25] Vgl. Robert Warington, "Observations on the Green Teas of Commerce", *Memoirs and Proceedings of the Chemical Society*, 1843, vol. II, pp. 73-80; Robert Warington Esq. (1844) LXXV. "Observations on the green teas of commerce", *Philosophical Magazine Series* 3, 24:162, 507-514, DOI: 10.1080/14786444408644914.

we repeated the process of making Berlin Blue in the lab and mixed it with tea in several experiments documented in the film “Berlin Blue – The making of” **https://www.youtube.com/watch?v=rlVdfx_sioM**

These tea leaves were domestic waste – waste that was upgraded for export to Europe. The addition of green color powder ensured that the tea had a bright green color both when dry and brewed – as Europeans obviously imagined green tea to be. Even today's European distinction between green and black tea is a cultural and probably also linguistic misunderstanding, a translation error. After all, in China a distinction is made not between green and black, but between non-oxidized and oxidized tea leaves. If this story is true, then China sent the imported or appropriated European Berlin blue back to its place of origin as a stowaway with its own export product and thus twisted the European Orientalism of green tea in an unnoticed way.

The fact that Fortune's revelations led to the conclusion that Chinese tea should therefore be avoided and only Indian tea should be bought, played financially into the hands of the British Crown and suggests that the "discovery" of tea adulterated with Berlin blue also obeyed economic motives. The tea leaves were colored by the Orientalism, which was appropriated in multiple ways/spiral, reversed, altered and remixed, and then sent back to Europe in an altered form. On the one hand, this story worked as a market argument and competition, both in the production of Berlin blue and tea - because it followed from Fortune's revelations in England that Chinese tea - as trash and adulterated. On the other hand, it delivered as a story of the bad Chinese as producers of bad tea and the good Indians as producers of good tea.

5. Conceptual Reflections: Similarity and Differences



In the object laboratory, we also mixed tea leaves together with turmeric powder using our filtered pigment from Berliner Blau. In one pot, we infused the leaves and in the other pot the tea powder with hot water and again dropped it onto chromatogram paper. The result can be seen in the movie: On the ferrous (II) sulphate stain, Berlin blue immediately stood out in the tea drops; on the blood liquor stain, it only emerged slightly after several weeks of reaction time. Time was not only the decisive procedural component in our experiments, but also the decisive aesthetic component in our filmic representation: our time lapse should have been extended over weeks, because the substances continue to react on the images even today. And last but not least, we linked different historical moments and covered the time between the discovery of Berlin blue in 1706 and its chemical detection in color flowers around 1850. We wish to conclude with some conceptual aspects of our research on color. The historical research on the production, use and perception of color usually is based on written records: recipe books, the history of discovery, chemical treatises, testimonies of dyers and painters about the practices, also of producers and distributors, as well as reception, for example in literature. An accurate example is the work of the historian Michel Pastoureau on the color blue[26], who was able to

[26] Cf. Pastoureau Blau.

examine above all the sources on the dyers and thus trace, among other things, conflicts over the colors.

Our approach was to produce the color ourselves – the object laboratory gave us the opportunity to do this and to document this process. For our study of Berlin blue as a color found, mixed, used, and experienced in history, we did not simply imitate the techniques and practices of production, but we changed the condition of the historical experiments. It is relations of similarity that we are interested in.[27]

In our approach to Berlin blue, we have repeated a historical experiment, but not with the claim to reconstruct it without gaps, seemingly erasing historical differences. But we have consciously focused on the differences from the outset and changed parameters: we have made shifts in space/place, time, institutions, instruments, substances, subject-object relationships, perception, shifts in actors*, practices and effects, but also shifts in presupposed knowledge and perception and affects to effect.

We started with mixing of substances to obtain the color Berlin blue as it is reported by Diesbach. Then, we literally translated the process of mixing to the method of Runge using chromatogram paper making and separating Berlin blue. As the process gained momentum and the "color blossoms" inspired our imagination, we left Runge's systematics more and more. The chemical "Bildungstrieb der Stoffe" and the intellectual "Bildungstrieb" merged and produced unexpected results which left behind our initial questions. This is how we position in the field of artistic research[28]: We do not aim to level differences of artistic procedures and historiography, we try to make them productive and to enrich knowledge. With the repetition of the mixing and dripping of Berliner Blau, we did not want to produce identity, but – with a conscious look at differences – similarity. This allows us to fathom, to translate and to question the procedures and practices themselves, and not least to carve out common features, differences and similarities of scientific and artistic research.

[27] We are inspired by the argumentation of Dorothee Kimmich: „Ähnlichkeitsbeziehungen sind verwendbar für die Beschreibung von Verhältnissen, die eine relative Nähe und eine relative Ferne zugleich implizieren und dabei die jeweilige Entfernung nicht als unüberwindbar, sondern immer eher als eine zu überbrückende präsentieren. Ähnlichkeiten markieren einen Ort, der nicht identisch ist mit dem eigenen, der aber auch nicht in der Fremde liegt. Es ist der Ort zwischen dem Fremden und dem Eigenen und damit der Ort bzw. der Raum – auch metaphorisch –, der als dritter Raum Begegnung und Kommunikation ermöglicht." (Dorothee Kimmich, Ins Ungefähre. Ähnlichkeit und Moderne (Brill u.a.: Konstanz University Press, 2017), p. 41.

[28] Cf. *Künstlerische Forschung - Ein Handbuch*, eds. by Jens Badura, Selma Dubach, Anke Haarmann, Dieter Mersch, Anton Rey, Christoph Schenker, Germán Toro Pérez (2nd edition, Berlin: diaphanes, 2015).