Visual Instruction

The use of the optical lantern in Dutch academic teaching practices, 1890-1940.

Jamilla Notebaard

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Visuele instructie

Het gebruik van de projectielantaarn in het Nederlandse academische onderwijs, 1890-1940

(met een samenvatting in het Nederlands)

Proefschrift

ter verkrijging van de graad van doctor
aan de Universiteit Utrecht
op gezag van de
rector magnificus, prof. dr. H.R.B.M. Kummeling,
ingevolge het besluit van het college voor promoties
in het openbaar te verdedigen op

vrijdag 22 maart 2024 des middags te 4.15 uur

door

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geboren op *27 november 1989*
te *Amstelveen*

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Dit proefschrift werd mede mogelijk gemaakt met financiële steun van de Nederlandse Organisatie voor Wetenschap (NWO)

Acknowledgments

When I was granted the opportunity to write my PhD dissertation within the larger research group “Projecting Knowledge”, funded by the NWO, it was a wish come true. Throughout the trajectory over the past five years, I have constantly been aware of how privileged I am that I was given the chance to do what I love most: historical research. Although there were some hurdles along the way I enjoyed every minute of it. Largely this had to do with the fact that I was able to conduct this research in the company of very inspiring, knowledgeable scholars, that, at the same time, became friends.

First of all, I cannot thank my promotor Frank Kessler enough for his supervision, constructive feedback and comments throughout this process. He was not only an inspiring scholar, being one of the most renowned authorities in the field of the educational use of the optical lantern, but also an enormous support in times that I struggled with my writing or on a more personal level. It has helped me a great deal to know that despite the more difficult times throughout this research, he trusted that I would push through. Another true inspiration within this process was my co-promotor Nico de Klerk. He helped me tremendously with my writing, constantly trying to help me with my English, but also by motivating me and cheering me on whenever I needed it. On a more personal note, I can truly say that our talks, whether at the office or over his cooked diners, whether they were about work or about more personal topics, have helped me a great deal to continue putting in the work and have faith in what I was doing. And I am happy that I can call him my friend. Last but not least, I want to thank Dulce da Rocha Gonçalves, the other PhD candidate within this project. I have enjoyed every single one of our conversations about various topics, but mostly the ones where our different academic background came to the fore. She has been a true support whenever I needed a sparring partner or when I was curious about her stance on a certain issue. I cannot emphasize enough how much of a pleasure it was to share this journey with you.

Furthermore, I am deeply grateful to have been able to work with many other scholars, who helped me throughout this research. A special thanks needs to be given here to all the people that have helped me in my search through the various archives: Marieke de Natris from the RKD, Paul Lambers and Frits Kruijt from the University Museum Utrecht, Jan-Waling Huisman from University Museum Groningen, and Laurens de Rooy from Vrolik Museum in Amsterdam. But also, visiting researcher Martin Bush was very helpful in discussing possible angles for my research. All these people have been instrumental in finding the right source material that I needed for my research, but also in discussing my research and providing me with new questions or angles that

I could use in further studying the topic at hand. Without their effort and help this research would have been impossible.

Furthermore, I want to thank everyone who has commented upon or asked questions about my work at the various workshops, seminars, and conferences I attended. Here I would especially like to thank the members of the Screen History Seminar at Utrecht University: Klaas de Zwaan, Stéfanie Chessel, Nina Vabab, Li-An Ko, Bekir Duzcan, and many others, for their feedback, but also for sharing their ideas and work in the sessions of the seminar. Another important group of scholars that I would like to thank are the people from the Belgian research group, B-Magic: Margo Buelens-Terryn, Wouter Egelmeers, Anse de Weerdt, Bart Moens, Eleonora Paklons, Marte van Hassel, and Adeline Werry. Our shared conferences and workshops, as well as each individual research has been very inspirational.

Over the past years, my fellow PhD candidates at Utrecht University using the office at Drift 15 have offered an amazing atmosphere to work in. For this I would like to thank Gerwin, Tim, Rosa, Shuang-Li, and Laura.

Dan wil ik ook graag een woord van dank uitspreken naar mijn familie en vrienden die mij in de afgelopen vijf jaar altijd hebben gesteund. Zonder hen had ik dit traject nooit kunnen voltooien. In het bijzonder wil ik mijn tante, Jacqueline, en mijn zus, Fleur, uit de grond van mijn hart bedanken voor hun onvoorwaardelijke steun. Ik kan niet in woorden uitdrukken hoeveel hoe belangrijk jullie in mijn leven zijn en hoeveel kracht ik haal uit het feit dat jullie er altijd voor mij zijn. Tot slot wil ik mijn lieve vriendjes bedanken die altijd geïnteresseerd zijn geweest in wat ik doe en mij ook de nodige afleiding hebben bezorgd in de afgelopen jaren, dank daarvoor lieve Jaimie, Ilse, Alwand, Isa, Joy, Birgit, Leonie, Soraya, Tony, Wiebe, en niet te vergeten de quarantaine squad: Dinja, Judith, Ellen.

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Introduction

Setting the stage for exploring the pedagogical form of the academic lantern lecture 1890-1940

> Yesterday morning at 11am, Prof. Winkler resumed his clinical lecture on nervous diseases in his auditorium (Binnengasthuis). This time it was done with some ceremony; and not without reason, because Prof. W. was introducing a *new system of teaching* [my italics] within the University of Amsterdam, with the regular application of projected lantern slides as demonstration tools during clinical classes. One will appreciate the difficulty of demonstrating, clearly and timely, even the most common diseases during the short academic year, since the right patients are not always available. If, however, one has at one's disposal a series of lantern slides, carefully recorded and arranged over the years, of all the major diseases, the possibility of demonstrating them, instead of a single patient, to a large audience is a great advantage.[1]

On 14th of October 1902, an anonymous reporter wrote enthusiastically about the implementation of the optical lantern at the Binnengasthuis, a clinic that was part of the University of Amsterdam.[2] It is presented as a "new system of teaching" that offered clear solutions to specific problems in the transmission of knowledge to an academic audience that—in this case—professor Winkler had been confronted with before. The reporter continued:

> The optical lantern offers the opportunity to suggestively conjure up all the possible anatomical, physiological, microscopic relations [sic] of the diseased organs in the blink of an eye and create a lasting memory image of the teacher's words, infinitely better, simpler, and more effective than wallcharts, pictures circulated during the lecture or specimen. Moreover, not every patient exhibits all the typical symptoms of his disease to the same extent. So again, projections on the white screen offer an important tool for comparison and supplementation of the clinical demonstration.[3]

The introduction of the *lantern* lecture within academic teaching practices has been adequately and tellingly described by this reporter. Yet it should be noted that it is one of the few descriptions that has come down to us about this specific way of teaching. Just for that reason it is important to unpack this report in order to understand contemporary thoughts about the pedagogical affordances of the optical lantern.

The reporter calls the use of the optical lantern by Winkler a "new system for teaching", pointing to a set of elements that together make up the newness of this teaching practice. First the

[1] STADSNIEUWS.. "De projectielantaarn in dienst van het Hooger Onderwijs". *Algemeen Handelsblad*. Amsterdam, 14-10-1902, p. 2. Consulted on Delpher 10-03-2023, https://resolver.kb.nl/resolve?urn=ddd:010649209:mpeg21:p002.

[2] The Athenaeum Illustre received a university charter in 1877, thereby becoming the University of Amsterdam. In Dutch also the term "Gemeentelijke Universiteit van Amsterdam" was used, however, it was never the official name of the university. This meant that it could offer academic education, offer doctoral programs and exams. *Staatsblad van het Koningrijk der Nederlanden*. Consulted on Delpher 04-08-2023, https://resolver.kb.nl/resolve?urn=MMKB10:001084002:00001.

[3] "De projectielantaarn in dienst van het Hooger Onderwijs". *Algemeen Handelsblad*. Amsterdam, 14-10-1902, Consulted on Delpher on 04-08-2023, https://resolver.kb.nl/resolve?urn=ddd:010649209:mpeg21:p002.

optical lantern itself, i.e., the projection technology that uses a strong light source to project lantern slides onto a wall or screen within a lecture hall. Secondly, he highlights the acquisition and composition of a series or a collection of (photographic) lantern slides recorded and arranged with the utmost care. The 'new' teaching practice was no longer only dependent on the expertise and authority of the professor lecturing; rather, part of this authority was transferred to the proper visual material. An exhaustive collection of lantern slides—visual (real-life) examples—offered the visual input for Winkler to present a convincing overview of the range of pathologies that patients present.

Indeed, it is the very possibility of showing many projected examples of pathologies in a short period of time that made this teaching practice so valuable. As the reporter explains, the use of lantern slide projections offered a very concrete solution to the short time span of the academic year, the limited availability of patients in the university clinic, and the necessity of demonstrating significant cases to teach medical students about the many variations of pathologies. Given that the clinic only had a few pathologies to display during an academic year, the lantern slides were most probably acquired from various (international) clinics that had a program of recording their patients photographically. At this point in time, the development of photographic facilities at the service of scientific work, whether for research or education, was already common. With the emergence of modern laboratories, during the so-called "Laboratory Revolution",[4] as designated university buildings for both research and education, most of these architectural structures also housed photographic facilities and dark rooms. Hence, photographing patients' disorders and pathologies in-house became a new possibility, which, in its turn, led to the exchange of these 'data' among colleagues for the purpose of further study or for training medical students.[5]

Another pedagogical affordance of the lantern that the reporter praised is that it facilitates simultaneous viewing, meaning, first of all, the simultaneity of the lecturer's explanation or interpretation and the projected image that, secondly, could be seen by all students at the same time. Consequently, it offered a solution to the asynchronism of knowledge transmission when single (photographic) images were passed around among students during the lecture. In these

[4] This term is coined by Klaas van Berkel and Ernst Homburg, editors of the book: *The Laboratory Revolution and the Creation of the Modern University*, *1830-1940* (Amsterdam: Amsterdam University Press, 2023).
[5] In studying the floor plans of several laboratories constructed at the end of the nineteenth, beginning of the twentieth century it becomes clear that almost all have photographic facilities on their premises in the so-called "dark room". E.B. Titchener, a student of psychologist Wilhelm Wundt commented upon the psychological laboratory constructed at Leipzig in his discussion of the attic of the building that can be used for photography. E.B. Titchener, "The Equipment of a Psychological Laboratory", in: *The American Journal of Psychology*, vol. 11, 2 (1900): 253. Furthermore, another important aspect that was included in the floorplans of lecture halls was the presence of a "projection room", thus clearly indicating the importance of lantern projection facilities. One of the Dutch examples that show both the construction of photographic facilities as well as projection within the lecture hall, is the botanical laboratory in Groningen, which was constructed in 1899: J.W. Moll, "De hortus botanicus en het botanisch laboratorium", in: *Academia Groninga, MDCXIV-MCMXIV: gedenkboek ter gelegenheid van het derde eeuwfeest der Universiteit te Groningen uitgegeven in opdracht van den Academische* Senaat (Noordhoff – Groningen, 1914), 471.

instances, most of the students would see an image at a moment that the explanation or interpretation had already been given. This advantage of collective viewing, however, did not only stress the guiding task of the professor—by pointing out the aspects that he deemed important for them to know or to remember—, it also changed the attitude of the students who could 'see for themselves' by having all information at once and actively participate in what the lecturer was telling and showing them.[6] In other words, the implementation of the optical lantern did significantly change the dynamics of the lecture hall.

Remarkably, while the reporter uses the term *optical lantern* when pointing out a 'new' system for teaching, he also uses, albeit in one instance, "tooverlantaarn", or in English "magic lantern", to refer to the projection device. Although the use of the optical lantern within academic teaching practices may have been relatively new in the Netherlands, the technology of projecting hand-painted slides—mainly for entertainment purposes—dates back to the seventeenth century. In this period, it was Christiaan Huygens, who first invented this optical device in the Netherlands. However, he also soon disowned its use because of its strong connotations to "magic". In other words, as a respected scientist he did not want to associate himself with this type of device.[7] From the seventeenth to the mid-nineteenth century, the lantern was mostly used for entertainment purposes, but also became a children's toy.[8] Yet, there was a number of scientific men who saw possibilities in projection technology for showcasing experiment, and turning the lantern into a "demonstrations apparatus". They used the lantern's quality of amusement to seek a particular "educational advantage", especially within the field of natural philosophy.[9]

In view of the lantern's historical connection to magic and entertainment, it is widely believed among scholars that these connotations had to be eliminated if the medium was to be used for scientific purposes.[10] The shift from the magic (entertainment) to the scientific

[6] One of the persistent ideas about academic lectures is the fact that students are passive within this type of knowledge communication. However, as I will argue in this research, the addition of images to its practice also changed the involvement of students when attending an academic *lantern* lecture. See for similar comments for example: Van Berkel and Homburg, *The Laboratory* Revolution, 23.
[7] Willem Hackmann, "The Magic Lantern for Scientific Enlightenment and Entertainment", in: Peter Heering and Roland Wittje (eds.), *Learning by Doing. Experiments and Instruments in the History of Science Teaching* (Stuttgart: Franz Steiner Verlag, 2011), 118, 121; Lenny Lipton, *The Cinema in Flux. The Evolution of Motion Picture Technology from the Magic Lantern to the Digital Era* (New York: Springer, 2021), 6-8.
[8] For an overview of the history of the "magic lantern" and its various uses, see among others: Laurent Mannoni, *The Great Art of Light and Shadow: Archaeology of the Cinema* (Exeter: University of Exeter Press, 2000); David Robonson, Stephen Herbert, Richard Crangle, *The Encyclopaedia of the Magic Lantern* (London: The Magic Lantern Society, 2001); Jeremy Brooker, "The polytechnic ghost: Pepper's ghost, metempsychosis and the magic lantern at the Royal Polytechnic Institution", in: *Early Popular Visual Culture,* vol.5, 2 (2007), 189-206; Joe Kember, "The magic lantern: open medium", in: *Early Popular Visual Culture*, vol 17, 1 (2019), 1-8; Sarah Dellmann and Frank Kessler (ed.), *A Million Pictures. Magic Lantern Slides in the History of Learning* (New Barnet: John Libbey, 2020); Lenny Lipton, *The Cinema in Flux. The Evolution of Motion Picture Technology from the Magic Lantern to the Digital Era* (2021).
[9] Hackmann, "The Magic Lantern for Scientific Enlightenment and Entertainment", 122, 124-125.
[10] See for instance, Jennifer Eisenhauer, "Next Slide Please: The Magical, Scientific, and Corporate Discourses of Visual Projection Technologies", in: *Studies in Art Education*, vol. 47, 3 (2006), 198-199; Frank Kessler and Sabine Lenk, "'…to not only tell, but also to show, to show plenty…' The Magic Lantern as a Teaching Tool in

(knowledge transmission) use of the lantern was mainly the result of "mechanical improvements", such as stronger light sources and the possibility of using photographic lantern slides.[11] As has been observed by media historians Frank Kessler and Sabine Lenk, these improvements largely coincided with the shift in terminology at the end of the nineteenth century. In America the prevailing term became "stereopticon", in England "optical lantern", in Germany "sciopticon", while in the Netherlands the term "projectielantaarn" was used.[12] Throughout this study, I will use the term optical lantern to refer to the projection technology within Dutch academic teaching practices.

In view of the changing terminology at the end of the nineteenth century, the reporter's one-off use of the term "magic lantern" may be seen as a rhetorical strategy of bridging the 'old' and probably better-known way of using the device, with its embedment within academia. By stressing the type of imagery that was used by Winkler as well as the seriousness of the topic under discussion, this simultaneously helped set his practice apart from the entertaining practices that the lantern had been known for.

Changing teaching practices in Dutch academia, 1850-1900

The emancipation of the optical lantern as a teaching tool can be connected with broader developments within Dutch academia that emerged roughly from the 1850s onwards. According to historian Peter Baggen, the second half of the nineteenth century saw significant changes in the *vormingsideaal* (in English: educational ideal) that underpinned Dutch universities.[13] In the mid-nineteenth century, this ideal shifted from encyclopedic to specialization. The former emphasized the acquisition of a broad palette of scientific knowledge based on a canon consisting of classical authors. It was shaped by a broad range of subjects, consisting of 48 lectures for all students independent of their field of study.[14] The official language of education at the time was Latin, the language that was considered to give access to the sources of all human knowledge (the classics

Art History around 1900", in: *Fonseca, Journal of Communication*, 16 (2018), 47; Thomas L. Hankins, "How the Magic Lantern Lost its Magic", in: *Optics & Photonics News* (2003), 39-40; Hackman, "The Magic Lantern for Scientific Enlightenment and Entertainment", 114-115.

[11] Eisenhauer, "Next Slide Please", 201; Jens Ruchatz, *Licht und Wahrheit. Eine Mediumgeschichte der fotografischen Projektion* (München: Wilhelm Fink, 2003) 200-206; Kessler and Lenk, "'…to not only tell, but also to show, to show plenty…'", 47.

[12] Ibid.

[13] In his study Peter Baggen uses this term as the central thread for his study of the changes that university education underwent between 1815 and 1960 in the Netherlands. Peter Baggen, *Vorming door wetenschap. Universitair onderwijs in Nederland 1815-1960* (Eburon: Delft, 1998). The term is also used for the edited volume: Leen Dorsman and P.J. Knegtmans, *Universitaire vormingsidealen. De Nederlandse universiteiten sedert 1876* (Hilversum: Verloren, 2006).

[14] Baggen, *Vorming door wetenschap*, 61.

were all translated into Latin).[15] In turn, as Baggen states, this ideal had "impact on the form and content of education."[16] The pedagogical forms that supported encyclopedic education were the *dictaatcollege* together with the *responsiecollege*. During a dictaatcollege the teacher read aloud parts of canonical (Latin) texts, followed by his own commentary at 'dictation speed' that allowed students to make notes. The dictaatcollege was followed by the responsiecollege, which was meant to check if students had fully understood what had been said earlier, by asking them questions that had fixed answers. This pedagogical form, moreover, was also intended to check whether the students comprehended the Latin vocabulary.[17] All in all, this encyclopedic ideal was based on the ideal of obtaining a broad body of knowledge.

As argued by Baggen, starting roughly in the 1850s, the educational ideal gradually shifted towards specialization. This was the result of a confluence of developments; a) the medical and natural sciences focused more on practical education, based on the idea that academic education needed to be aligned with professions that were practiced[18], b) the disappearance of Latin as the main educational language[19], and (as a result) c) professors had to conform less to the straitjacket of the classics, but were able to compose their own lectures, which also offered possibilities of integrating their own research endeavors into their teaching practices.[20] The 'practical turn' in academic education, propelled by the new research ethos that entered universities, thus enhanced the relation between what was being taught and how that knowledge could be applied within future research as well as preparing students for their future profession. Consequently, the need was felt to further expose the students to the world outside the lecture hall. For this not only the teaching practices needed to change:

> More and more professors became convinced that knowledge makes a more lasting impression if one has acquired it by oneself, if one has made one's own observations and performed one's own chemical and physiological experiments, for example.[21]

Clearly, this new emphasis put an end to 'simply' reproducing what was being taught during the *dictaatcollege*. It also implied that the places where this education took place needed to change.

[15] Joseph C.M. Wachelder, *Universiteit tussen vorming en opleiding. De modernisering van de Nederlandse universiteiten in de negentiende eeuw* (Hilversum: Verloren, 1992) 210.
[16] Baggen, *Vorming door wetenschap*, 61.
[17] Ibid., 61, 81-82; Wachelder, *Universiteit tussen vorming en opleiding* (1992), 210; Klaas van Berkel, *Universiteit van het Noorden. Vier eeuwen academisch leven in Groningen. Deel 1. De oude universiteit 1614-1876* (Hilversum: Verloren, 2014), 658.
[18] Baggen, *Vorming door wetenschap*, 97-98.
[19] On the one hand this development was prompted by the requirements of practical education and the production of new knowledge, whereas on the other hand, the level of Latin was declining among both students and professors. See: Wachelder, *Universiteit tussen vorming en opleiding*: 208-210.
[20] Ibid., 28, 260.
[21] Van Berkel, *Universiteit van het Noorden. Deel 1*, 660.

The new pedagogical instrument that supported the new ideal was the form of the *hoorcollege*, later combined with the demonstration lecture and the *practical*. Due to the virtual abandonment of Latin as the main language of education (in most cases at least), the hoorcollege, in contrast to the dictaatcollege, was extemporized ("vrije voordracht") and reflected the personal views of the professor of the topic. Instead of reciting the classics, now they could lecture on their own specialized knowledge obtained through their own experiences. Another consequence of this new direction was that the *responsiecollege* became superfluous.[22] Instead, the *practical*—dependent on the specific discipline and thus the type of knowledge acquisition—entered the curriculum to stimulate students to independently learn and study the skills of their science.

Moreover, as noted, much of these changes emerged from a growing need for specialization. Because of the expansion of scientific knowledge, partly resulting from the abandonment of the encyclopedic ideal, a growing need was felt to embed these fields of scientific knowledge within Dutch academia.[23] These changes were also reflected in the Act on Higher Education in 1876 (and subsequent legislation). This law stipulated for example, that at least at one of the state universities—Groningen, Utrecht, Leiden—should offer curricula in art history, dentistry, and psychiatry.[24] Although this did not yet mean that these were full-blown academic disciplines in which exams could be taken, for example, it does reveal a wider need for establishing distinct fields of knowledge that required new methods of knowledge acquisition and teaching.

Scholarly works on Dutch universities—but also more international scholarship—have paid much attention to the shift towards practical education, since its emergence had a huge impact on the way in which scientific knowledge was taught and acquired from the 1850s onwards. One specific development that has attracted much attention is the creation of 'modern' academic laboratories as the 'natural' outgrowth of the practical focus of academic education. Due to the intrinsic relationship between this practical angle of research conducted within university laboratories, these practices have acquired much scholarly attention; the same goes for the 'toolbox' or instruments that were at the professors' but also at the students' disposal.[25]

Less emphasis has been given, however, to the role of theoretical teaching practices, where knowledge is communicated through the pedagogical form of the lecture. Apart from discussing it as part of the curriculum, or as a tenacious pedagogical form that makes use of various

[22] Baggen, *Vorming door wetenschap*, 82.
[23] Baggen, *Vorming door wetenschap*, 75.
[24] Higher Education Act 1876. Wet op het Hooger Onderwijs van 28 April 1876 gevolgd door de Verordening tot Regeling der Universiteit te Amsterdam. Met al de daarop betrekking hebbende Koninklijke Besluiten (Amsterdam: J.C. Loman Jr., 1876): ch. III. § 2, section 43, 18.
[25] An important study in this field is the edited volume by Peter Heering and Roland Wittje, who stress the didactical implications of working with scientific instruments. Importantly, they point out how instruments as educational tools often needed to be adjusted or used differently from their usage in scientific research. See for example: Peter Heering, "Tools for Investigation, Tools for Instruction: Potential Transformations of Instruments in the Transfer from Research to Teaching", in: Heering and Wittje: 26-27; Hayo Siemsen, "The role of instruments in science teaching: a Machian view", in: Heering and Wittje, 352-353.

technologies, hardly any thorough studies have been made of the significance and meaning of this specific teaching form.[26] One exception is the three-volume study of university historian Klaas van Berkel, *De Universiteit van het Noorden*, in which he devotes relatively much attention to the different forms of education at the University of Groningen. Apart from discussing practicals and laboratory education, he also briefly discusses the implementation of the optical lantern at the University of Groningen. He mainly discusses the case of J.W. Moll, professor of botany between 1890 and 1910, who put a lot of effort in implementing this 'new system of teaching' by constructing a lecture hall specially equipped for the use of the optical lantern.[27] Since the main purpose of *De Universiteit van het Noorden* is to present the (long) history of the university and everything attached to it, Van Berkel does not solely focus on teaching.

History of science

In the past decades, the history of science has significantly changed its outlook in studying scientific practices. Instead of focusing its attention to the big names of science or theories that are the result of scientific endeavors, historians of science are more invested in scrutinizing the material, cultural, and social contexts in which scientific practices take place or are embedded in. If historians want to better understand the mechanisms of knowledge production as well as their dissemination, it is important to understand under which circumstances this took place, e.g., in a laboratory where a team of scientists perform an experiment, but also what objects or instruments were used to achieve particular results. One of the fields that has emerged out of this new direction is that of laboratory studies. Within this field, research is focused on laboratory practices, such as the cooperation between craftsmen, artists, and scientists, the role and calibration of scientific instruments, as well as the purposeful design of the architectural structure itself.[28]

Another important perspective within the history of science emerged out of the "iconic turn" instigated by art history and philosophy in the 1990s, a movement that sought to do justice

[26] Educational scholar Norm Friesen has described the history of the academic lecture from the Middle Ages to our current day and age, including the changes in lecturing styles as well as the media that are used. Remarkably, however, the introduction of the optical lantern and, thus, the addition of 'showing' to telling is completely absent. He addresses the addition of "audio, image and video" although without further explicating its consequences for the performance of the academic lecture. Norm Friesen, "The Lecture as a Transmedial Pedagogical Form: A Historical Analysis", in: *Educational Researcher*, vol. 40, 3 (2011), 95. Another important example, is the book by Sybille Peters, *Der Vortrag als Performance* (Bielefeld: Transcript, 2011), in which the lecture as broader format for knowledge transmission—both in- and outside- academia—as study from the perspective of performativity.

[27] Klaas van Berkel, *De Universiteit van het Noorden. Deel II. De klassieke universiteit 1876—1945* (Hilversum: Verloren, 2017), 141-143.

[28] See for example: Michael E. Lynch and Steve Woolgar (eds.), *Representation in Scientific Practice* (Cambridge, MA, London: MIT Press, 1990); Van Berkel and Homburg, *The Laboratory Revolution*; Peter Heering, "Neglected Uses of Instruments and Experiments in Science Education", in: Heering and Wittje, 7-14.

to the role of images in scientific knowledge construction. Traditionally, history (of science) focused on texts as the main sources that gave access to human knowledge in particular time periods. This, in turn, led to conceive the images within these texts as mere illustrations[29], without considering the possibility that these images might have contributed to or even created certain scientific texts.[30] The "iconic turn" provided a reassessment of studying scientific images by recognizing that they are part of producing and communicating knowledge. One way that allowed the systematic study of images to take center stage was through the use of the term "epistemic image". Partly, according to art historians Marr and Heuer, this term gained ground because of the anachronistic connotations of "scientific images" in studies focusing on illustrations or drawings from medieval and early modern times.[31] According to Lorraine Daston "[a]n epistemic image is one made with the intent not only of depicting the object of scientific inquiry but also of replacing it." [32] She continues:

> A successful epistemic image becomes a working object of science, a stand-in for the too plentiful and too various objects of nature, and one that can be shared by a dispersed community of scholars who do not all have direct access to the same flora and fauna.[33]

In this relatively strict definition the image functions as both an object of study and communicative tool that allows scholars that are separated geographically to study the same object. In other words, the image takes the place of the object—e.g., the human body in anatomical atlases—and actively contributes to its standardization on which further knowledge claims can be based. Therefore, in order to become "a working object of science", these images had to include recognizable features to be 'correctly' interpreted and used by others. Moreover, many of these studies have dealt with images from the early modern period that visualize new discoveries, such as "new discovered continents, the blood circulatory system", etc.[34] This definition also implies

[29] Interestingly, in some studies the term "scientific illustration" is still common, while 'illustration' literally means "a picture or image that is used to decorate or clarify a text"; definition retrieved from the website: https://www.thefreedictionary.com/illustration. By using the term "scientific illustration" the meaning of the image used within scientific practices remains limited to being an extension of the text, instead of offering the possibility that the text was created because of the image or that there is more complex interplay between the two.

[30] Peter Burke, *Eyewitnessing. The Historical Use of Images* (London: Reaktion, 2001), 10; Bert S. Hall, "The Didactic and the Elegant: Some Thought on Scientific and Technological Illustrations in the Middle Ages and Renaissance", in: Brian S. Baigrie (ed.), *Picturing Knowledge. Historical and Philosophical Problems Concerning the Use of Art in Science* (Toronto: University of Toronto Press, 1996), 3-39, 3-4; Christoph Lüthy and Alexis Smets, "Words, Lines, Diagrams, Images: Towards a History of Scientific Imagery", in: *Early Modern Sciece and Medicine*, vol. 4 (2009), 398-439, 398.

[31] Alexander Marr and Christopher P. Heuer, "Introduction. The Uncertainty of Epistemic Images", in: *Inquiries into Art, History, and the Visual. Beiträge zur Kunstgeschichte und visuellen Kultur* (vol. 1, 2 (2020), 251.

[32] Marr and Heuer, "Introduction", 17.

[33] Lorraine Daston, "Epistemic Images", in: Alina Payne (ed.), *Vision and its Instruments. Art, Science, and Technology in Early Modern Europe* (University Partk, PA: Penn State University Press, 2015), 17-18.

[34] Victoria Höög, "Visualising the World: Epistemic Strategies in the History of Scientific Illustrations", in: *Journal of the Nordic Society for the History of Ideas*, vol. 5, 1-2 (2010), 53.

the possibility of controversy, i.e., of debates about the accuracy of these types of images because they are part of the process of knowledge production, often within textbooks.[35]

Consequently, as Daston also states: "not all scientific images, then or now, count as epistemic images"[36]; rather, their meaning depends on the context of display, i.e., for what purpose are they made, who is using these images, in what context? It is important to recognize that scientific knowledge is not only communicated through images in published texts, but also within the educational context where it was guided by spoken words. The educational dimension, however, encompasses different strategies with respect to its composition, embedding, and purpose. Therefore, the term "epistemic image" is less fruitful in reconstructing the use of images within teaching practices. In contrast, within the context of education, the images that are presented do not (always) yield new knowledge in the abovementioned sense, but rather present the status quo of knowledge shared by a community of scholars. Another important aspect is that within teaching practices a lecturer might use images that are not necessarily made for teaching—e.g., images extracted from books—meaning that they can be appropriated to convey information, but not necessarily obey the intention of its maker. Furthermore, instead of replacing objects of study the (projected) images might function as a first encounter, a way of familiarizing oneself with the common object of study. In addition, although Daston does not reflect upon this explicitly, the function of (epistemic) images also depends on their relationship to the text: whether they are inserted within textbooks or academic lectures, their meaning is interpreted in conjunction with what is written or said about them.

Instead of focusing on knowledge production, this research will explore the role of projected images in the process of knowledge transmission and lay bare different strategies pursued within the construction of knowledge claims before academic audiences. Through the reflection upon the way in which projected images were deployed to convey knowledge I will demonstrate how the combination of spoken words and the new educational system of projecting images by the optical lantern has impacted *ways of knowing* within the academy. I will, therefore, further explore the implications of the uses of the optical lantern and its lantern slides for knowledge transmission in several scientific disciplines that emerged in the academe around the turn of the twentieth century, more specifically its implications for inducting students into specific, disciplinary, so-called "thought collectives" and their "seeing styles", terms I will discuss in the following section.

[35] Christoph Lüthy and Alexis Smets also use the term "epistemic image", which they refer to as "any image that was made with the intention of expressing, demonstrating or illustrating a theory." Here, again the emphasis is on the 'making process', the intention of the maker in an image. As noted, for teaching other mechanisms are at work, and the interpretation of these images can be separated from the intention of its maker. The classroom situation offers freedom in dealing with images, how to use them, how to structure them within the lecture, etc. Lüthy and Smets, "Words, Lines, Diagrams, Images", 399, 401, 404.
[36] Daston, "Epistemic Images", 17.

Approach – scientific pedagogy, thought collectives, seeing styles

It is important, first, to stress that this type of research is situated at the intersection of different fields of historical research: university history, history of science, and media history. As university historian Klaas van Berkel argues: "University history is not history of science. (…) But the university does represent an idea of science and scholarship that changed over time."[37] Within the history of science, however, there was a similar lack of research on the pedagogical form of the academic lecture in understanding the mechanisms of knowledge transmission. Nonetheless, Iwan Rhys Morus has claimed that there is a renewed appreciation within the history of science about the relationship between "production and consumption of scientific knowledge", in which the role of knowledge transmission is more central.[38] And my research will indeed be part of an attempt to foreground the role that is played by knowledge transmission and consumption and how communities of scientists are formed, shaped, and maintained.

Therefore, as I will propose following historian of science Kathryn M. Olesko, these two fields of study—university history and the history of science—can be bridged by using "scientific pedagogy as a category for historical analysis".[39] Olesko argues that the use of scientific pedagogy is "central to understanding the contours of scientific practice, the formation of scientific personae, and indeed the ability of science as an enterprise to reproduce and survive."[40] The advantage of this approach is that it offers a way to unravel the formation and persistence of a specific scientific community based on their shared, scientific knowledge: How is a certain discipline institutionalized? What was at stake? How did they accommodate their teaching practices? And what are the centers of gravity in their education? Instead of focusing on the idea of 'geniuses' of science "who had not been taught", the use of scientific pedagogy as a category for study elucidates the formative power of science education. In this way a broader understanding is obtained of the many ways in which a discipline manifests itself. But the focus on a particular teaching practice, such as the lantern lecture, also lays bare the shared principles, ideas, methods, and standards that form the basis for a community of scientists.

In recent years, the growing attention to scientific pedagogy as a category for historical analysis has largely benefited from the rediscovery of the work of Polish-Jewish bacteriologist and philosopher of science Ludwik Fleck. Although his book *Entstehung und Entwicklung einer wissenschaftlichen Tatsache* (*Genesis and Development of a Scientific Fact*), was published as early

[37] Van Berkel, *Universiteit van het Noorden. Deel 1*, 14.
[38] Iwan Rhys Morus, "Seeing and Believing Science", in: *Isis*, vol. 97, 1 (2006), 102.
[39] Kathryn M. Olesko, "Science Pedagogy as a Category of Historical Analysis: Past, Present, and Future", in: *Science & Education*, 15 (2006).
[40] Ibid., 863.

as in 1935, it took until roughly the 1970s and beyond (the abovementioned work was translated into English in 1979) before scholars picked up his ideas.[41] In his writings Fleck situated the foundation of science education in the formation and reconfirmation of the so-called *thought collective*. The Fleckian thought collective is defined as "a community of persons mutually exchanging ideas or maintaining intellectual interaction (…)."[42] It is through education that new generations of students, aspiring to become members of that thought collective, learn about the fundamental knowledge claims of the discipline, understand its methods, but also learn how to 'see' the essentials of the science shaped by that thought collective.[43] Understanding education as imperative for the formation of thought collectives allows one to uncover the different formative stages in its creation and reaffirmation. As members themselves are also constantly educated, albeit from a more advanced stage in the thought collective, I discern three formative stages: the introductory, the advanced, and the professional stage (the latter being mainly used when I discuss lectures that were performed before peer audiences, such as at congresses).

An important element in holding the thought collective together is the "thought style", which Fleck describes as "[the readiness for] directed perception" and positions instruction as its sine qua non. Paraphrasing Fleck, philosopher of science Nicola Mössner states that a "thought style" reflects the "shared knowledge, methods, and communicative behaviour" that are at the heart of what binds the thought collective.[44] Uncovering *how* exactly scientists are made, that is, in what ways students are guided through the various stages of the collective via their training (i.e., thought style), understanding how certain knowledge is communicated and taught is fundamental in understanding the functioning of a Fleckian thought collective. According to Fleck, in order to *know* something one needs to be trained to "see with the eyes of the collective".[45] In such a training 'experience' is one of the most important elements to attain cognition. In turn, for Fleck, cognition is a social process that needs to be negotiated through social interaction, meaning in this case, that students are not only being introduced to new knowledge, but also encountering that knowledge in several educational contexts or as a repetitive exercise collectively. As Olesko

[41] Part of the explanation why Fleck's book received little attention at the time of its publication had to do with the fact that he was a Jewish author trying to get his work published in Germany while the Nazi's had just taken power. Therefore, he had to emigrate to Switzerland where only 200 copies of his book were sold. Marc Stuckey, Peter Heering, Rachel Mamlok-Naaman, Avi Hofstein, and Ingo Eilks (eds.), "The Philosophical Works of Ludwik Fleck and Their Potential Meaning for Teaching and Learning Science", in: *Science & Education*, vol. 24 (2015), 282.
[42] Ludwik Fleck, *Genesis and Development of a Scientific Fact* (Chicago and London: University of Chicago Press, 1979 [1935]), 39.
[43] Fleck is very much aware of the fact that this definition of *thought collective* is not limited to scientific communities only, as he states: "Every individual belongs to several thought collectives at once." (p. 45).
[44] Nicola Mössner, "Thought styles and paradigms – a comparative study of Ludwik Fleck and Thomas S. Kuhn", in: *Studies in History and Philosophy of Science*, vol. 42, 2 (2011), 365.
[45] At least for those sciences based on observation and experiments. Ludwik Fleck, "To look, to see, to know", in: R.S. Cohen and T. Schnelle (eds.), *Cognition and fact – materials on Ludwik Fleck* (Dordrecht: D. Reidel, [1947] 1980), 137.

has argued, for Fleck it was less the content "but rather the form and practice" that guided the formation and maintenance of the thought collective by means of "science education".[46]

In this research, I will be arguing that the academic lecture performed by means of projected images was an important pedagogical form that, at least in some disciplines, inducted new members into their thought collective based on the act of simultaneous seeing, i.e., by creating an "educated eye". In the edited volume *The Educated Eye* (2012), the authors conceive it as the result of the use of "visual images [as] a teaching tool that has worked to convey information or train the eye and the mind in the ways of seeing, researching, organizing, and acting in the world."[47] In my view, "the educated eye" is in such disciplines an intrinsic part of the formation and persistence of the "thought collective". Even though these essays in the edited volume reflect on different types of visual images, in my research I will use the term "seeing style" in discussing the way in which various disciplines train the eye of students (and aspiring members of) the thought collective through the academic lantern lecture. Historian Lorraine Daston, on the other hand, uses the term "seeing collective" to refer to the formation of scientific communities based on the act of observation as a distinct scientific practice. By also drawing upon Fleck's idea of the thought collective, she argues that "formal scientific training has played a central role in instilling and honing shared ways of seeing things."[48] Yet, I do think it is important to be aware of the fact that scientific training not solely deals with observation, but also with practices of reading about observations made by others that in turn inform the act of observation. Instead of focusing on a "seeing collective", I believe that using "seeing style", seen here as a particular educational form—the lantern lecture—that informs a thought collective, is more productive, especially because it allows one to discern the various ways and stages in training students in the intricacies of scientific observation. From an educational point of view, the pedagogical form that is chosen, is largely driven by the methods of communication that are thought to lead to the best result. Consequently, this research will further explore *how* the eyes of students were calibrated through the act of 'collectively seeing' what was presented to them by the professor by means of the projected images, and, thus, were trained to "see with the eyes of the collective", as Fleck phrased it so aptly.[49]

Pedagogical Dispositif

[46] Olesko, "Science Pedagogy as a Category of Historical Analysis", in: *Science & Education*, vol. 15 (2006): 872. 'Form' in this context refers to teaching situations, for example classroom teaching versus laboratory assignments.
[47] Nancy Anderson and Michael R. Dietrich, "Introduction. Visual Lessons and the Life Sciences", in: Anderson and Dietrich (ed.), *The Educated Eye: Visual Culture and Pedagogy in the Life Sciences* (Lebanon, NH: University Press of New England, 2012), 6.
[48] Lorraine Daston, "On Scientific Observation", in: *Isis*, vol. 99, 1 (2008), 106.
[49] At least for those sciences based on observation and experiments. Fleck, "To look, to see, to know", in: Cohen and Schnelle (ed.), *Cognition and fact*, 137.

In what follows, I will use the media historical model of the *dispositif* as a heuristic framework to uncover in what ways the academic lantern lecture contributed to the incorporation of students into a particular "thought collective", particularly based on the "seeing style" that is constructed. This allows one to study the particular affordances of the lantern's use in teaching practices. I will mainly elaborate the concept of media scholar Frank Kessler, while adding the 'pedagogical' lens as formulated by Eef Masson in her study of classroom films in the Netherlands between 1940 and 1960.[50]

The model conceived by Kessler is based on the interdependent elements of three constitutive poles: the performance context pole, the textual pole, and the spectator pole (see fig. 1). Together, they establish but also allow an analysis of the "complex interplay between the various constituents of an educational or instructive projection situation."[51] Although Kessler's use of the model can be applied to different kinds of media performance, such as public (lantern) lectures, film screenings, etc., it can also be used for the study of one particular kind of performance, in this case the academic lantern lecture. The value of this model lies in its appreciation of the historical and situated dimension of the instruction situation at hand.[52]

In researching the academic lantern lecture, the performance context pole entails the institutional embedding (i.e., the university as an educational institution), the lecture hall where it is performed, the optical lantern, and the professor representing a specific scientific discipline. The textual pole, consists of the teaching aids, such as the lantern slides or projected images, and other tools such as wallcharts, specimen etc. These aids are used within a specific order and volume in relation to the lecture text by the lecturer—itself part of the textual pole. Obviously, the spectator pole of the academic lantern lecture consists of a group of students that are assigned the role of "wanting or needing to learn".[53] In the case of the academic lantern lecture, however, I would like to add that the spectator pole goes beyond the individual performance, because it is influenced by the ideals of the thought collective that are expressed through the knowledge transmitted. The expectations of the students are informed by their knowledge, however little, of what the discipline's main aims are. Consequently, the mode of address by the textual pole—teaching staff—is informed by the standardized, state-of-the-art knowledge, methods etc. In other

[50] Eef Masson, *Watch and Learn: Rhetorical Devices in Classroom Films after 1940* (Amsterdam: Amsterdam University Press, 2012), 95-98. Additionally, the complex history of the French term *dispositif* has been extensively described by Frank Kessler in his "Notes on dispositif", which can be consulted on the following website: http://www.frankkessler.nl/wp-content/uploads/2010/05/Dispositif-Notes.pdf.
[51] Frank Kessler, "The Educational Magic Lantern Dispositif", in: Dellmann and Kessler (ed.) *A Million Pictures*, 182.
[52] In a special issue of the *TMG Journal for Media History*, entitled: "The Educational Dispositif", the concept is explored for studying "audio-visual media" and "their use in schools, universities, popular education or vocational training since the late-19th century". Open access available on the website: https://tmgonline.nl/57/volume/26/issue/1.
[53] Kessler, "The Educational Magic Lantern Dispositif", 183.

words, the entire institutional set-up of this type of lecture is concerned with calibration, of learning to see with the eyes of the collective.

Even though these poles are roughly similar for every occasion in which the lantern lecture is performed within academia, their specific interplay varies according to factors such as the availability of a lecture hall devoted to the use of projection, the number of slides used, or whether the projected images are used in conjunction with other visual teaching aids. Furthermore, it may also be that the same slides are used by different lecturers, which possibly results in attributing a different meaning to these images depending on the purpose of the professor in question. Finally, the composition of the group of students varies according to their position within the thought collective—are they first year students or have they reached a more advanced level? These formative stages also impact on how students are addressed and instructed according to the level of prior knowledge they are assumed to have.

Another advantage of the *dispositif*-approach is that it enables to single out one particular pole, for example the textual pole, by focusing on the structure of the lecture, i.e., the ways in which its elements have been arranged. This will also shed light on the positioning and mode of address towards the spectator pole—e.g., students during a lantern lecture. Thus, allowing for a certain degree of contextualization despite the lack of available source material that is connected to the spectator pole.

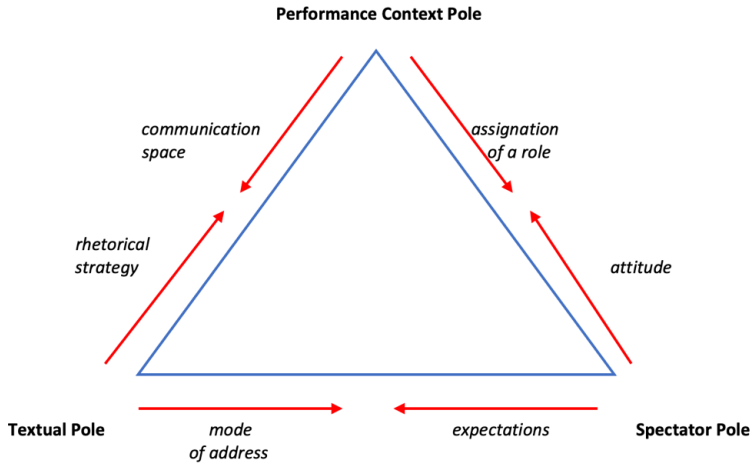

Figure 1. Model of the performance dispositif as visualized by Frank Kessler. [54]

[54] Revised image from the image that is included in: Kessler, "The Educational Magic Lantern Dispositif", 182.

Following Eef Masson, I will add "the element of constraint" as pivotal to the *dispositf* of the performance of the lantern lecture.[55] As she stresses, the instructional situation—in her case the screening of classroom films in primary and secondary education—is characterized by a difference in the "level of authority", which in case of the academic lecture depends on a difference of status within the "thought collective", i.e., the difference between an expert member and the students. Therefore, this element sheds light on the (sometimes restricted) interplay between the textual and spectator pole, which is distinctive for the performance of the academic lantern lecture. In order to enter the thought collective students are largely dependent upon what teachers tell them; in other words, the relationship between the teacher and students is characterized by "a certain amount of coerciveness (...) inherent to the education institution itself."[56] The significance of the "hierarchical relationship between teachers and pupils"—or in this case: professors and students—brings her to define her model as the "pedagogical dispositif", which I will follow throughout this research.[57]

Taken together, the framework of the pedagogical dispositif allows the analysis of the interplay between constitutive elements of a performative situation. In the following chapters I will perform such analyses of particular instances of the academic lantern lecture.

The momentum of lantern studies

In studying the academic lantern lecture practices this research builds upon the pioneering work of the research project "A Million Pictures: Magic Lantern Slide Heritage as Artefacts in the common European History of Learning". This European project was especially important in the Dutch context for its aim to make lantern slide collections accessible to researchers interested in the role slides played in entertainment and instruction.[58] Bringing out the widespread and versatile use of the lantern slide in past centuries, this project spurred two connected research projects: *B-Magic* (Belgium) and *Projecting Knowledge* (The Netherlands).[59]

[55] Masson, *Watch and Learn*, 120.
[56] Ibid.
[57] Ibid.
[58] This project ran from 2015 until 2018 and was based on collaboration between the universities of Utrecht, Antwerp, Exeter, Girona, and Salamanca. Dellmann and Kessler, *A Million Pictures*, 3; information retrieved from the website: https://a-million-pictures.wp.hum.uu.nl.
[59] B-Magic is a collaborative project between several Belgian universities (University of Antwerp, KU Leuven, Université Libre de Bruxelles, Université Catholique de Louvain, School of Arts -HoGent), and the University of Utrecht. The aim of this project is: "(…) to rediscover the various functions of the lantern performance within the Belgian public sphere, in particular, its use in the transmission and negotiation of knowledge, norms and values by different social groups." For further information, see: https://www.uantwerpen.be/en/projects/b-magic/research/scope/. For the educational context, in particular, the work of Nelleke Teughels and Wouter Egelmeers into the use of the optical lantern in Belgian schools has led to great insights into the application of this device for teaching. See e.g.: Wouter Egelmeers, ""Deep and lasting traces". How and why Belgian teachers integrated the optical lantern in their teaching (1895-1940)", in: Nelleke Teughels and Kaat Wils (ed.), *Learning*

My research is part of the NWO-funded research project *Projecting Knowledge – The Magic Lantern as a Tool for Mediated Science Communication in the Netherlands, 1880-1940*, under the supervision of professor in Media History, Frank Kessler.[60] The overall aim of *Projecting Knowledge* is to study "the use of the magic lantern in science communication in the Netherlands, 1880-1940", and to "elucidate the role of this important visual medium in the transmission and dissemination of knowledge."[61] To map the role of the optical lantern in knowledge dissemination, this project focuses on both the practices of public lantern lectures as well as academic lantern lectures, as well as on prominent figures within the lantern performance circuit.

This research project is divided into three sub-projects (two PhD's and one postdoc): the first sub-project "Science for the People", by researcher Dulce da Rocha Gonçalves, studies the phenomenon of the public illustrated lecture in the Netherlands. Within this research, she maps the institutions and associations that were involved in this cultural practice, as well as the types of speakers, topics, and venues that were part of it. The postdoc research, undertaken by Nico de Klerk, consists of several case studies about academics in performing public—that is, extramural—lantern lectures. And lastly, my research represents the other subproject "Visual Instruction".

Research Objectives

The main purpose of my research is to give an answer to the following questions: How was the optical lantern used in academic teaching practices in the Netherlands between 1890 and 1940 and how did it affect pedagogical teaching practices in different disciplines? What were the main pedagogical and didactical affordances of the optical lantern and its accompanying lantern slides in training students within a specific thought collective? On the one hand, these questions allow me to carve out all the various aspects that created and informed this type of teaching practice. In doing so, I will underscore the implications of the combination of spoken words and projected images to understand the educational mechanisms that result in particular *ways of knowing*. Furthermore, it allows to disentangle the strategies that were pursued by both the thought

with light and shadows. Educational Lantern and film projection, 1860-1990 (Turnhout: Brepols, 2022), 101-121; Wouter Egelmeers, "Making Pupils See: The Use of Optical Lantern Slides in Catholic Geography Teaching in Belgium", in: Sabine Lenk and Natalija Majsova (Turnhout: Brepols, 2022), 83-98; Nelleke Teughels, "Teachers' agency and the introduction of new materialities of schooling: the projection lantern and classroom transformations in Antwerp municipal school, c. 1900-1940", in: Teughels and Wils, 145-167. Indeed, the volume edited by Teughels and Wils is the first edited volume devoted to the role of the lantern for teaching purposes. Another important contribution to this volume is the chapter by Frank Kessler and Sabine Lenk, "The Emergence of the Projected Image as a Teaching Tool in Higher Education (1860-1914)", 27-49.

[60] This project is a sister-project of B-Magic; joint PhD seminars, workshops etc., facilitated the exchange of materials and ideas and to further explore the optical lantern's wide scope and influence.

[61] See: https://projectingknowledge.sites.uu.nl.

collective and the individual teacher. On the other hand, because of its focus on different disciplines, it offers a multi-faceted picture of the academic lecture in general and the academic lantern lecture in particular. These disciplines then, function as a lens onto both their institutional embedding within academia (e.g., an established or newly acquired position) and onto their specific knowledge claims. In systematically studying the pedagogical practice of the academic lantern lecture this research describes the ways in which a number of quite different, scientific disciplines have applied lantern projections within their teaching. It thereby demonstrates how this seemingly uniform practice brought out particular, discipline-specific affordances of the lantern *dispositif*.

Methodology

In answering these questions, this research involves historical research focusing on primary source material. However, since this research is a first attempt in systematically studying the pedagogical use of the optical lantern within academic lecture performances, the quest for the *right* source material was a true voyage of discovery. In contrast to the performance of public lantern lectures, which were often reported in newspapers, similar reports on academic lantern lectures are (largely) absent from these sources. Yet, there was a published annual report covering the activities of the past academic year, including information about the number of students, the teachers that taught at the different universities in the Netherlands, as well as the courses that they gave.[62] Although the optical lantern is mentioned in various instances, often by reporting on the purchase of an optical lantern, as in the case of the Physics Laboratory in Utrecht in 1902, these reports do not inform us about the lantern's particular pedagogical value.[63] Still, these reports were valuable, as they pointed me in the direction of specific collections within academic archives for clues on the lantern's use. What needs to be stressed is that this research largely involved connecting small hints that sometimes led to nowhere, but on occasion resulted in finding true treasures.

Lantern slide collections

The main purpose of this dissertation is to reconstruct the historical practices of performing an academic lecture, ranging from understanding the practical implications of its use (the set-up of

[62] This annual report, entitled: *Verslag van den Staat der Hooge, Middelbare en Lagere Scholen in het Koninkrijk der Nederlanden*, first published in 1876, only reflects in a few instances on the purchase of "projection apparatuses". This *Verslag* is accessible through the website of delpher.nl.
[63] *Verslag van den Staat der Hooge-, Middelbare en Lagere Scholen in het Koninkrijk der Nederlanden. Jaargang 1902-1903* (1904) 55. Accessible through the website: https://www.dbnl.org/arch/_ver042190201_01/pag/_ver042190201_01.pdf#page=41.

the lecture hall, the acquisition of lantern slides, ways of storage or ways of combination with other teaching aids, for example), disciplinary strategies (types of images, scientific or pedagogical requirements attached to the quality of the images, etc.), to the ways in which projected images were inserted within the overall performance of the lecture, the number of slides used, or their order. The heuristic model of the *pedagogical dispositif*, with its three constitutive poles, was instrumental in identifying the sources that would allow such a reconstruction, with no guarantee that these sources were available in sufficient numbers, or at all. As noted, the momentum of lantern studies, combined with the (re-)discovery of large slide collections housed at Dutch museums and archives, was an important starting point in my initial endeavor in understanding what these objects, as traces of past teaching practices, could tell us about their use.

The first case that I studied for this research was art history, and it was largely prompted by the fact that this was one of the few disciplines that had already received (international) scholarly attention with respect to the use of the optical lantern within teaching practices.[64] Moreover, the availability of a slide collection that had been initiated by professor Willem Vogelsang, made this case promising as a starting point. The slide collection that we studied collectively was that of the former Art Historical Institute of the University of Utrecht, now housed at the RKD-Netherlands Institute for Art History. This collection included more than 25.000 glass lantern slides, measuring 8,5 by 8,5 cm. Even though we consulted this collection as a group, the enormous number of slides required a targeted strategy, or strategies, in understanding what this collection meant for teaching art history. The first step in this process was to understand the information that could be retrieved from the individual objects themselves. One telling example in this respect was a slide containing two images of gothic cathedrals in one single lantern slide (see fig. 2).

Art history as a scientific discipline attached great importance to the comparative method in learning about, for example, the development of certain architectural styles, their similarities and differences in specific time periods. This slide, then, is the materialized form of this method, enabling students through its display to directly comprehend the comparison that is set before their eyes through projection. This example illustrates one of the visual strategies that was pivotal to the discipline of art history—simultaneous viewing—, which, in its turn, points to the important pedagogical aim of training the eyes of art historical students.

[64] See for example: Heinrich Dilly, "Lichtbildprojektion – Prothese der Kunstbetrachtung", in: Irene Below (ed.), *Kunstwissenschaft und Kunstvermittlung. Kunstwissenschaftliche Untersuchungen des Ulmer Vereins, Verband für Kunst-und Kulturwissenschaften* (Giessen: Anabas,1975), 153-172; Robert S. Nelson, "The Slide Lecture, or the Work of Art "History" in the Age of Mechanical Reproduction", in: *Critical Inquiry*, vol. 26, 3 (2000); Donald Preziosi, "The Question of Art History", in: *Critical Inquiry*, vol. 18 (1992). In the Dutch context, Annemieke Hoogenboom has pointed out the use of the optical lantern by Willem Vogelsang in her book: *De evolutie van compositie. De kunsthistorsische onderwijsplaten van Willem Vogelsang (1875-1954)* (Vianen: Optima, 2007), 8.

Figure 2. Lantern slide containing two images from the collection of the Kunsthistorisch Instituut Utrecht (Art Historical Institute Utrecht). (RKD-Nederlands Instituut voor Kunstgeschiedenis (Netherlands Institute for Art History).

Another source of information connected to the slides are the labels attached to the frame of the slides, which are often descriptions of the object shown. Furthermore, in some cases the labels also referred to the slide producers that were responsible for its production. However, in studying various slide collections, these descriptions were not standard practice in all disciplines. In the case of the botanical slide collection of Utrecht, for example, most of the slides have no descriptive labels. Instead, all relevant information was included in a reference system through accompanying catalogues and index books. Each slide in the collection contains a number that corresponds to a catalogue that provides further information about what is depicted, the slide's provenance, i.e., whether it was extracted from a textbook or photographed by a particular person. In both examples, however, the variety of labels, the different types of handwriting on both the labels as well as in the catalogues reveal the complex nature of this type of collections. Instead of representing one particular practice, created and composed by one individual, these objects reveal their enduring yet mutable institutional character. They bear witness to the shared commitment that was needed in its compilation. By extension, and important for the context of teaching practices, the nature of these collections reveal their use by various professors and lecturers.

Still, it is important to note that the state in which I found these collections might not necessarily reflect a historical 'completeness'. Being fragile materials, slides often broke as a result of rough handling or transportation. Another aspect that needs to be remembered is the possibly outdated character of a given lantern slide as a teaching object. It is conceivable that in some cases slides represented knowledge that had become obsolete. Moreover, many teachers or institutions got rid of large collections of glass lantern slides, because they had the new, more efficient 35mm slides at their disposal. Most probably, the glass slides contained the same images and were therefore disposable or the professors and other personnel dealing with teaching aids thought that other types of images would be better suited.

On a final note, the knowledge that is being transmitted within a particular historical framework, here 1890-1940, also indicates a certain *Zeitgeist*. Meaning here, on the one hand, newly emerging scientific fields that position themselves among other, more established disciplines, and are based on new methods and use new objects or data. However, universities and their disciplines also reflect their role and connection to the society that they are part of.

One important element that came to the fore, especially when looking into the discipline of botany, was the intimate relationship between scientific interests and the Dutch colonies. Although I am aware of this connection, its discussion is beyond the scope of this research. It is treated in passing here, with a focus on the personal networks and connections that professors had with researchers in the colonies, as well as with governments or companies. Still, the historical object of the lantern slide and the teaching practices in which it functioned can be very fruitful material in further understanding the relationship between Dutch universities and their colonial territories, because, the images were often retrieved from photographers on the spot, but also because they provide a specific Dutch perspective on relevant and new terrains of scientific knowledge.

Despite the important insights that can be taken from the slide's materiality, whether a single slide or a whole collection, these objects do not allow the reconstruction of their embedding in teaching practices: i.e., by whom they were used, for what specific purpose, or how they were sequenced in a single lecture or lecture course. Therefore, an important prerequisite in studying these lantern slide collections was to connect them to written source material that reflected their actual use by specific professors, such as lecture notes, inaugural addresses, annual reports, textbooks, scientific publications, and correspondence.

Written sources

The next step was to identify professors who made use of lantern slides for their teaching practices, which was quite challenging. This can best be illustrated through by the case of botany, to see what steps are involved in acquiring the *right* source material. After being informed about

an unique botanical slide collection at the University Museum of Utrecht (hereafter: UMU) by curator Paul Lambers, I was also pointed in the direction of one professor who had worked with the collection, F.A.F.C. Went. A first hint of his use of slides I found in the *Utrechtsche Studenten Almanak*[65] in 1905:

> "Prof. Went discussed at the general lecture, in his known manner, the morphology of plants. The last months were fully devoted to Fungi. By numerous lantern slides executed with great care, these classes were richly illustrated."[66]

Indeed, in several instances, starting from the 1890s onwards, these almanacs included brief descriptions or remarks about the use of the lantern within different disciplines. However, these were mostly limited to stating that the lantern lecture was "clear", "appealing", "rich", or offered "clarifications".[67] The comments on Went's lecturing (or other professors for that matter), do not provide us with any further information about the more far-reaching implications that this new teaching practice had on student's learning abilities, or whether this also had consequences for their more active role within the timespan of the lectures.

Yet, it did help with pursuing Went's case in further contextualizing the use of the botanical slide collection. Thereupon, I consulted the usual channels to find personal documents on Went that reflected his teaching practices, mainly looking for lecture notes. I started with the Special Collections of Utrecht, where I was looking for notebooks, publications, and even for correspondence. This brought me to several lecture notes written by one of Went's students, P.J. van der Feen. Unfortunately, as this research shows throughout, student notes that reflect the projection of images during classes are completely absent. In some instances, as in the notebooks by Van der Feen, I did find drawings made during lectures; however, it has proven to be impossible to determine whether these were made after projected images, wallcharts, or drawings on the blackboard.

Unfortunately, this institutional archive did not yield notes that were actually written by Went himself. Until I spoke with Frits Kruijt, information specialist at the UMU, who suggested to look in the library of Museum Boerhaave, the science museum in Leiden. According to him, part

[65] The Student Almanacs were yearbooks, which first appeared in the 1820s. Students from Groningen, Leiden, and Utrecht were responsible for the publication of the student almanacs and they recorded various aspects of student life, such as addresses of professors, the toal of students enrolled at university, but also the lectures that were given in the past years. For more information about these sources, see: Annelies Noordhof-Hoorn, *De Stem van de Student. Nederlandse studentenbladen in de negentiende eeuw* (Hilversum: Verloren, 2016), 15, 42-43.
[66] *Utrechtsche studentenalmanak voor 1905* (Utrecht: P. den Boer, 1905), 303-304. Utrechtsche studenten almanak voor ..., 1905, 1905. Consulted on Delpher 04-04-2022, https://resolver.kb.nl/resolve?urn=MMUTRA01:001385001:00009
[67] *Utrechtsche studenten almanak voor het jaar 1898* (Utrecht, 1898), 258. https://resolver.kb.nl/resolve?urn=MMUTRA01:001378001:00270; On professor F.A.F.C. Went: *Utrechtsche studenten almanac voor het jaar 1905* (Utrecht, 1905) 303-304. https://resolver.kb.nl/resolve?urn=MMUTRA01:001385001:00315. On Vogelsang's lecture: *Utrechtsche studenten almanak voor het jaar 1910* (Utrecht, 1910) 310.

of Went's personal archive was brought over to Boerhaave on behalf of his son, who was a professor at Leiden University. And indeed, this is where I found lecture notes by Went; in fact, they were fully written out lectures with references next to the running text to the slides that he used. It should be noted that these types of complete lecture notes are rare, as most of the lecture notes that I found for this research merely contained keywords and brief sentences that summarize the lecture as well as indicate its flow. In going through these notebooks, the use of slides was sometimes indicated by explicit references in the margin, where lists of slide numbers were written down. However, these references are also more implicit, as they simply said "lantaarn" accompanied by "x's". This complicates their usefulness in reconstructing these lectures, as this limited information made it difficult to fully grasp, what was conveyed through the conjunction of both the images and text.

In both cases, however, whether the lecture notes were extensive and detailed or not, it is fundamental to cross-reference the texts and slides with other published sources, most importantly inaugural addresses, scientific publications, and textbooks presented or written by the professors. Many of the professors in the time period studied here wrote textbooks that served as a guide for their students throughout their study. In some cases, these books actually follow the order of the courses given and their intentions and emphases.[68]

Despite the variety of sources used for this research, in retrospect they largely represent traditional primary sources. Furthermore, it might have been fruitful to also include correspondence more thoroughly. Especially because many of the archives that I have inspected do not have systematic inventory lists of what all collections encompass. For example, in the botany case I missed the role of Johanna Westerdijk, the first female professor in the Netherlands. From the book by Patricia E. Faasse that I recently discovered, one learns that Westerdijk was a prominent figure within the new direction of the botanical discipline. Subsequent research in delpher shows that Westerdijk used the optical lantern to convey knowledge about her field of study in public lectures.[69] Faasse was able to reconstruct Westerdijk's close relationship with Went by thoroughly analysing their correspondence, which contains a reflection on her teaching: "I shall do my utmost to ensure that my lectures are not boring; that is an idea that has always made me shudder."[70]

[68] See for example: J.A.W. van Loon, *Alfred Körbitz' Kursus der Orthodontie. Nach den Aufzeichnungen von J.A.W. van Loon, Med. Doct. D.D.S.* (Berlin: Berliner Zahnärtzliche Poliklinik, 1909); F.A.F.C. Went, *Leerboek der Algemeene Plantkunde* (Groningen, Den Haag: J.B.Wolters, 1923).
[69] See for example one of the news reports on a lantern lecture held by "Prof. Dr. Johanna Westerdijk" for the Physics Society in 1924. Natuurkundig Genootschap.. "Leeuwarder courant". Leeuwarden, 08-11-1924, p. 2. Consulted on Delpher 08-09-2023, https://resolver.kb.nl/resolve?urn=ddd:010603239:mpeg21:p002.
[70] Westerdijk quoted in: Patricia E. Faasse, *In Splendid Isolation: A History of The Willie Commelin Scholten Phytopathology Laboratory, 1894-1992* (Amsterdam: KNAW Press, 2008) 82. This part of the book is largely based on correspondence between Westerdijk and Went; see pages 81-93.

Taken together, all these sources that I consulted for this research provided snippets of information that, by connecting them in various ways, reveal the practices attached to and involved in performing the academic lantern lecture. Their combination allowed me to point out the main affordances of the lantern in various academic disciplines that are central to this research.

The selection of disciplines that are analyzed for this research originate from two important considerations. First, the entry of new disciplines within the Dutch academic structure, starting roughly in the last quarter of the nineteenth century, demanded their positioning among more established disciplines. Because of the need to reflect on how their respective fields of knowledge related or diverged from other disciplines, their advocates set up new departments based on requirements prompted by the thought collective. These, in turn, found their way in part through their teaching practices, of which the lantern lecture was one important and shaping aspect. The case of botany is slightly different in that it of course was already an established discipline within academia. However, its focus and, therefore, its methods changed significantly during the last quarter of the nineteenth century. As a result, this discipline also constructed new laboratories, asked new questions about the functioning of plants and their relation to their environment, all of which obviously affected the way in which botany was taught.

Secondly, the focus on art history, dentistry, and botany as the main focuses here—astronomy and psychology are also briefly discussed—also represents three important faculties within academia: the faculty of arts and philosophy, of medicine, and of physics and mathematics. Together they reflect the broad implementation of the optical lantern as a teaching aid.

Nevertheless, in some instances my selection was influenced by the availability of source material or the lack thereof. The discipline of astronomy, for example, would also have been an interesting case study: a large slide collection that belonged to the Sonnenborgh Observatory (now at the University Museum of Utrecht), professors who were avid users of slides for their lectures, notably A.A. Nijland, whose lecture notes, moreover, include lists of slides that he used in his lectures. However, in line with the notion of the thought collective, in order to fully understand and appreciate how slides were integrated within astronomical teaching practices, what types of knowledge were conveyed through the images, one needs to be knowledgeable about astronomy's methods, questions, and practices. Even Nijland's lecture notes, with their keywords and brief sentences, require a certain level of expertise.

In order to bring out the variations in the lantern's implementation within academic teaching practices this research is divided into four case studies. Instead of subjecting the various disciplines that are at the center of this research to the same—with the risk that the answers may overlap, especially in considering the necessary setup of the lecture hall—I decided to focus on

different aspects of the *lantern* lecture in each case. As a result, the combination of the presented cases together provides a well-informed overview of the varieties of the *pedagogical dispositif*, highlighting both common denominators and particularities.

Structure

In studying the implications of the new pedagogical form of the academic lantern lecture, this dissertation offers a first, thorough review of lantern practices within various scientific disciplines in Dutch academic culture between 1890-1940. Accordingly, I will discuss the infrastructure that was necessary for projecting images in a lecture hall as well as the particular visual knowledge claims that were expressed through the simultaneous combination of words and images. This text consists of four case studies each of which covers a scientific discipline that made use of the optical lantern. Although the examples that are explored here are not exhaustive, they do reflect the main concerns involved in the pedagogical form of the academic lantern lecture.

In chapter 1, I discuss with the scientific discipline of botany by focusing on the performance context pole, more particularly the role of the optical lantern in the construction of the lecture hall of the Botanical Laboratory at the University of Groningen. In this chapter I mainly comment on the pedagogical and pragmatic choices in creating the right teaching setup. This chapter will also show how the lantern functioned alongside, but also impacted, the use of other visual teaching aids. Taken together, this chapter demonstrates what type of space was necessary in order to create and stimulate a "seeing collective".

Chapter 2 showcases the discipline of art history at both the University of Utrecht and the University of Amsterdam. I demonstrate the pivotal role of the optical lantern in the establishment of art history as a full-blown, scientific discipline within academic culture, starting in 1907. As I will argue, the lantern proved to be instrumental, both literally and figuratively, in creating a scientific basis for the study of artworks.

Chapter 3 examines another emerging discipline at the beginning of the twentieth century, dentistry. As it focused on treating patients, the creation of a seeing collective needed to be based on real-life examples. Consequently, two of the images that feature in this chapter can be experienced as shocking, yet at the same time they do illustrate the necessity of real cases to prepare students for their future profession. However, before they are able and allowed to treat patients, they first needed to be taught how to *look* at cases, to distinguish between symptoms and causes in certain deformities.

In the final chapter, the reconstruction of lantern lectures takes center stage, with a focus on the different formative stages of the thought collective. In this chapter I explore the possibilities of reconstructing lectures, or sometimes rather the meaning of projected images in teaching practices, when confronted with partial information. By contrast, I also analyze a lantern lecture that allows full reconstruction, a lecture performed by professor of botany at Utrecht University, F.A.F.C. Went, on the topic of plant movement. Because of its completeness, this last case reveals the different strategies that were pursued in transmitting knowledge to (different) academic audiences.

Chapter 1.

The range of visual teaching aids in botanical science education

In 1932, film director Max de Haas made a short film of the Botanical Laboratory of the Utrecht University that was at that time led by professor of botany, F.A.F.C. Went. The film presented a 'typical' day at the laboratory, showing the interconnectedness of both educational and research activities on its premises, but most importantly the ins and outs of the *modern* botanical laboratory.[71] As academic institutions, due to a confluence of circumstances, botanical laboratories arose in the 1870s in the Netherlands. The first big change in the botanical discipline itself was a shift in focus, from predominantly taxonomical studies (focused on the description and classification of plants) to a more experimental, research-oriented pursuit focused on the internal functioning of plants.[72] This experimental emphasis necessitated the need for new and modern botanical laboratories, with room for microscopy lessons, for conducting research on a larger scale, as well as for giving lectures to instruct and train students for further research.

[71] De Haas, M. (Director). (1932). *Prof. Went en het botanish laboratorium* [Film]. Visie Film (Amsterdam). Eye Filmmuseum. https://www.youtube.com/watch?v=uIlZoSNgj2A. Max de Haas (1898-1983) was a journalist, director, and screenwriter. Fascinated by film, he founded his own cooperative, the Dutch Film Association 'Vision', this outfit was commonly known as Visiefilm. https://wiki.beeldengeluid.nl/index.php/Max_de_Haas.
[72] R.P.W. Visser, "De ontwikkeling van de universitaire biologische laboratoria", in: *Tijdschrift voor de Geschiedenis der Geneeskunde, Natuurwetenschappen, Wiskunde en Techniek,* vol. 9 (1986) 255; J.W. Moll, *Onze Laboratoria en de Wetenschap. Rede, bij de opening van het botanisch laboratorium der Rijks-Universiteit te Groningen* (Den Bosch: Stoomdrukkerij Firma Robijns & Co, 1899), 16; Patricia E. Faasse, *In splendid isolation*, 70.

The orientation to experiment and research reflected a change in universities' "educational ideal" towards "training and preparing students to become independent practitioners of science", and to equip them for professions that "required a scientific education".[73] Instead of only focusing on theory, illustrated by empirical examples, this new focus led to the introduction of the *practical*, classes where students were expected to perform certain actions themselves, such as setting up an experiment.[74] As professor of botany in Groningen P. de Boer summarized in his inaugural lecture in 1871, when addressing his students: "Seeing for yourself, exploring for yourself, that is the focus here."[75]

In the Netherlands it was not until the 1980s that scholarly interest was directed to the establishment and development of laboratories in general in the nineteenth century. As historian of science C. Hakfoort explained, "whoever wants to write about the development of laboratories in the period of 1860-1940 (...) has almost no literature to build upon." He adds: "For the Netherlands, the situation is even more disappointing.[76] Therefore Hakfoort and others took up this task and created the first body of knowledge about Dutch laboratories, focusing on the new, academic laboratories (as well as the industrial ones).[77] Interestingly, in their reflections they hardly speak about the (theoretical) education that took place within the confinement of the laboratory, even though the botanical laboratory for example "was mainly for education and research", as R.P.W. Visser stated.[78]

Most probably, the contemporary focus on practical education, its emphasis on learning how to conduct research independently, has created a blind spot among historians, as they largely ignore the more theoretical teaching forms, such as the (lantern) lecture.[79] This leads to an incomplete understanding of the various educational forms that were fundamental for training botanical students. This incompleteness is especially significant in light of what the American

[73] Higher Education Act 1876. Wet op het Hooger Onderwijs van 28 April 1876 (Amsterdam, 1876): ch. III. § 1; historian Peter Baggen traces three different ideals underpinning the Dutch universities from 1815 until 1960. Baggen, *Vorming door* wetenschap, 84, 101-102.
[74] Wet op het Hooger Onderwijs van 28 April 1876 (Amsterdam, 1876), 3; Baggen, *Vorming door wetenschap*, 84.
[75] P. de Boer, *De waarde van vergelijkend onderzoek voor de beoefening der plantkunde*, inaugural lecture, University of Groningen, 1871, 31.
[76] C. Hakfoort, "Inleiding. Laboratoria als werkplaatsen van wetenschap en techniek", in: *Tijdschrift voor de Geschiedenis der Geneeskunde, Natuurwetenschappen, Wiskunde en Techniek*, vol. 9, 4 (1986), 144-145.
[77] R.P.W. Visser, "De ontwikkeling van de universitaire biologische laboratoria", in: Ibid., 255-265; H. Beukers, "Een nieuwe werkplaats in de geneeskunde: de opkomst van laboratoria in de geneeskundige faculteiten", in: Ibid., 266-277; H.A.M. Snelders, "Chemische laboratoria in de negentiende eeuw", in: Ibid., 204-215.
[78] Visser, "De ontwikkeling van de universitaire biologische laboratoria", 263.
[79] The master thesis of Jaline de Groot, *'Doelmatig maar tevens schoon'. Architectuur & wetenschap in het Botanisch laboratorium in Groningen 1892-1899*, master thesis Groningen University, 2016, is an exception to this rule. While her perspective is architectural, she devotes a part of her thesis to the role played by pedagogical considerations in constructing the botanical laboratory in Groningen, including professor of botany J.W. Moll's ideas about the use of the lantern. In this chapter I will expand these ideas and reconstruct his 'visual pedagogy' to fully appreciate the necessity of the lantern for botanical teaching practices.

university lecturer A.C. Noé stated in 1928 about the enormous changes this educational form introduced:

> Old teachers of natural science subjects will remember the time when charts were used extensively in classroom and laboratory instruction. That was before the general introduction and universal use of the lantern, now the principal means of classroom demonstration. The lantern slide has almost completely driven out the chart, and many university departments of zoology, anatomy, physiology, bacteriology and botany have practically no charts at all, or whatever they have is antiquated material or homemade, crude and unattractive.[80]

Despite the different situation in the United States with respect to the use of the optical lantern—as explained in the introduction of this dissertation—and Noé's possible exaggeration of the situation in 1928, his comment is worth further exploration in the Dutch context. In this chapter, I therefore shift the focus to the role of lectures, more specifically *lantern* lectures, and how they related to other visual teaching aids in transmitting botanical knowledge to students. Since no scholarly research has focused on the optical lantern for botanical teaching practices—both nationally and internationally—I will make a first attempt in underscoring its significance in the modernization of academic studies as well as its institutions. This chapter will recover and reconstruct the ideas and goals of different teaching aids, both inside and outside the lecture hall.

Let us start by briefly discussing the film by De Haas for clues to the use of visual teaching aids, more specifically the optical lantern, within the Botanical Laboratory in Utrecht.

Instructive film

The film opens on a scene showing Went walking the grounds of the Botanical Laboratory, heading from his home (on the same terrain) towards the building where the lecture hall is situated, to start his day with a lecture on "Algemeene Plantkunde" (General Botany). Once the scene of Went's entry into the laboratory has passed, the chronology of events in the film is changed. After the intertitle "College: Algemeene Plantkunde", the film shows an assistant in a white overcoat preparing demonstration material (scales and a volumetric flask) on the demonstration table. Next, the assistant hangs up two large wallcharts that depict a plant growth regulator and the principles of phototropism (Fig. 3-5). Here, the viewer is shown two important visual teaching aids that served to support what was being discussed by Went. Furthermore, this scene also underscores the preparatory work that was necessary to take care of *before* the lecture could be given. In other words, from a pedagogical perspective the presence of visual aids made sure that the flow of the lecture was not disturbed.

[80] A.C. Noé, "The use of charts in the natural sciences", in: *Science, New Series*, vol. 67, 1745 (1928), 571.

Figure 3. Screenshot of film "Prof. Went and the Botanical Laboratory", assistant hanging up wallcharts (at 2',40,").

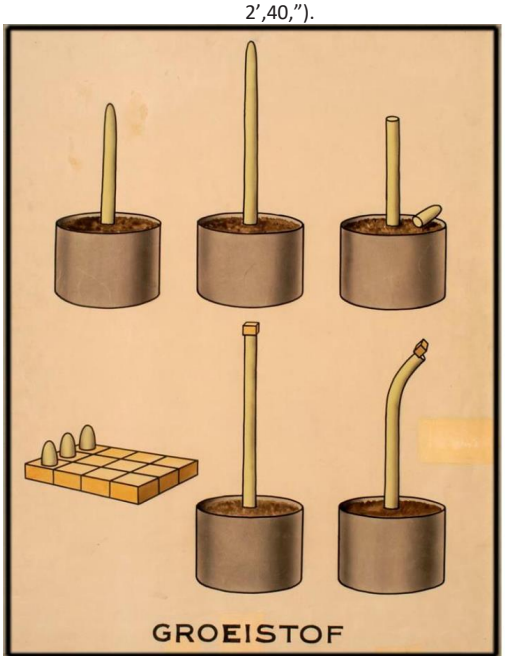

Figure 4. Wallchart: "Groeistof". (Collectie Universiteitsmuseum Utrecht).[81]

[81] In English: "Growth regulator". Botanical wallchart collection of University Museum Utrecht. Inv. Nr.: UG-28751.

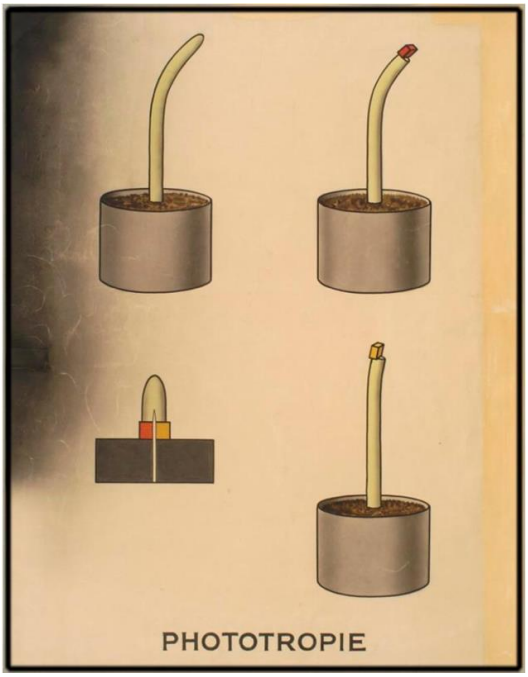

Figure 5. Wallchart: "Phototropie". (Collectie Universiteitsmuseum Utrecht) [82]

Once all the students have arrived, Went walks into the lecture hall and takes his position behind the lectern, where he lays down his papers in front of him and starts with his lecture (Fig. 6). In this shot, the blackboard, five wallcharts, and three small vases with flowers are visible: they form the basic didactical material for this particular lecture. However, the demonstration instruments as well as the two wallcharts seen earlier in the scene featuring the assistant have disappeared.

There are three possible explanations for this: 1) it shows that more wallcharts were used for one lecture; or 2) the first scene had a more instructive function within the short film itself, emphasizing the preparatory work involved in the setup of a lecture; or 3) this scene could have been recorded on a different day. Nevertheless, what these edited scenes do show is the importance of the presence of divers visual teaching aids during a lecture.

[82] Botanical wallchart collection University Museum Utrecht. Inv.nr.: UG-28752.

Figure 6. Professor Went standing in front of the students about to give his lecture "Algemeene Plantkunde". (at 4',16,").

Another important aspect that stands out in this scene is the fact that the lecture was presented with daylight coming into the windows on the side of the lecture hall. The presence of natural daylight is important in our quest for clues about the use of the optical lantern, since a darkened lecture hall was a condition for its use (as we will see in more detail later in this chapter). If the curtains were not closed, or the windows would not be blinded in any way, this natural light would distort the light beam of the lantern, making the projection of images impossible.

Interestingly in this respect, at the end of the day, at 4pm, a "*refereer college*" is held, a class meant to discuss new or important literature. Every week students took turns in presenting a summary or a reflection on the literature to their peers as well as to their professors. The setting of this class was again the lecture hall where Went also generally gave his lecture. However, now the lecture hall was fully darkened, except for the light that is necessary to film this scene, the rest of the hall is completely dark (Fig. 7). This could be an indication of the use of the lantern for this class.[83] The camera is positioned at an angle behind the student, while we see two professors sitting in the first row, Went and his colleague, professor A.A. Pulle, on the left (professor of special botany and plant geography).

[83] Even in wintertime in the Netherlands it is not until 16.45h that it is fully dark outside. So, the reason for the darkness in the lecture hall is purposely created.

Figure 7. "Refereercollege" with Prof. Went and Prof. Pulle. Student is standing at the lectern of the lecture hall in the Botanical Laboratory. (at 17'24,").

When closely watching these two men one sees that light is reflected in their glasses. Could this light then be the reflection of a projected image being shown? While Went and Pulle are attentively listening to the presentation, Pulle (sitting on the left for the viewer, closest to the student) suddenly makes a subtle movement to the right (Fig. 8). This movement is familiar to anyone trying to look behind some else's back when his or her view is blocked.[84] In this case, it most probably had to do with a certain detail that was pointed out by the student in his text and shown on the screen behind him. Furthermore, when running this scene at lower speed, it becomes clear that the light reflected in their glasses is stable, a further confirmation that they are watching a still image rather than a moving one.

[84] In his article, J.R. van Pelt discusses the "symptoms" of using visual teaching aids, which often lose their value due to mishandling of the material. J.R. van Pelt, "Lantern Slides and Such", in: *American Scientist*, vol. 38, 3 (1950), 452.

Figure 8. Professor Pulle trying to look behind the student at…? (at 17'28,").

But how can we be certain, judging from this shot alone, that the object that Pulle was so eager to see was indeed a projected image? If we assume that it was, where would the lantern have been placed? Normally the lantern would be placed on a platform to allow an unobstructed view of the projected slides.[85] However, without the visual 'evidence' of the optical lantern in the film, or of possible projected images, its presence cannot be established with certainty.

Luckily, there are other, more plentiful clues and sources that can help us better understand the pedagogical affordances of the lantern within the botanical laboratory. In what follows, two elements of this puzzle are central: first, the construction of the 'model' laboratory by J.W. Moll at the University of Groningen. Moll not only had very outspoken ideas about the importance of the lantern, but his case also sheds light on the interplay between visual teaching aids, the assigned role of lantern slides among wallcharts, specimens, herbaria, living plants, etc. After 'setting the stage' with the help of Moll's efforts around 1900, the final part of this chapter will focus on a purpose-built cupboard filled with a collection of approximately 1,850 lantern slides connected to the Botanical Department of Utrecht University. By inspecting this unique slide collection, I want to demonstrate what its study offers with respect to obtaining a better understanding of academic and arrive at a full appreciation of what Gillian Rose has coined as

[85] Van Pelt, "Lantern Slides and Such", in: *American Scientist*, vol. 38, 3 (1950), 455. See also the purposely built lecture hall of professor Vogelsang (among others that will be discussed in this dissertation), as well as botanical laboratories at Dutch universities around the turn of the 19th century.

"visual disciplines" and how these disciplines use visuals in instructing, informing, persuading their audiences.

The model laboratory by J.W. Moll

> This now 36-year-old building has in many respects been the model for the botanical laboratories subsequently built in other university towns [i.e. Leiden and Utrecht]. (…) Special mention should be made of the large hall for practical work, with its great windows to the north, and the lecture room with its lantern installation. Moll was one of the first to grasp the importance of satisfactory projection.[86]

In fully appreciating the arrangement of Botanical Laboratory in Utrecht and the central role given to visual teaching aids, we need to understand its history. This history started in 1892 in Groningen, the year that J.W. Moll, sent an explanatory memorandum to the Minister of Home Affairs about the necessity of a completely new, up-to-date botanical laboratory.[87] According to M.J. Sirks, who discussed the Groningen laboratory some fourty years later at the International Botanical Congress in the Netherlands in 1934, this building was not just the 'archetype' of botanical laboratories in the Netherlands, it was also the first (botanical) lecture hall that was constructed around the use of the lantern.[88]

The first botanical laboratories in the Netherlands arose in the 1870s, starting with Amsterdam in 1870, Groningen in 1874, and Utrecht in 1876.[89] Despite these efforts it soon became clear that these buildings did not meet the standard that modern scientific endeavours, both research and teaching practices, required. While this concept percolated through all layers of science at Dutch universities, its full consequences for the discipline of botany were only felt in the 1890s with the appointment of J.W. Moll in Groningen. For him, scientific research was

[86] M.J. Sirks, *Botany in the Netherlands. Edited for the organizing committee of the sixth international botanical congress* (Leiden: E.J. Brill, 1935), 15.

[87] Nationaal Archief. Algemeen Rijksarchief. Tweede Afdeling. Binnenlandse Zaken. Kunsten en wetenschappen. 1875-1918. Nr. 500-502, 502. "Afschrift J.W. Moll. Memorie van toelichting tot het ontwerp voor een botanisch laboratorium in den Hortus Botanicus te Groningen", 4 February 1892. (Nationaal Archief. General State Archive. Second Section. Home Affairs. Arts and Sciences. 1875-1918. Nr. 500-502, 502. "Copy J.W. Moll. Explanatory Memorandum for the design of a botanical laboratory at the Hortus Botanicus in Groningen", 4 February 1892. See also Henning Schmidgen, "Pictures, Preparations, and Living Processes: The Production of Immediate Visual Perception (Anschauung) in Late-19th-Century Physiology", in: *Journal of the History of Biology*, vol. 37, 3 (2004), 477-513, where one of the main arguments is to pay attention to architectural structures to fully understand the ideals of "acquiring experimental knowledge". "I argue that in this period [1870s], technology and architecture worked within a system for preparing images that was an important, if not central aspect in acquiring experimental knowledge within the disciplinary framework of physiology." (479).

[88] Sirks, *Botany in the Netherlands*, 15. Jaline de Groot, a former MA-student at the University of Groningen has written her PhD thesis also about the construction of the Botanical Laboratory of Groningen, mainly focusing on the architectural construction of the lecture hall and the microscope room. In her thesis she also discusses use of the lantern and its importance for the construction of the lecture hall. However, she omits to explain why exactly this medium was so important in Moll's concept of teaching practices. That is what this chapter will add to the existing literature. De Groot, 2016.

[89] Visser, "De ontwikkeling van de universitaire biologische laboratoria", 262.

fundamental: "the first and foremost duty of a professor is to do original scientific research and to the best of his abilities promote it in others [i.e. students]".[90] However, as Moll admitted in an interview he gave in 1926 to the *Nieuwe Rotterdamsche Courant*, his true talent was in teaching, i.e., "sharing knowledge gathered by others."[91] Consequently, with respect to the renovation of the botanical laboratory, he stated that the lecture hall, together with the microscopy room, should be given priority.

In Moll's plea for a new design of the lecture hall, he was effectively arguing for a change in *dispositif*: a new arrangement that facilitated the optimal transmission of botanical knowledge. As I discussed in the introduction of this dissertation, the concept of the *dispositif*, more specifically the *pedagogical dispositif* coined by film historian Eef Masson, is enormously useful in understanding the context of the classroom that Moll was describing. In contrast to the concept of the "grammar of schooling"[92], the heuristic tool of the *dispositif* sheds light on the subtle shifts and changes in teaching practices. In this case, the focus will be on the "performance context pole", i.e., the physical space where the lectures take place and the position of the professor while addressing his audience. By concentrating on elements that are part of the physical setting this emphasis offers new ways of understanding historical and situational discrepancies in the ways knowledge transmission is accomplished. In the present context, this approach offers a thorough understanding of the need for the reconstruction of university buildings and why the lantern played such a fundamental role in these educational changes.

In order to understand what Moll wanted to change let us start with what I would like to call the 1892 *dispositif*, the configuration that was the object of his complaint that year. The first element that Moll discussed was the increased number of students that attended his lectures. According to the *Report of the state of affairs of higher, secondary and elementary education institutes within the Kingdom of the Netherlands*[93], in the academic year 1891-1892 about seventy-five students attended Moll's lectures, whereas the lecture hall at that point could only accommodate fifty students.[94] Moll reports that the surplus of students had to be placed behind him on chairs without desks, a situation that severely impacted his pedagogical practices:

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[90] J.W. Moll, *Onze Laboratoria en de Wetenschap. Rede gehouden bij de opening van het Botanisch Laboratorium der Rijks-Universiteit te Groningen* (Den Bosch, 1899), 3. Original Dutch text: "(…) de eerste en voornaamste plicht van een hoogleeraar, is het verrichten van oorspronkelijk wetenschappelijk onderzoek en het naar zijn vermogen bevorderen daarvan bij anderen."

[91] "Feuilleton Prof. Dr. J.W. Moll (ter gelegenheid van zijn vijftigjarige promotie)", in: *Nieuwe Rotterdamsche Courant* (12-06-1926). "Nieuwe Rotterdamsche Courant". Rotterdam, 12-06-1926, p. 5. Consulted on Delpher 10-09-2022, https://resolver.kb.nl/resolve?urn=ddd:010028473:mpeg21:p005.

[92] David B. Tyack and Larry Cuban, *Tinkering Toward Utopia: A Century of Public School Reform* (Cambridge, MA, London: Harvard University Press, 1995).

[93] An annual report that was sent to the Dutch government by educational institutions about the past year; what classes had been given, who was hired etc.

[94] Verslag van den staat der hooge-, middelbare en lagere scholen in het Koninkrijk der Nederlanden over …, 1892 [volgno 1]. Consulted on Delpher 01-06-2022, https://resolver.kb.nl/resolve?urn=dts:1463001:mpeg21:0003: Jaline de Groot has charted all the data from the

> A natural consequence of these circumstances is that a significant part of the audience is unable to see the blackboard or the wallcharts and to properly perceive the experiments taken and the specimens demonstrated.[95]

What needs to be stressed here is Moll's emphasis on the inoperability of commonly used (visual) teaching aids, a situation created by an increased number of students. It was not simply a matter of replacing unsuitable, old-fashioned teaching aids that had lost their meaning for teaching. On the contrary, it was their problematic nature when used before a large audience, since it was impossible that everyone could see them at the same time. Secondly, another complicating factor of this situation was that the surplus students did not have desks that facilitated notetaking. All in all, it was the obstruction of these two important didactical principles that Moll valued highly—simultaneous viewing and note-taking—that forced him to make fundamental changes in his teaching practices.

> Each time I am forced to refrain from demonstrating some of the experiments and especially of living plants, where I would consider them most necessary. The use of an optical lantern—a necessary aid with such a large audience—is impossible [within the small lecture hall].[96]

Here, for the first time, Moll hints at the use of the optical lantern, a medium that would meet his demands where other ones were failing. The *1892 dispositif* was based on visual teaching aids, such as wallcharts, specimens, living plants. But due to the growing number of students this *dispositif* proved to be insufficient to fully exploit the visual teaching aids. Consequently, Moll had to accommodate the 'new' medium that would allow him to serve the growing number of students.

Moll's visual pedagogy

Moll had very clear ideas about the role distribution of all kinds of materials that were at his disposal, such as plant models, wallcharts, and photographic slides. These ideas become most evident in a textbook that he wrote in 1900 on the importance of plant description in education. This textbook was specifically written for teachers in secondary schools and the *gymnasium* (which gave access to the university). However, in his foreword Moll also pointed to its potential for university students, as he explained the fundamental importance of visual teaching aids and

Verslag van den staat der hooge-, middelbare en lagere .. regarding the number of students that attended all the classes that Moll gave. What she shows in this appendix is that after the academic year 1893, the number of students decreased rather than increased, which would have undermined Moll's argument about the lack of space. The average number of attendees at his general lectures between 1892-1917 was 36, an amount that the old lecture hall would have easily accommodated. De Groot, *'Doelmatig en tevens schoon'* (2016) 103.

[95] NA. AR. Nr. 502 "Afschrift J.W. Moll. Memorie van toelichting", 4 February 1892.

[96] Ibid.

how they relate to each other.[97] The overall aim of this manual was to provide teachers and students with practical guidelines to facilitate the acquisition of observational skills.[98] In formulating these guidelines, Moll used the introduction to discuss the different visual objects and teaching aids that would expedite distinctive learning goals. However, not all visual teaching aids or objects were as effective for classroom teaching, as we will see, some of them were more effective for self-study.

Botanical education, for Moll, should be based on three main aims, 1) development of observational skills; 2) the acquisition of factual botanical knowledge; and 3) transmission of general knowledge that was not taught in any other classes.[99] After setting the stage with factual knowledge, which formed the basis of students' "better scientific appreciation" in general, the acquisition of observational skills was most important.[100] These skills, directed at nature itself, required self-study and the ability to make comparisons between what can be observed in nature and what was shown in the classroom. If students wanted to fully understand natural objects, they had to observe them as much as possible. From this it is obvious that Moll attached great value to the use of specimens for educational purposes, such as an herbarium. Yet, these specimens were often problematic in classroom teaching, as Moll discussed in his introduction of the handbook. "Without the possession of a collection of dried plant specimens" no botanical class could be started properly. Still, the number of these specimens had to be "big enough" in order for the students to "make distinctions between them".[101] This harks back to the earlier argument in the *Explanatory memorandum* of 1892 about the difficulties—sometimes impossibility—of demonstrating specimens and experiments before a larger audience.[102] Moll continued by stating that classes on systematic classification are most suitable for the use of dried specimens, since these allow a better grip on the Linnean system of plant description, which is based on their external features, such as stem, seed, flower etc. Besides size, Moll added another disclaimer: specimens, after being handled by one student after another, tend to flatten and eventually lose their practical value. Surprisingly, he does not include a much-heard argument at the time, namely that since they had been taken out of their natural habitat, their pedagogical value was limited as compared to their study in situ.[103]

[97] As far as I know, this textbook has never been studied to obtain more insights into Moll's ideas with respect to the use of various visual teaching aids. However, as I will show, this textbook (as well as similar books) can be very interesting sources for the reflections by contemporaries on the advantages and disadvantages of tools for education.
[98] J.W. Moll, *Handboek der plantbeschrijving* (Groningen: J.B. Wolters, 1900), 5.
[99] Ibid., 5.
[100] J.W. Moll, *Phytography as a fine art: comprising linnean description, micrography and penportraits* (Leiden: E.J. Brill, 1934), 499.
[101] Moll, *Handboek der plantbeschrijving* (Groningen, 1900), 11-12.
[102] NA. AR. 502. "Memorie van toelichting", 4 February 1892.
[103] Sanders, "The Death and Life of Plant Specimen", in: Heering and Wittje, 160-161.

The ephemerality of dried specimens led Moll to seek alternatives for teaching observational skills in the classroom. First, he opted for using plant models, specifically those made by the German company Brendel, world-famous for its manufacturing of these teaching aids.

> I consider them [plant models] indispensable for classroom teaching, for they could only be replaced by giving the pupils living objects, and this, due to the different flowering times of plants, would make regular treatment of the different forms belonging to each other impossible, and moreover, would often tie a teacher to a particular season.[104]

The didactic strategy of studying one plant more often to fully grasp its peculiarities and place it in the larger scheme of species needed a visual teaching aid that allowed not just personal observation, but also the subsequent and more permanent study of the same type. A similar argument was made earlier, in 1885, by a German colleague of Moll, professor of botany Alexander Tschirch:

> (…) their [the flowers'] smallness usually means that the beginner is unable to perceive it, and it therefore seems desirable to extend the teaching materials by using greatly enlarged models to show the structure of the flower in all its details in an easily comprehensible way, even when one is inexperienced. This is done with Brendel's models, which strive as far as possible for the most lifelike representation and also take into account the results of modern morphological research in the arrangement of the parts.[105]

At the same time, Moll realized that the cost of purchasing plants models was substantial. This led to a short discussion of plates and drawings. He was very clear in stating that plates were the last resource; teachers had "to settle for plates and drawings" if no other aid was at their disposal.[106] What is interesting however, is that these plates and drawings could not be used in isolation from the specimens they depicted. As Anne Secord argues, "plates were used alongside specimens to enhance the observation of natural objects through comparison with the more obvious depiction of their distinguishing features in pictures".[107] The main incentive, obviously, was that students needed to get acquainted with the structure and the shape. Therefore, the role that these images performed was that of developing "the observational skills necessary for looking at plants and other objects of nature."[108] Moll is very clear about how to use these visual aids, namely by "joint consideration and discussion".[109] In other words, the teacher had to guide the interpretation of the illustrations that were used, and therefore plates and drawings were not suitable for self-study.

[104] Moll, *Handboek der plantbeschrijving*, 12.
[105] A. Tschirch, *Erläuterungen zu den Botanischen Modellen von Robert Brendel* (Berlin, 1885), iii.
[106] Moll, *Handboek der plantbeschrijving*, 12.
[107] Anne Secord, "Botany on a Plate: Pleasure and the Power of Pictures in Early Nineteenth-Century Scientific Knowledge", in: *Isis*, vol. 93, 1 (2002): 46.
[108] Ibid., 32.
[109] Moll, *Handboek der plantbeschrijving*, 12.

Finally, let us compare this range of visual aids with what Moll argued in his *Explanatory memorandum* in 1892 regarding the necessity of employing the lantern for classroom teaching at the Groningen University. Apart from commenting upon the inability of students to make notes due to the lack of space, he also discusses the difficulty of showing microscopic specimen without using the optical lantern: "They are in general not applied anymore, while the same need [that of showing microscopic structures] can only to a very limited extent be fulfilled by wallcharts."[110] This statement is interesting in two respects; first, because it reveals that both aids (microscopic specimens and wallcharts) had their own specific qualities and served different, non-interchangeable purposes. And secondly, it confirms the long-standing assumption that for educational purposes drawings (or wall charts for that matter) are only informative when used in combination with real specimens.

However, what Moll seems to suggest is that the microscopic specimen *could* be substituted by photographic lantern slides of microscopic specimens. After acknowledging that the latter were not used anymore due to the increasing number of students, he refers to the need for "projecting microscopic specimens".[111] Without reflecting on photography and its scientific status (or any of the other teaching aids, for that matter), the ease with which Moll refers to microphotography and projection is telling. It appears that Moll was convinced that the photograph had the ability to copy 'exactly' what could be viewed under a microscope. In this context, it is valuable to include some reflections made by the bacteriologist Robert Koch, twenty years earlier. In *Kaiserliche Mitteilungen* Koch argued that in some cases the photographic image of microscopic specimens is more valuable than the microscopic object itself. For him this mainly has to do with the fact that an observation through the microscope by different people leads to (most probably) different results or different images. Therefore, having a technique with which the exact object, as it is seen through a microscope at a certain moment in time, is captured in such a way that it can be viewed by all in the same way, was for Koch a real breakthrough in the scientific debate about microscopic specimens.[112] Moreover, the different accounts of observations through the microscope originated in the subjectiveness of the observer.

For educational purposes then, in the case of Moll, the projection of a (photographically recorded) microscopic object enabled students to see the same specimen at the same time. In this way Moll was able to calibrate the eyes of his students, guide them "to see in the same way", and stimulating "collective perception", as Lorraine Daston puts it.[113] Taken together, given the ideas regarding the role and function of different visual teaching aids, one can conclude that within the

[110] NA. AR. 502. "Memorie van toelichting", 4 February 1892.
[111] NA. AR. 502. "Memorie van toelichting", 4 February 1892.
[112] Robert Koch, "Zur Untersuchung von pathogenen Organismen", in: *Mittheilungen aus dem Kaiserlichen Gesundheitsamte* (Berlin: Norddeutsche Buchdruckerei und Verlagsanstalt, 1881), 10-11. https://archive.org/details/s3728id1338102/page/2/mode/2up.
[113] Daston, "On Scientific Observation", 105.

1892 dispositif all aids served a particular purpose. However, due to the growing number of students attending his lectures the lecture hall was too small to teach botany properly. Therefore, the *dispositif* needed to change in order to do justice to training students the right observational skills. These are the circumstances that pushed Moll into the implementation of the lantern for teaching purposes.

Travel report 1894

After discussing deficiencies but also future wishes, it was important for Moll to make inquiries into existing lecture halls that were equipped with an optical lantern. It was clear from the start that the construction of the modernized lecture hall had to include optimal projection facilities.[114] While as a botanist Moll had clear ideas about what kind of place the modern botanical laboratory should be, he had little understanding of architecture. Therefore, the Minister of the Interior instructed state architect Jacobus van Lokhorst to assist Moll with the construction of his new botanical laboratory. Even though Van Lokhorst was an experienced architect, who specialized in the construction of educational buildings in the Netherlands, he was unfamiliar with the use of the optical lantern.[115] As he states in one of his letters to Moll, "There are no such facilities in our country."[116]

Because of the lack of domestic examples, Moll and Van Lokhorst had to look beyond the Dutch borders for their inspiration. First, Moll sent a letter to inquire about lantern facilities at German universities. Based on the responses that he received in 1894, it is clear that the universities in Berlin, Bonn, and Jena did already have projection facilities. However, these facilities did not belong to botanical laboratories, but to physiological laboratories or anatomical institutes, such as the one by professor O. Hertwig in Berlin.[117] What is intriguing about these letters, nonetheless, is that they provide insight into the status quo of educational settings of the period. Whereas one of Moll's German colleagues reports on the use of a solar microscope, another refers to an article written by professor Selenka about a specific electrical lighting system that was used for projection as early as 1887, a system that we will also encounter in Moll's later efforts.[118]

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[114] J.W. Moll, "De hortus botanicus en het botanisch laboratorium", in: *Academia Groninga, MDCXIV-MCMXIV: gedenkboek ter gelegenheid van het derde eeuwfeest der Universiteit te Groningen uitgegeven in opdracht van den Academische* Senaat (Groningen: Noordhoff, 1914), 475.
[115] *Geschiedenis van het Rijksbouwen. Jacobus van Lokhorst* (1987) 1. Report on behalf of the Ministry of Housing, Spatial Planning and Environment.
[116] NA. AR. SS. 502. "Letter from the Secretary of the Board of Curators from the University of Groningen from 13 April 1894 to the Minister of Home Affairs. Accompanying statement by J.W. Moll", 7 April 1894.
[117] Bijzondere Collecties Rijksuniversiteit Groningen. Archief J.W. Moll. Correspondentie. "Brief S217, from E. Stahl (about Hertwig) to Moll", 13 May 1894, and S223 from E. Strasburger to Moll", 13 May 1894. (Special Collections University Groningen. Archive J.W. Moll. Correspondence. Letters S217 and S223). Professor Oscar Hertwig (1849-1922) was an embryologist who became a professor in anatomy at the University of Berlin in 1888. https://www.britannica.com/biography/Oskar-Wilhelm-August-Hertwig.
[118] BC. RUG. Archief Moll. "Brief 223 van E. Strasburger", 13 May 1894.

Consequently, these letters exhibit a *Zeitgeist*, where professors were expressing their faith in this new medium and eager to learn more about its implications for their teaching practices.

Moll's letters served partly as a preparation for the eventual trip that he and Van Lokhorst would undertake through England, Belgium, and Germany, starting from The Hague on the 3rd of June 1894.[119] After visiting London, they continued their travels to Oxford, Cambridge, then crossed into Belgium, where they visited Brussels. The journey ended in Germany, where they visited Göttingen, Leipzig, and Berlin. These visits ranged from university buildings, such as physiological and anatomical institutes, to non-academic venues like the Royal Institution in London, which were dedicated to the "promotion of arts and sciences".[120] This 'voyage of discovery' had a dual purpose: 1) what type of optical lantern would best suit their pedagogical purpose and what did that mean for its placement in the lecture hall; and 2) what specific (electrical) lighting system could best be applied.[121]

Their first visit was to the Royal Institution in London, known for its seasonal public lectures. Its lecture hall could accommodate 500 people and, according to Van Lokhorst, it was famous for its "acoustics and efficient design".[122] In his report, Van Lokhorst made a note of the lantern manufactured by Newton & Co, which was positioned amidst the audience. This position of the lantern was not unusual, especially in more popular venues. They saw a rather different arrangement at the Institut Solvay in Brussels: while the lantern also stood amidst the audience, it was placed on a platform that could be easily raised and lowered (Fig. 9), meaning that it could also be lowered when it was no longer needed. According to Van Lokhorst, this lantern set-up was created to deal with the difficulties of operating the lantern. Hence, the installation of a 'test room' underneath the lecture hall, where the lantern was not only prepared for the next lecture, but also to test the projections. For example, before starting the lecture it was necessary to make sure that the projected image was bright and clear, while the slides had to be put in the right order and were all upside down for their correct projection.[123] Therefore this 'test room' had similar dimensions as the lecture hall. When the lantern was all set to operate, a sign was given that the lantern could be lifted.[124]

[119] BC. RUG. Archief Moll. L10. "Brief van Jacobus van Lokhorst aan Moll", 9 May 1894.
[120] NA. 502. "Travel report by Van Lokhorst addressed to the Minister of Home Affairs", 3 November 1894.
[121] Ibid.
[122] Ibid. Interestingly, the Royal Institution in London was a wide inspiration for all kinds of buildings arising at that time, such as laboratories, academic lecture halls etc. See: Schmidgen, "Pictures, Preparations and Living Processes", 485.
[123] Klaus Staubermann, "Instruments and Image: Inside the Nineteenth Centuiry Scientific Lantern Slide", in: Peter Morris and Klaus Staubermann (eds.), *Illuminating Instruments* (Washington: Smithsonian Institution Scholarly Press, 2009), 12.
[124] NA. 502. "Travel report by Van Lokhorst", 3 November 1894.

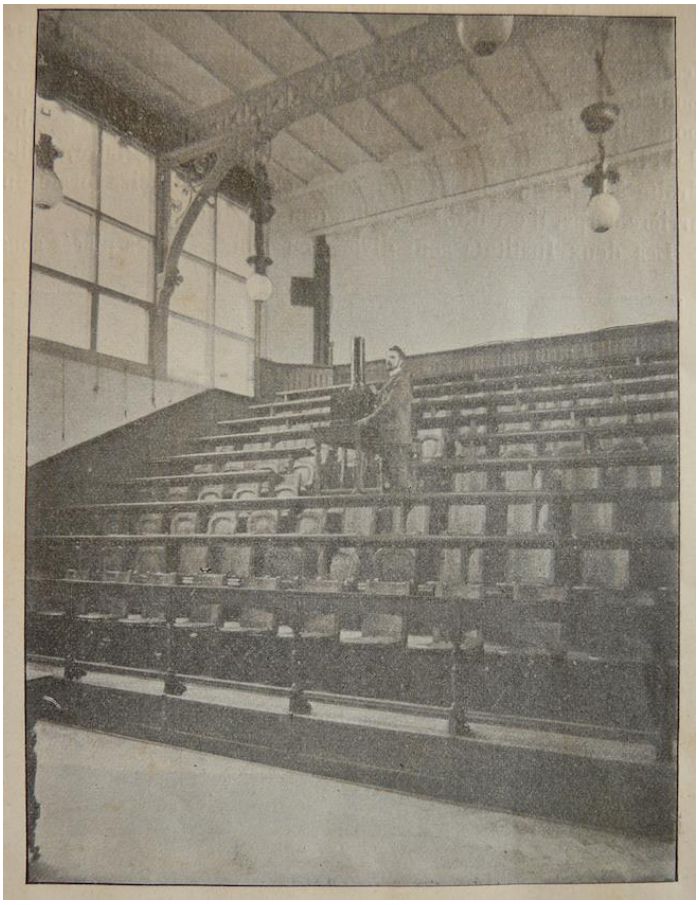

Figure 9. Lecture hall of the Institut Solvay in Brussels. Lantern is attached on an elevator and put amidst the audience. (Brochure 1895). [125]

Besides lanterns from Newton & Co, the name of the Viennese manufacturer Plössl is also mentioned multiple times, both in Belgium and in Germany.[126] Plössl was one of the first to use electric light with projection.[127] This technological development was crucial in stabilizing the optical lantern as a teaching tool, since it allowed constant light while at the same time it reduced the risk of fire hazards.[128] Most important to note is that they also visited the workshop of Newton

[125] This image I received from Sabine Lenk.
[126] A lantern that was used in the Physiological Institute at Brussels, at the second anatomical institute in Berlin, and at Urania in Berlin. More about Simon Plössl on the website of Luikerwaal: "In 1823 Plössl started his own workplace in Vienna, where he made microscopes and telescopes. He later traded under the name S. Plössl & Comp., and offered magic lanterns, sciopticons, projection microscopes and other optical instruments. Later, this firm, under the ownership of M. Wagner, was one of the first to use electrical light with projection.".
[127] Information retrieved on 4th of July from the website:
https://www.luikerwaal.com/newframe_nl.htm?/fabrikanten_pt_nl.htm.
[128] Still, by the 1890s the lantern was far from being regularly used in academia in the Netherlands. See: Kessler, Lenk, ""…To not only tell, but also to show, to show plenty…", in: *Fonseca* (2018), 47, 56; Ruchatz, *Licht und*

& Co. to see how its lanterns were manufactured and, most probably, talk about what they would need for their lecture hall in Groningen.

After this trip both men had a clear idea about how the new lecture hall should be set up. First, they wanted to have a separate projection room at the back of the hall to put the lantern in. This made sure that students were not distracted by the lantern standing next to them or by the clicking sound of the constant changes of lantern slides. Furthermore, as projection would be frequently used, it was important to use electric lighting, the most stable light source at that time. Consequently, a plan needed to be made for the constant supply of electricity. In addition, it was essential to switch from daylight to darkness instantly. Even though they did come across such a system during their trip, they felt they needed to create one themselves, since it was necessary to engage students with the subject matter while enabling them to take notes simultaneously. Finally, they decided to purchase what they considered the best lantern for the lecture hall: between Plössl and Newton &Co. the latter was considered more practical and easier to operate.[129]

The construction of the lecture hall in Groningen

Only ten days after Van Lokhorst had sent his travel report to the Minister of the Interior they received official approval of their plans for a new botanical laboratory.[130] Besides the things they had seen abroad, the construction also included original elements, such as a special lighting system and an optical lantern that could show several types of lantern slides.

Correspondence shows that, after their visit to Newton & Co in London, Moll kept in touch with the company to construct what would be a state-of-the art, custom-made optical lantern.[131] One of the most important features of this lantern was that it allowed the projection of either lantern slides or microscopic specimens by a simple switch between rack A and B (Fig. 10). As noted, Moll saw the projection of microscopic specimens as a necessity. Furthermore, besides the standard-sized lantern slides of 8,3 by 8,3, this lantern was adjustable to show a larger-sized slide measuring 13 by 18.[132]

Wahrheit, 175, 296; Jamilla Notebaard, Nico de Klerk, "The Photographic Turn in Visual Teaching Aids: Films and Slides for Schools in the Netherlands, 1911-1926", in: Teughels and Wils, 77-78.
[129] NA. 502. "Travel report by Van Lokhorst", 3 November 1894.
[130] BC. RUG. Archief J.W. Moll. L14. "Letter from Van Lokhorst to Moll", 14 November 1894.
[131] Groninger Archieven. I. Botanisch Laboratorium. 1018. Afdeling Plantenfysiologie van het Botanisch Laboratorium. Inv. Nr. 28-29. Correspondentie. "Letter from Newton & Co to professor Moll about the lantern that they are building in England", 7 September 1898. (Groninger Archives. I. Botanical Laboratory. 1018. Section Plant Physiology of the Botanical Laboratory. Inv.nr.: 28-29. Correspondence.)
[132] GA. I. Bot. Lab. 1018. 28-29. Correspondentie. "Brieven van Newton & Co aan J.W. Moll", 23 February 1898 and 7 September 1898.

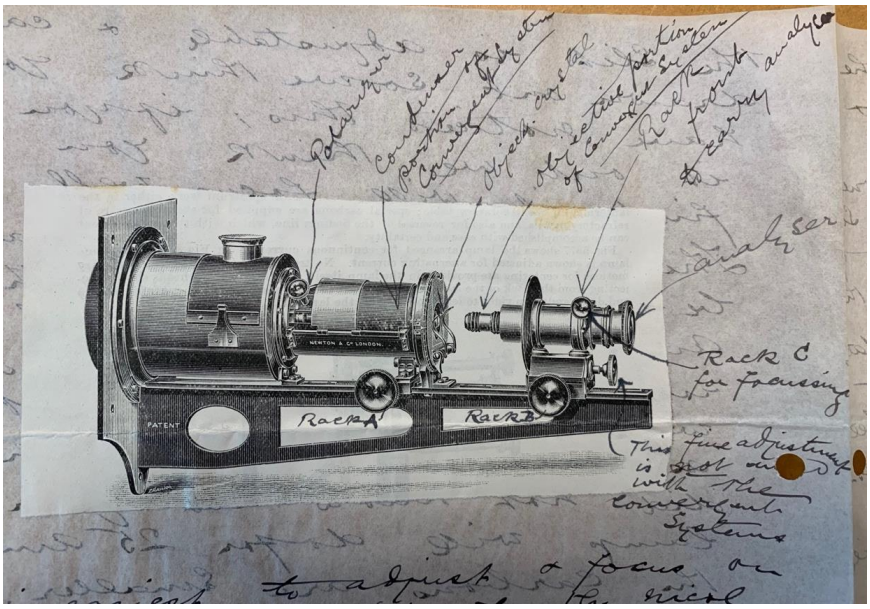

Figure 10. The lantern constructed and designed by Newton & Co. for Moll and his new laboratory. (Groninger Archieven).[133]

Apart from this state-of-the art lantern, two other novelties were installed in the Botanical Laboratory, elements that, according to Van Lokhorst, made the Groningen laboratory unique in Europe around this time.[134] The first novelty was a specially constructed electric lighting system, for which Moll had cooperated closely with the Doijer electricity company in Haarlem. Its most important feature was the option to illuminate the lecture hall without interfering with the slide projections. This was done by placing pendant ceiling lights at an angle just above the projector's beam (see Fig. 11). This enabled students to take notes while watching the slides (and listening to their professor). This asset was keenly appreciated by colleagues of other botanical laboratories. For instance, not long after the opening, in 1908, the botanical laboratory at the university of Leiden would copy this system.[135].

[133] Image inserted in the correspondence between Newton & Co and Moll, 23 February 1898. Groninger Archieven. I. Bot. Lab. 1018. Correspondentie.
[134] BC. RUG. Archief Moll. L15. "Brief van Van Lokhorst aan Moll", 30 July 1897. "I will be very much surprised when someone can point to an European botanical laboratory that meets the view of your beautiful science in the same way as the laboratory in Groningen does."
[135] J.M. Janse, *Rede gehouden bij de opening van het Botanisch Laboratorium der Rijks-Universiteit te Leiden op Woensdag 28 October 1908* (Leiden: E.J. Brill, 1908), 33.

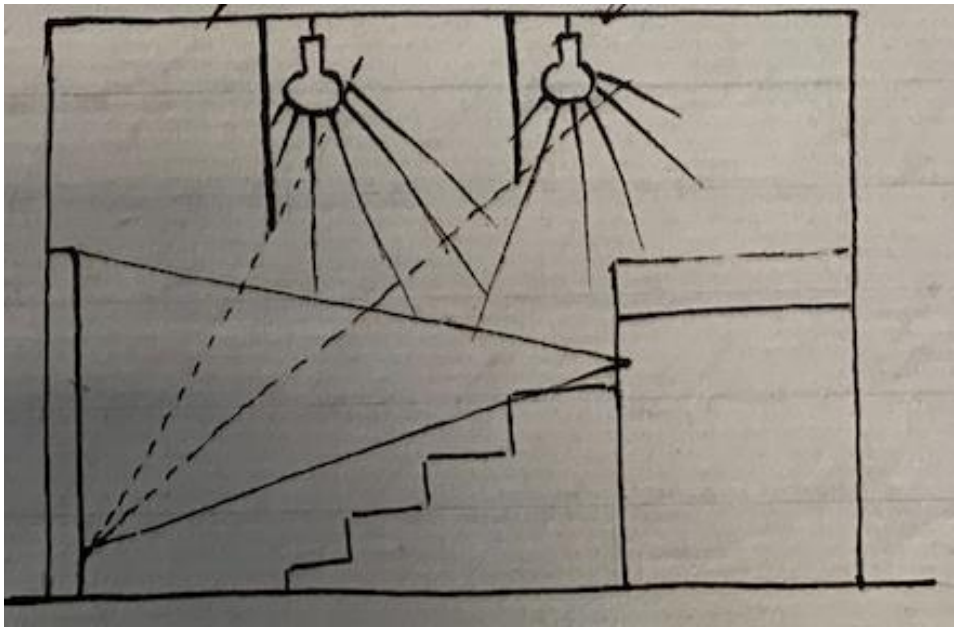

Figure 11. Sketch made by H. Doijer of the lighting system in the lecture hall, showing how the light would not affect the projector's light beam. (Groninger Archieven).[136]

Secondly, Doijer created a way to regulate the light from a position in front of the class, providing lecturers with the opportunity to dim the light coming from the ceiling as soon as everyone was seated.[137] The final new element of the lecture hall was to place the professor's lectern not directly in front of the students, but sideways. This measure prevented that the image projected from the booth at the back of the hall would be blocked from view. Even the professor had to stand aside, which emphasizes again the significance of the introduction of the optical lantern in academic teaching (see Fig. 12). However, the question remains, how did this arrangement effect the use of the other visual teaching aids?

[136] GA. Bot. Lab. 1018. "Letter from H. Doijer to Moll about the electricity facilities needed at the Botanical Laboratory", 29 August 1895.
[137] GA. 1018. Afdeling Plantenfysioloigie. 28-29. "Letter from H. Doijer to J.W. Moll", 29 August 1895.

Figure 12. Lecture hall at the Botanical Laboratory in Groningen. The entire arrangement is determined by the use of the optical lantern; projection room at the back, lighting system to enable notetaking, placement of the lectern, seating arrangements. (Beeldbank Groningen (Image database Groningen)).[138]

Motivated by the idea that any demonstration during a lecture could only be valuable when "the things that were demonstrated are visible to all simultaneously, clearly and at the right moment", the prominence of the optical lantern had severe consequences for the visual teaching aids that had previously been common practice.[139] Moll stated: "the largest part of the demonstration materials used in the past has become useless *in lectures*".[140] While only large instruments, large living plants, and projected images served the professor during his lecture, the other visual teaching aids, such as wall charts, small specimens, and even handbooks, were assigned a different role: they belonged to a different *pedagogical dispositif*, an arrangement of aids that was literally just one door away (see Fig. 13). Accordingly, Moll designed the 'demonstration room', where the other teaching aids would be on display for at least a week:

[138] This image was retrieved from the *Beeldbank Groningen*. NL-GnGRA_2138_3857. "De collegezaal van het Botanisch Laboratorium aan de Grote Rozenstraat 31", 1894-1914. https://www.beeldbankgroningen.nl/beelden/detail/52c41664-2c03-580c-2e80-1db790e72fb4/media/9a6a52a7-b666-6fbb-3ffd-92de7742ca6d?mode=detail&view=horizontal&q=%22Botanisch%20Laboratorium%22&rows=1&page=45.
[139] Moll, "De Hortus Botanicus en het Botanisch Laboratorium", in: *Academia Groninga,* (1914), 474.
[140] Ibid. My emphasis.

> There the students will find all the demonstration materials related to the lectures held during that week, exhibited throughout the week: plants from the herbarium in cabinets fitted for that purpose under glass, living plants (…), microscopes with specimens, wall charts, museum objects, instruments, and samples, books, the lantern slides that were shown during the lectures etc.[141]

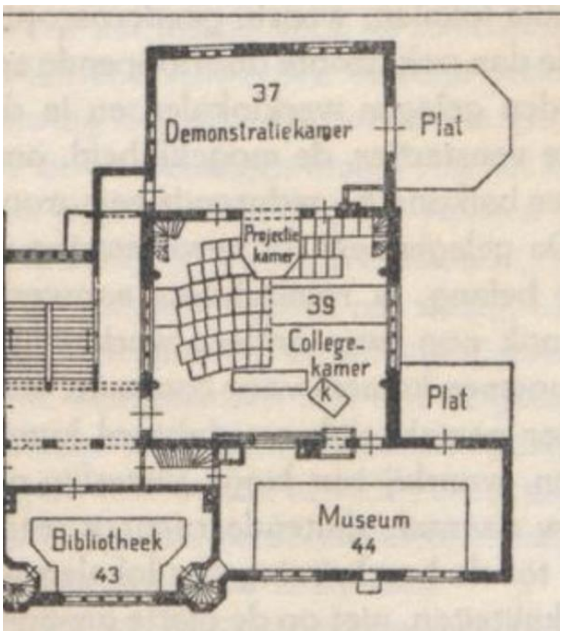

Figure 13. Floorplan of the Botanical laboratory at Groningen, highlighting the lecture hall with its separate projection room.[142]

The demonstration room was always accessible for students, and it was important to Moll that the demonstration materials that were laid out there were more extensive than what could be seen during the lectures. Furthermore, the demonstration room was meant to be consulted after the general lecture to both stimulate individual studies and collective discussions about what was on display and how it was connected to the information presented during the lecture. In this way, the demonstration room was closely linked to the *dispositif* of the lecture hall, since it was built into a combined practice that would lead to acquiring the most complete picture of what students needed to understand, study, and see for themselves.[143] The fact that Moll reserved an important place for the other visual materials, however, shows that these objects were not all useless. They simply required a different lay-out in order to add to the knowledge of botanical students.

[141] Moll, "De Hortus Botanicus en het Botanisch Laboratorium", 475.
[142] Image as published in: Moll, "De Hortus Botanicus", 471. [image cropped by the author].
[143] Ibid., 475.

However, can we consider this demonstration room as part of the same botanical *dispositif*? In contrast to the lecture, students were stimulated to walk around the demonstration room. In some cases, they were even authorized to make it their temporary study room. Instead of passively watching what was being shown, here, they were encouraged to take a closer look, to make connections between the projected images they had seen and the real specimens that were on display. It created a space for interaction, for asking specific questions to deepen their knowledge. This probably was a strategical choice by Moll, to make sure that his lectures did not get (too much) interrupted by questions and thus allow the flow within his lectures. Besides individual study, Moll also wished to encourage joint viewing and discussion, whereas in the lecture hall the direction of the information was typically unidirectional, at least in the setup that was created. Even though both *dispositifs* are connected and perform different functions, they contribute to the training of botany students in the way Moll envisioned it.

What Max de Haas captured so well in his film about the Utrecht laboratory is the same, wide range of visual teaching aids in botany's educational practice. While the lantern proved to be the best solution for providing a collective, visual support during lectures, further knowledge, getting acquainted with the structures and colors of plants for example, or comparing a handbook to dried specimens, was supposed to be done elsewhere, after the lecture, but *with* the projected image in mind—and the possibility to look at the glass slides themselves. The modern botanical laboratory was an architecturally achieved meeting place, accommodating both teaching and research, lectures and experiments, with a lecture hall, a microscopy room, a botanical garden. An institutional framework that was created for a comprehensive didactic setup that aimed to tantalize the eyes.[144]

Collections of botanical lantern slides

Now that we have established the prominence of the optical lantern in Moll's teaching practices, it is also necessary to understand the organization of the lantern slides. According to his own description, the collection consisted of about 5,000 slides in 1914; 3,000-4,000 standard-sized slides of 8,3 x 8,3 and about a 1,000 slides of the 13 x 18 format. However, this number had grown extensively, because when I studied the collection, over 10.000 slides were present at the University Museum of Groningen. Moll also provides us with an insight into how this collection was created and had grown over the years. As the laboratory had all the necessary facilities, most of the lantern slides could be made in-house. Most of them reproduced "diagrams or images in books, the rest were original slides of plants from the garden, museum objects, experiments

[144] Visser, "De ontwikkeling van de universitaire biologische laboratoria" (1986), 256, 262.

etc.".[145] A priority for Moll in putting this collection together was a meticulous method of cataloguing. Most of these books are now in the archive of the University Museum in Groningen. An important aspect in this collection is that the slides did not have any labels on their frame, only a number that corresponded to the catalogues (Fig. 14). Interestingly, most of these catalogue descriptions refer to the materiality of the image—whether it is a photograph, or an image obtained from a textbook—as well as the year in which the (mostly) photograph was taken. These catalogues, most of which are now in the archive of the University Museum in Groningen, are an invaluable resource in getting a quick and comprehensive grasp of the botanical lantern slide collection, not just in Groningen, but also in Utrecht. Indeed, the Botanical Department in Utrecht seems to have followed the example of Groningen in composing, ordering, and cataloguing its slide collection. But since the Utrecht collection has been stored in a unique way, I will examine the latter collection in more detail here.

Figure 14. Example of a slide from the Groningen collection and its description in the catalogue. (Universiteitsmuseum Groningen (University Museum Groningen)). (Photographed by the author).[146]

[145] Moll, "De Hortus Botanicus en het Botanisch Laboratorium", 476.
[146] Universiteitsmuseum Groningen. (University museum Groningen). Uninventoried. Slide collection and accompanying catalogues and index books.

Figure 15. Botanical slide collection in Groningen University Museum archive. On the left the boxes with slides and on the top right the catalogues. (Universiteitsmuseum Groningen). (Photographed by curator Jan Waling Huisman).[147]

The custom-made cupboard

In 2006 the University of Utrecht acquired a cupboard filled with glass lantern slides from the faculty of Biology (see fig. 16).[148] Divided over 90 drawers this cupboard contains 1,845 lantern slides, the 'first part' of a larger collection of more than 3,000 slides devoted to the discipline of botany. Here, my focus is on the slides that are part of the cupboard.[149] First of all, it should be noted that the cupboard was custom-made to hold a large collection of botanical lantern slides. In addition, the cupboard must be seen as a time capsule going back to 1925, the year that professor Went, together with professor Pulle, are said to have reorganized the cupboard.[150] It is especially the preservation in a dedicated cabinet that makes the Utrecht slide collection so unique. This in contrast to the collection in Groningen, the slides of which are stored and preserved in separate boxes (see Fig. 15), the way most collections discussed in this thesis are.

[147] Photograph of the complete botanical slide collection as present at the Universiteitsmuseum Groningen.
[148] Newsletter Stichting Academisch Erfgoed. Theme issue "Gered uit de container", 34 (October, 2012), 1.
[149] Numbers higher than 1845 seem to refer to a later time, since the slides were chronologically inserted.
[150] According to the curator of the University Museum in Utrecht, Paul Lambers, the arrangement of the cupboard has not changed since this reorganization.

Figure 16. Purpose-built cupboard that contains part of Utrecht University's botanical slide collection. (Universiteitsmuseum Utrecht (University Museum Utrecht).(Photographed by the author).[151]

The storage of about 1,845 slides in one single cupboard has important advantages: the slides are close at hand, they offer a direct overview because of its ingenious drawer-system (Fig. 17), which enabled a quick and direct overview of all slides it contained. These advantages all benefitted the accessibility of the collection.[152] And while the drawers, like the boxes in Groningen collection in Groningen (Fig. 15), were ordered by numbers, the difference between the two lies in the way the drawer stored their contents.

[151] This cupboard is part of: Collectie Botanie Universiteitsmuseum Utrecht. Uninventoried collection of slides.
[152] Here I want to thank Eloise Pasmore O'Pray, student assistant at Utrecht University, with whom I have studied this collection of slides. We had very interesting, fruitful, and eye-opening discussions about the meaning and function of this cupboard in academic teaching as well as an archive in and of itself. She has really inspired me and helped me to get a better understanding of all of this cupboards' implications. Together we also presented our findings at the Teylers Museum for our project's Stakeholders Meeting in 2022.

Figure 17. Drawer system inside the cupboard of botanical slides. (Universiteitsmuseum Utrecht).

Instead of vertical order as was common when slides were stored in boxes, whether they were made from wood, iron or other material, the drawer-system of the cupboard allowed a horizontal display of lantern slides (Fig. 18). In terms of space this meant that 'only' twenty slides could be stored in one drawer. In comparison, in a single box from the Groningen collection, for example, approximately fifty slides could be stored. However, there were some great advantages in storing slides horizontally. When a drawer is pulled out, all the slides can be seen at a glance, including their numbers on the frames. Again, this contrasts with the style of the boxes of slides, where slides need to taken out in order to see what its number is or what is depicted on it. In Groningen this problem was solved by creating so-called albums (Fig. 19). As one can see, these albums have been compiled in almost the exact same way as the cupboard's drawers by offering an immediate overview of which slide numbers correspond to which image. The fact that these albums were thus created says something about the need for user-friendliness when consulting the collections.

Figure 18. Drawer 1-22 from the Botanical Cupboard. (Universiteitsmuseum Utrecht).

Figure 19. Album from the Groningen collection. Images representing what can be found on slides from a particular box or boxes. (Universiteitsmuseum Groningen).

Even though these albums were not created for all boxes, their composition indicates the additional value of some sort of guide through the collection *outside* of the boxes themselves. It shows the importance of accessibility, but also underscores the inventiveness of the cupboard in the sense that this was created through its construction.

It is worthwhile here to further analyze the numbering system of the slide collection of Utrecht. Each drawer is fitted with a brass plate with numbers on it. These numbers correspond to the lantern slides that are supposed to be inside these drawers. Or so it seems at first glance, because the numbering system was more complicated than that. Therefore, the next step was to check the numbering on the drawers and to see to what extent this corresponds to its content. For example, the plate on the first drawer reads number 1 to 22, drawer 2 contained numbers 23 to 46, drawer 3 contained slides 47 to 75, and drawer 4 had slides 76 to 101 stored inside it. This seems to indicate that some drawers included more slides than others; drawer 2 supposedly contained 23 slides while drawer 3 contained 28 slides. But each drawer only has room for 20 slides. How can we explain these discrepancies in the numbering system here? It was necessary to put this to the test. Drawer 1, numbers 1-22, was completely filled, which means that there were indeed 20 slides in the drawer (see Fig. 18). When checking the numbers on the slides, it quickly became clear that slide number 3 and 16 were no longer present in the drawer. But the fact that there are still 20 slides in the drawer implies that the numbering system prevailed in order to avoid empty spaces in a drawer. What does this say about the cupboard's composition? First, that slide numbers 3 and 16 were already missing when this cabinet was assembled (in 1925). Secondly, that the numbering system had already been determined when the cabinet was put into use. For example, if slide 3 would have been added or replaced on a later date, the whole ordering system would be completely useless.

Then there is the issue of physically missing slides in some of the drawers. For example, drawer 2 (23-46) has no less than 4 open spaces where once slides had been but are longer there (see Fig. 20). Their absence could have various reasons, one of them being that these slides were considered obsolete. Moreover, what we can establish is that these slides did not go missing until after the cupboard was assembled by Went and Pulle in 1925. If this would have been the case, the numbering would have continued with the subsequent numbers, as we have already encountered with drawer 1. Other reasons for their absence could be; 1) lack of relevance; 2) broken slides; 3) slides lent that were never returned. In analyzing the missing slides it is a great advantage that the catalogues and index books that belong to this collection can be consulted.

Figure 20. Drawer 2: four physically missing slides. (Universiteitsmuseum Utrecht).

For example, comparing the missing slides of drawer 2 with the index book entitled "Lantaarnplaatjes 1-1999" ("Lantern slides 1-1999"), we learn from the description that slide number 32, for example, showed *Ficus bengalensis. Waringlaan at Buitenzorg. From A.F.W. Schimper Pflanzengeographie. Fig. 162, p. 345*.[153] Not only does this allow the identification of the image itself, i.e., a copy of a book illustration, but also, with the help of the website *Biodiversity Heritage Library*, it is possible to consult this book online and see what the lantern slide could have shown (see Fig. 21). Since this book, was published in 1908, we may assume that these slides were produced anywhere between 1908 and 1925. Even though this is a very rare case, these examples underscore the possibilities that a thorough study of slide collections offer in reconstructing "visuals knowledge systems", linked to the use of the optical lantern.

[153] A.W.F. Schimper, *Pflanzen-geographie auf physiologischer Grundlage* (Jena: Gustav Fischer, 1908), 345. This book is accessible through the online Biodiversity Heritage Library: https://www.biodiversitylibrary.org/item/100046#page/9/mode/1up. Accompanying slide and description can be found in: Collectie Botanie UMU. Index book: "Lantaarnplaatjes 1-1999".

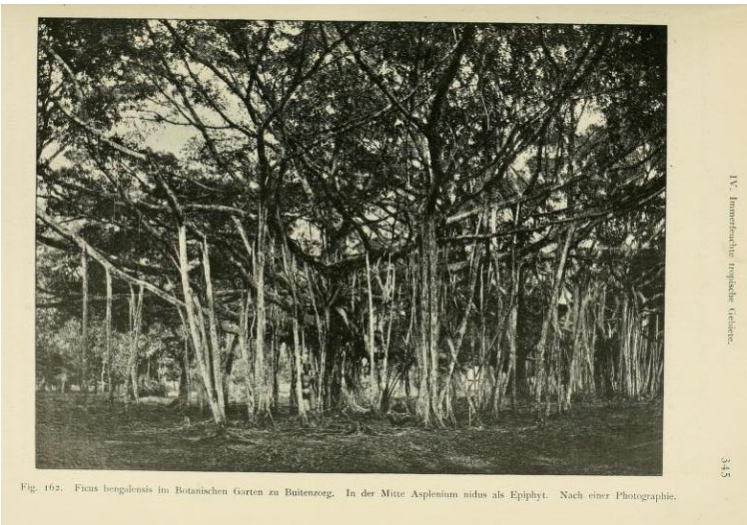

Figure 21. Figure 162 from the book by A.F.W. Schimper, an image that was used for slide number 32 of the Utrecht collection.[154]

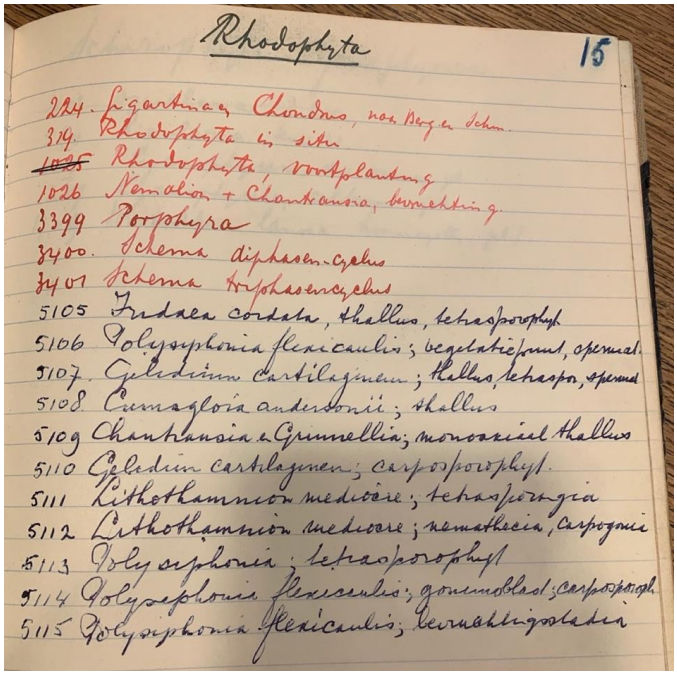

Figure 22. “Course Systematics of Vertebrates”. In red pen the list of lantern slides that could be used, and the black ink represents the wall charts that could be used.[155]

[154] Image extracted from: Schimper, *Pflanzen-geographie auf physiologischer Grundlage* (1908) 345. This book is accessible through the online Biodiversity Heritage Library: https://www.biodiversitylibrary.org/item/100046#page/9/mode/1up.

[155] UMU. Collectie Botanie. Uninventoried. Catalogue “Cursus Systematiek”. In this catalogue the difference between the red pen and the black pen is described.

There is more to be said about the catalogues linked to these slide collections in Groningen and Utrecht; whereas the ones in Groningen are mostly catalogues that represent one-to-one relationships between the slides and its description, the books from Utrecht have a more versatile nature and function. Besides the index books just mentioned, there are also catalogues organized by object, such as "Course Systematics Angiosperms" or "Course Systematics Vertebrates". These books do not just include lists of lantern slides, but are also combined with wall charts than can be used (see Fig. 22). These Utrecht catalogues show that it was very common to combine lantern slides with wall charts in botanical teaching. However, here again we are left with the question of how exactly these visual teaching aids functioned within a lecture, especially when we recall the remark made by A.C. Noé at the beginning of this chapter, that wallcharts were more or less substituted by lantern slides.

And indeed, in Moll's creation of the *modern botanical dispositif* wallcharts were accommodated in the demonstration room, while the lecture hall was devoted to the use of the lantern. Even though here the wallcharts were not completely supplanted, they were rather 'banned' from the auditorium, since the darkened lecture hall made them didactically useless.[156] In Utrecht, on the contrary, at least according to the film by Max de Haas, the wallcharts occupy a prominent place within the lecture hall. Again, this could have been a strategy by De Haas to showcase the variety of teaching aids employed within the botanical laboratory, but it also may indicate a difference in approach. Furthermore, when studying these Utrecht catalogues, there were 'formats' about what aids to use when discussing certain species. For example, in discussing the Rodophyta (red algea), eleven wallcharts and seven lantern slides are listed in one of the catalogues. All of which most probably offered various visualizations or schematic treatments of this species.[157] It remains uncertain whether these were merely suggestions or they were all used. I suspect that it was mostly left to the professors' discretion, and that the presence of multiple options allowed them to work best with their own expertise. Still, it might also point to the fact that in Utrecht not all the lectures were supported by the use of the optical lantern.

The content of the slides

Besides allowing a full reconstruction of a lantern lecture given by Went (see chapter 4), both slide collections provide important insights into the possible ways in which these images functioned. One example that emerged from a sample taken from both collections was the reliance on images—often composed images—extracted from botanical textbooks or atlases. The provenance of these images is retrievable through the accompanying catalogues. An important book in both

[156] Moll, "De hortus botanicus en het botanisch laboratorium", 474.
[157] UMU. Collectie Botanie. Uninventoried. Catalogue "Systematiek der lagere planten", 15.

collections is the book *Die natürlichen Pflanzenfamilien* by Adolf Engler and Karl Anton Prändl.[158] Engler and Prändtl were botanists who created a classification system of plants around the turn of the twentieth century. By drawing upon the book's illustrations, the slide collections encompassed the state-of-the-art of botanical taxonomical knowledge. Their projection allowed students to familiarize themselves with a large variety of plant families and at the same time enhance their observational skills.

Despite the understandable similarities between these two, there is also a difference that deserves more attention here. And that is the link with the Dutch colonies in the East and West Indies that is apparent from a selection of the slides in combination with the catalogues from the Utrecht collection. Further research of this slide collection will give more insight into an aspect of "the practice of science in the colonial era", in the words of Henk van Rinsum.[159]

In his inaugural address, Went had already highlighted the significance of the colonies for his students:

> The task that awaits you, students of botany (…); the subjects of research are still so plentiful that it is difficult to choose! Come! Come! I can imagine Java, surrounded by the halo of the sun that exposes its treasures for you, that winks at you, that calls you to leave your fatherland, to come to the other side of the equator and uphold the name of the Netherlands.[160]

This idea of the uncharted scientific territory of the Netherlands East-Indies, ready to be explored by graduate students of botany, is exemplary of the *Zeitgeist* of the second half of the nineteenth century. Under the influence of Darwinian thought, in the words of historian Wim van der Schoor, "The tropical climate was believed to reflect the 'original' conditions of life that had prevailed all over the planet in a distant evolutionary past."[161] In other words, the tropics could contribute to understanding the history of life, since in these territories the remnants of ancient species were still present.[162] Dutch academics in the field of botany, but also geology, geography, or astronomy, were stimulated to travel to the colonies and do scientific research there. One of the main

[158] See for example: Slide number 93 from the botanical slide collection of Groningen and slide number 40 from the slide collection in Utrecht. Adolf Engler and Karl Anton Prändtl, *Die natürlichen Pflanzenfamilien. Nebst ihren Gattungen und wichtigeren Arten inbesondere den Nutzpflanzen, unter Mitwirkung zahlreicher hervorragender Fachgelehtrent* (Leipzig: Wilhelm Engelmann, 1897). This book has had a lot of editions, while also being divided in several parts. From which parts or editions these images were extracted is hard to reconstruct, unless one would go through all these books separately and compare them to the slide collections. UMU. Collectie Botanie. Uninventoried. Slide number 40; UMG. Collectie Botanie. Uninventoried. Slide number 93.
[159] Henk van Rinsum, "Blijf niet steken bij de slavernij, onderzoek het hele koloniale verleden van de UU", in: *DUB*, 20 April 2022. https://dub.uu.nl/nl/analyse/'blijf-niet-steken-bij-de-slavernij-onderzoek-het-hele-koloniale-verleden-van-de-uu'.
[160] F.A.F.C. Went, *Botanische problemen der laatste 15 jaren. Redevoering uitgesproken den 21sten september 1896, bij gelegenheid van de aanvaarding van het ambt van Hoogleeraar in de Plantkunde aan de Rijks-Universiteit te Utrecht* (Amsterdam: J.H. de Bussy, 1896), 20.
[161] Wim van der Schoor, *Zuivere en toegepaste wetenschap in de tropen. Biologisch onderzoek aan particuliere proefstations in Nederlands-Indië, 1870-1940* (PhD thesis., Utrecht University, 2012), 85.
[162] Ibid.

arguments that was put forward in organizing expeditions to either the West Indies or the East-Indies was the 'lack' of knowledge about these areas. In 1919, Went claimed that more than half of Surinam's native plant species was still unknown.[163] Went himself has often been regarded as one of the most important botanical advocates for scientific research in the colonies. He travelled to the Netherlands East-Indies for the first time in 1890, aided by the Buitenzorg Fund, an annual governmental subsidy that was meant to stimulate Dutch natural scientists to visit the Botanical Garden at Buitenzorg (today's Bogor), on Java.[164] The years he spent in the colonies, particularly as director of the Sugarcane experimental station between 1891-1896, were formative for his career as professor of botany.

Before 1880, science in the tropics was not very developed yet. As Robert-Jan Wille points out, at that time the Dutch were still mainly engaged in 'exploration', in surveying land. Moreover, the expeditions that had been organized up to that point did not involve scientists, but mainly military personnel and engineers.[165] Scientific activity in the Netherlands East Indies received an enormous boost with the appointment, in 1880, of Melchior Treub (1851-1910) as director of the Botanical Garden at Buitenzorg, a government institution that existed since 1817. Treub was an enthusiastic botanist who, to his disappointment, had never had the opportunity to work as a professor at one of the Dutch universities.[166] Another important development that led to an increase in the scientific interest and activity in the Dutch colonies was the international agricultural crisis of the 1880s.[167] Since export crops such as sugar, coffee, and indigo, were crucial products for the Dutch economy and the State Treasury, European owners of large plantations in the colonies invested heavily in creating a higher sustainability of agriculture to maintain their profits.[168]

According to Went, the direct consequence of the agricultural crisis, in particular that of sugarcane and the "sereh"-disease that planters were confronted with, was the establishment of so-called experimental stations.[169] These stations were established by the Dutch government in

[163] F.A.F.C. Went, "Natuurwetenschappelijk onderzoek van de binnenlanden van Suriname", in: *De West-Indische Gids*, vol. 1 (1919), 432.
[164] Information retrieved on 30th of June 2022 from the website: https://www.ensie.nl/oosthoek1916/buitenzorg-fonds.
[165] Robert-Jan Wille, *De stationisten. Laboratoriumbiologie, imperialisme en de lobby voor nationale wetenschapspolitiek, 1871-1909*, (PhD thesis, Radboud University Nijmegen, 2015), 259.
[166] Robert-Jan Wille, *Mannen van de microscoop. De laboratoriumbiologie op veldtocht in Nederland en Indië 1840-1910* (Nijmegen: Vantilt, 2019), 214-216; Robert-Jan Wille, "Een Indische geschiedenis van symbiose en parasitisme. De tropen als laboratorium voor de vervlechting van politiek, wetenschap, maatschappij en natuur", in: *Groniek. Themanummer: Ontwikkelingen in het geschiedbedrijf anno nu*, 200 (2013), 298; Van der Schoor, *Zuivere en toegepaste wetenschap in de tropen*, 35.
[167] Van der Schoor, *Zuivere en toegepaste wetenschap in de tropen*, 41.
[168] Wim van der Schoor, "Biologie en landbouw. F.A.F.C. Went en de Indische proefstations", in: *Gewina*, 17 (1994), 150-151.
[169] Went himself also investigated the "sereh"-disease during his time at Java between 1891-1896. Together with Dr. J.H. Wakker he published their results: J.H. Wakker en F.A.F.C. Went, *De ziekten van het suikerriet op Java* (Leiden: Brill, 1898).

cooperation with the agricultural industry. Their main aim was the optimization of export crops for the prosperity of 'Western' export agriculture, and of the main tasks of these stations was the conduct of scientific research.[170] From the perspective of botanists such as Treub and Went the establishment of the experimental station system emphasized the fact that "scientific botany was the motor of the progress of agriculture", and Went is considered to be its most "zealous advocate and propagandist".[171] The system was unique in its kind, mainly because of its focus on scientific research and its independence from government involvement; the scientists fell under the responsibility of Treub to ensure 'objective' scientific research free from economic and political interests.[172] It was to these institutions, aimed at doing scientific research to improve agricultural crops, Went encouraged his students to go.[173]

Went's involvement in and appreciation of the system of experimental stations in the Netherlands East-Indies has been extensively described by historian Wim van der Schoor.[174] Went saw the scientific future of his students in strengthening this system with specialized botanical knowledge. Although Went did not include the applied, 'useful' research into his Botanical Laboratory at Utrecht (e.g. research into plant diseases or processes of fertilization), he did set up a training program that was focused on the more "fundamental questions" that had a more "indirect" influence on planters working overseas. In a speech held before the International Rubber congress in Jakarta, Went explained that the "fundamental questions" were just as important for the future of export agriculture as were the more applied studies. As he reflected, knowing the exact functioning of milky sap (latex) in the rubber plant would contribute to improving research research conducted at experimental stations and optimize production.[175] It was this type of research that he stimulated during his professorship, which eventually led to the creation of the so-called "Utrechtse school" of plant physiology (which will be discussed in chapter 4).[176]

[170] Van der Schoor, *Zuivere en toegepaste wetenschap in de tropen*, 15, 29.
[171] Van der Schoor, "Biologie en Landbouw", 151.
[172] Van der Schoor, *Zuivere en toegepaste wetenschap in de tropen*, 15-16, 112.
[173] The word 'independent' is intentionally put into quotation marks here, since even though this was the ideal of most of the botanists (also explicitly expressed by Went), the interlacement with economic interests is all too obvious. As Van der Schoor writes: "The experimental stations gained a firm foothold in the Indian economy, as evidenced by the ever-growing recognition of the importance of experimental stations in colonial agriculture and the consequent increased resources, the stimulating interference and financial support from government agencies and the expansion in size and tasks of experimental stations." (Van der Schoor, *Zuivere wetenschap*, 77.)
[174] Van der Schoor, "Biologie en Landbouw", 145-161; Van der Schoor, *Zuivere en toegepaste landbouw in de tropen*.
[175] F.A.F.C. Went, *Wetenschap en Tropische Landbouw* (Weltevreden: Filiaal Aalbrecht & Co, 1914), 11-12.
[176] This school mainly focused on plant physiology and acquired international fame with its research into tropism as well as growth regulators. Went did not conduct the research himself but supervised his students in the research process. In chapter 4 I will showcase one of the lectures that Went gave based on the research that was conducted in part by his students working at his Botanical Laboratory at Utrecht. Van der Schoor, *Zuivere en toegepaste wetenschap in de tropen*, 195.

It was important for Went to maintain a close relationship with the researchers and planters working on botanical issues overseas. In part, these connections were based on the time he had spent in the Netherlands East-Indies himself. On the one hand these contacts were important to keep himself up to date with ongoing research, while on the other hand, these contacts stimulated his students to go work there. In turn, this of course strengthened Went's ties with the work done at the experimental stations. And it is in this context that we can retrace some of Went's contacts at experimental stations that made their way, through photographic material, into the botanical slide collection of Utrecht.

Here again, the catalogue "Lantaarnplaatjes 1-1999" is very informative because of its extensive description of what is depicted on the slide and what its provenance was. One illuminating example is a series of slides collected in one drawer, numbers 1265-1285, which encompass photographic material from Jacob Jeswiet. Just like Went before, Jeswiet had worked at the Sugarcane experimental station in Java between 1912 and 1925. Interestingly, however, the photographic material that Jeswiet had sent Went was not so much about sugarcane or his research into the hybridization of sugarcane, but rather about the various species of plants which could be found in the surroundings of the experimental station. The description of slide number 1279 for example states: "waterfall of Bahoeng at Lawang. Ficus roots hold the lava rocks together. Nov. 1916 (Jeswiet)" (Fig. 23).[177]

Another example from the cupboard is a series of lantern slides (nr. 1075-1083) that were made after photographs taken by C.P. Cohen Stuart in 1913. In this year, Cohen Stuart worked at the experimental station for tea near Buitenzorg, where he investigated "the selection of the tea plant" as part of his doctoral study, which was supervised by Went.[178]

[177] UMU. Botanische collectie glasdia's. Uninventoried. Catalogue "Lantaarnplaatjes 1-1999", nr. 1279.
[178] Cohen Stuart, *Voorbereidende onderzoekingen ten dienste van de selektie der theeplant* (Amsterdam: J.H. dr Bussy, 1916); Gedenkboek der Nederlandsch-Indische Theecultuur 1824-1924", book review, in: *De Indische mercuur; orgaan gewijd aan den uitvoerhandel*, vol 48, 10 (March 6, 1925). Consulted on Delpher op 04-07-2022, https://resolver.kb.nl/resolve?urn=MMUBL09:001040011:00001. See catalogue "1-1999 Lantaarnplaatjes", Universiteitsmuseum Utrecht.

Figure 23. Lantern slide nr. 1277, made after a photograph by Jacob Jeswiet. “Bamboe op Poespo: Bamboe betoeng”, 1917. (Universiteitsmuseum Utrecht).

Figure 24. Lantern slide number 1075, made after a photograph by Cohen Stuart. “Young tea garden, Java” (“Jonge theetuin, Java”). (Universiteitsmuseum Utrecht).

The images mainly depict the tea plantations, such as nr. 1075, which shows "Young tea garden, Java" (Fig. 24).

As Van der Schoor pointed out, Went probably transferred "tropical botanical knowledge via his lectures". Indeed, these slides in part confirm this.[179] They emphasize the cross-pollination between botanists working overseas (largely resulting from Went's network) and the training of future botanists in the 'motherland'. Although I am not able to establish how exactly these slides were used in Went's teaching practices, their presence alone suggests that they were part of the preparatory strategy employed by Went. In his call upon his students to pursue their career overseas, these slides most probably were used to familiarize and instruct the students about the kind of environment and work that they would be expected to encounter.

Conclusion

What these final examples have shown is that the study of institutional slide collection can unearth relevant information. In the case of botany at Utrecht University, various pedagogical parameters can be identified. As well analysis of these "time capsules"[180] provide insights into their composition: who was responsible for its creation, what particular ideas and considerations lay behind its composition, etc. Furthermore, as cultural historian Sibylle Peters has argued, a collection of slides can be seen as an archive in itself, materials that were at the disposal of professors that reflect actual teaching practices. Peters argues that the relationship between an archive, such as a slide collection, and the performance of a lantern lecture is reciprocal. It is the intermix of the lecture's narrative and the archival material from which it can be drawn that is fundamental in understanding the possible "Szenario der Vortragsperformance".[181] This perspective also sheds light on the relative 'freedom' that a professor had in preparing a lecture from the available material and share this knowledge with his students. In turn, however, the availability is dependent on the institution, the academic culture, and the emphasis on a particular 'school'.

The importance of the modern botanical laboratory with its lecture hall devoted to the use of the optical lantern was not limited to botany. As we will see in the next chapter, art history, especially in its formative years under the supervision of the Utrecht professor Willem Vogelsang, also

[179] Van der Schoor, *Zuivere en toegepaste wetenschap in de tropen*, 230.
[180] As argued by art historian Anke Napp, slide collections could be seen as "time capsules" that allows one to trace the history of teaching objects, in: Anke Napp, "Time Capsules: Lantern slides in their media-archaeological environment at the Seminar of Art History at the University of Hamburg", Frank Kessler, Nico de Klerk, Jamilla Notebaard, Dulce da Rocha Gonçalves (eds.) *Projecting knowledge* (Turnhout: Brepols, forthcoming, 2024).
[181] Sibylle Peters, *Vortrag als Performance*, 106.

heavily relied on its facilities for using the lantern. Furthermore, I will explore the specific methodological consequences that slide projection had on the particular teaching style advocated by Vogelsang and some of his colleagues. As well I will demonstrate the enormous influence that the lantern had on not only teaching practices, but also the methodological principles of the visual discipline itself.

Chapter 2.

Art history and the projected image

> "Slide lectures, like the photographic technology that made them possible, have had a profound impact on art history; indeed, for many who passed through university classes, art history *is* the illustrated lecture."[182]

Contrary to other academic disciplines, within the historiography of art history the lantern and photographic lantern slides have received much scholarly attention, especially in Germany and Britain.[183] This interest lies especially in the fundamental change that both photography and the optical lantern brought about in the number and variety of artworks that could be shown to student audiences. As Donald Preziosi expresses:

> [photography] afford[ed] a systematic and uniform formatting of objects of study. Artifacts as diverse as buildings and miniature paintings were reproduced at a common scale for analysis and study (…).[184]

It not only allowed the display of a wider scale of different types of artworks, but also the presentation of geographically widespread artworks within the walls of the lecture hall. In other words, these two media forms changed the mode of knowledge transmission fundamentally within the field of art history, also greatly impacted teaching practices:

> Being able to speak about an image that is equally accessible to speaker and audience permits a deeper and more detailed visual analysis than was possible before photography (…).[185]

As we will see in this chapter, part of the appeal of the optical lantern for academic art historians was the comparison of this teaching instrument with the microscope, as a way of systematically analyzing the image that was projected through its lens.[186]

A number of recent publications on the development of art history as a scientific discipline discuss several prominent professors of the beginning of the twentieth century. In their publication *Gezichtspunten* (1993) Marlite Halbertsma and Kitty Zijlmans largely focus on ideas and methods within art historical research and how those impacted different perspectives in

[182] Nelson, "The Slide Lecture", 415.
[183] See among others: Dilly, "Lichtbildprojektion", in: Below, 153-172; Heinrich Dilly, "Die Bildwerfer. 121 Jahre Kunstwissenschafliche Dia-Projektion, in: *Rundbrief Fotografie* (1995), 39-44; Trevor Fawcett, "Visual Facts and the Nineteenth-Centiury Art Lecture", in: *Critical Inquiry*, vol. 6, 4 (1983), 442-460; Preziosi, "The Question of Art History", *Critical Inquiry* (1992), 363-386; Nelson, "The Slide Lecture", 414-434; Frederick N. Bohrer, "Photographic Perspectives. Photography and the institutional formation of art history", in: Elizabeth Mansfield (ed.), *Art History and its Institutions: the Nineteenth Century.* (London, New York: Routledge, 2002), 246-259; Angela Matyssek, ""Entdecker" und "Finder". Über die fotografische Wissenproduktion der Kunstgeschichte und die Probleme der Reproduktion von Kunstwerken", in: *Berichte zur Wissenschaftgeschichte*, vol. 28, 3 (2005), 227-235.
[183] Nelson, "The Slide Lecture", 215.
[184] Preziosi, "The Question of Art History", 365-366.
[185] Nelson, "The Slide Lecture", 423.
[186] Ibid., 431.

looking at artworks throughout the nineteenth and twentieth centuries.[187] Other art historians concerned themselves with the way in which art history was taught at the beginning of the twentieth century. Chris Stolwijk, for example, discusses the pioneering teaching practices of Willem Vogelsang in how he imparted a particular "art historical understanding" (in Dutch: kunsthistorisch begrip) to his students based on "learning to see".[188] How exactly Vogelsang shaped his teaching, however, remains vague, most probably because of Stolwijk's focus on the ideas that lay behind Vogelsang's understanding of what art history as a science should be. Annemieke Hoogenboom, in her publication *De evolutie van de compositie* (2007), thoroughly reflects upon Vogelsang's teaching practices, more specifically on his use of his "art historical wallcharts" in the course that he gave on "composition in art".[189] These visual teaching aids were made with great care and functioned as a way of analyzing the composition of artworks. By scrutinizing this material, Hoogenboom is able to connect the construction of wallcharts with Vogelsang's art historical ideas and method. Although Hoogenboom is aware of Vogelsang's use of the optical lantern and its accompanying lantern slides, acknowledging that this was part of his array of teaching aids, she mainly deals with the wallcharts in understanding the underlying scientific pedagogy.[190]

Despite the great deal of attention that has been given to the history of art history as a scientific discipline, the role of the optical lantern had not yet played any part in it. In this chapter, then, I want to fill in some blanks and demonstrate the fundamental role played by the optical lantern and its projection of (photographic) lantern slides in the creation of the Dutch art historical discipline from 1907 onwards. I describe the significance of lantern slide collections for art history, both as objects of teaching and of study. Specifically, I want to highlight the enormous amount of time and effort that was put in the institutional embedding of the new discipline of art history, its consequences for the structure, composition, and use of the slide collections and how they were seen by staff as well as students. This chapter consists of three parts. First, I will sketch the German tradition of the use of the lantern that importantly influenced the establishment of Dutch art historical practices. Second, I will compare the pioneering work by the first Dutch full professor in art history, Willem Vogelsang and his colleague in Amsterdam, Ferrand Whaley Hudig who was appointed professor *extraordinarius* in 1928. Both men created their own art history institutes, institutes that were created after their German counterparts, and were based on the

[187] Marlite Halbertsma and Kitty Zijlmans (eds.), *Gezichtspunten. Een inleiding in de methoden van de kunstgeschiedenis* (Nijmegen: SUN, 1993), 10-11.
[188] Chris Stolwijk, *"Die wetenschap noemen Gij en ik kunstgeschiedenis". Denken over kunstgeschiedenis in Nederland. J.G. van Gelder (1903-1980)* (Steenwijk: van Kerkvoorde & Hollander, 1991), 16, 20.
[189] Hoogenboom, *De evolutie van compositie: de kunsthistorische onderwijsplaten van Willem Vogelsang (1875-1954)* (Vianen: Optima, 2007), 7. Hoogenboom traces four academic years in which he gave this course: 1924-5, 1927-8, 1932-3, 1935-6.
[190] Ibid., 8.

collection of various materials, such as paintings, books, casts, reproductions, and slides that were used for research and teaching.[191] As I will show, much time and effort was devoted to the establishment of these institutes. Holding a slide collection of some magnitude was very important for the academic status of both the institution as well as the professors working there. The third part will showcase a few lantern slides obtained from the collections respectively from the Art Historical Institute of Utrecht (henceforth: KHI) as well as from Amsterdam and discuss the close connection between art historical methods and the material manifestations of those ideas.

Part I. The German lantern tradition of art history

As noted, in order to fully understand the efforts that were undertaken by both Vogelsang and Hudig it is important to first discuss the German tradition of art history that these men were both influenced by because of their studies there (albeit some 20 years apart in terms of time). Vogelsang studied between 1894 and 1898 in Freiburg, Vienna, and Munich, with professors Franz Wickhoff, Franz Studniczka, Julius von Schlosser, Alois Riegl, and Adolf Furtwängler, whereas Hudig studied in Berlin between 1913 and 1915 with professors Adolf Goldschmidt, August Griesebach, and Georg Loeschcke (professors who all in some ways were connected to the pioneers of the art historical tradition in Germany).[192]

With respect to the use of the optical lantern in the German tradition of art history with respect to the use of the optical lantern three names are important: Bruno Meyer (1840-1917), Herman Grimm (1828-1901), and Heinrich Wölfflin (1864-1945). Bruno Meyer, a lecturer at the Polytechnische Hochschule in Karlsruhe, was the first outspoken advocate of the use of the optical lantern and the projection of photographic lantern slides for art historical teaching practices. However, the introduction of the lantern and lantern slides, as well as conveying its pedagogic affordances were not straightforward. At the first Art History Conference in Vienna in 1873, Meyer gave a lecture on art history for an academic audience in order to convince them of the usefulness of projected images. As Meyer reported afterwards, his performance had not really hit the mark due to the bad quality of the slides.[193] In his attempt to convince his colleagues of the

[191] Annemieke Hoogenboom, "Studie of decoratie? Schilderijen van oude meesters in het Kunsthistorisch Instituut te Utrecht, 1923-1974", in: *Article*, vol. 10, 19 (2017), 4.
[192] Chris Stolwijk, *"Die wetenschap noemen Gij en ik kunstgeschiedenis;…"*, 18; Nederlands Instituut voor Kunstgeschiedenis. RKD. Archief Willem Vogelsang. NL-HaRKD.0287. Box 18. "Studentenjaren". Notes on the professors that he studied with: Prof. Wickhoff (Wenen), Prof. Terey (Freiburg), Prof. Adolf Furtwängler (München) and Prof. Alois Riegl (Vienna). Information extracted on June 19, 2023 from the website: https://arthistorians.info/hudigf.
[193] Maria Männig, "Bruno Meyer and the Invention of Art Historical Slide Projection", in: Julia Bärnighausen, Costanza Caraffa, Stefanie Klamm, et al. (eds.), *Photo-Objects: On the Materiality of Photographs and Photo Archives*. (Berlin: Max-Planck-Gesellschaft zur Förderung der Wissenschaften, 2019), 278. Online version at http://mprl-series.mpg.de/studies/12/

indispensability of the lantern in teaching practices, he was made aware of the most important thing: the images should reflect the artworks as accurately and as clearly as possible. Other technical elements, such as a stable light source that could ensure projection for over an hour, were often failing or not always available. These technical problems led to scepticism and contributed to the rejection of the use of the lantern for art history lecturing.[194] Still, Meyer did not give up. Given the relatively new market of photographic slides, he decided to devote himself to the production of high-quality art historical slides to ensure that they matched the didactical aims of the new academic discipline.[195]

Almost two decades later, using similar arguments, Herman Grimm, professor in art history at the University of Berlin, also advocated the wide-scale employment of the optical lantern. His main aim, as he explained in a series of three articles published over the year 1892, was to stress the advantages of the lantern in comparison to older visual teaching aids, such as reproductions and prints that were handed out during the lecture.[196] In these articles Grimm provides his readers with three main arguments in favor of the lantern for didactical purposes. First, he praises its affordance of projecting *sequences* of artworks. This enables professors to vividly demonstrate developments, changes, and the specific contexts in which artworks were embedded.[197] Secondly, the lantern offers the possibility of adding 'showing to telling' (a similar argument had been made by Meyer already in 1873). Instead of relying on handing out reproductions to the students, who then passed them around, which often led to an asynchronism between looking at the image and listening to the lecture, the projected image created simultaneity of the lecture and the artwork on the screen, thereby enhancing the effect of the explanation given by the professor.[198]

The addition of synchronized showing to telling had a great impact on the attitude of the students, as opposed to passing photographs around. It transformed them from passive listeners into active observants. They were not only enabled to 'see for themselves' while the argument of the professor unfolded, but they were also allowed, according to Grimm, to check if what was being said was correct. However, at the same time we do have to realize that the credibility of the projected artworks, depended on what the professor told them. As art historian Frederick N. Bohrer points out:

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[194] Dilly, "Die Bildwerfer", in: Martha Caspers (ed.), *Zwischen Markt und Museum. Beiträge der Tagung "Präsentationsformen von Fotografie"* (1994), 39.
[195] Männig, "Bruno Meyer and the Invention of Art Historical Slide Projection", *Photo-Objects* (2019): 277-278.
[196] Herman Grimm, "Die Umgestaltung der Universitätsvorlesungen über Neuere Kunstgeschichte durch die Anwendung des Skioptikons. Erster Bericht", in: *Beiträge zur Deutschen Culturgeschichte* (Berlin: Wilhelm Herts, 1897[1892]).
[197] Ibid., 280-281; Daniel Adler, "Painterly Politics: Wölfflin, Formalism and German Academic Culture 1885-1915", in: *Art History*, vol. 27, 3 (2004), 440.
[198] Grimm, "Die Umgestaltung der Universitätsvorlesungen", *Beitrage zur Deutschen Culturgeschichte* (1897[1892]) 281-283; Fawcett, "Visual Facts and the Nineteenth-Century Art Lecture", *Art History* (1983): 454-455.

> The images are held together not merely by an optical effect, but by the student's very investment in them and acceptance of the professor's authority. In this sense, an art history lecture never merely illustrates art objects, but also illustrates an authority's power over them, and over their audience. Hence the ironic situation that the art history lecturer fixed for the audience what he or she is in the least privileged position to actually see.[199]

The third important improvement of the lantern, according to Grimm, was its possibility of showing enlargements of artworks. Some paintings were quite small in real life but could be enlarged for the benefit of in-depth visual analysis, whereas photographic reproductions were smaller in most cases than the original artwork. That meant that thanks to projection, paintings could be shown as close to their true size as possible. Yet, it needs to be stressed that this view is paradoxical, since by showing artworks by means of projected images, students did not get a sense of the format or dimensions of the paintings as their size on the screen depended on the position of the projection lantern. Because this is the case with all types of reproductions, Grimm makes a virtue out of a necessity. And finally, the demonstration of art historical details was fundamental to Grimm. Details were much easier to grasp through the projected images, partly because of the possibility of enlargements, but also because of the ability to demonstrate certain parts of the artwork (subsequently), rather than just the whole. Accordingly, for Grimm this also had consequences for the possibility of discovering forgeries.[200] In this sense, the lantern was not only used to train students, but also to support connoisseurs and art historians in their research.

Contrary to Meyer's failed attempt to integrate the lantern within academic lectures, Grimm's enthusiasm for the illustrated lecture was accompanied by two developments that paved the way for the acceptance of the optical lantern. The discourse changed partly because of the substantial and rapid production of art historical photographs by companies such as Alinari and Braun.[201] The wide availability of reproduced artworks enabled art historians to thoroughly develop their arguments based on a wide variety of artworks. Another important development was the availability of electric light, which remained steady for the duration of an entire lecture and was much easier to handle than oxyhydrogen lamps.[202]

[199] Frederick N. Bohrer, "Photographic Perspectives. Photography and the institutional formation of art history", in: Mansfield, 254.
[200] Grimm, "Die Umgestaltung der Universitätsvorlesungen", 280-283.
[201] Ingeborg Reichle, "Fotografie und Lichtbild. Die 'unischtbaren' Bildmedien der Kunstgeschichte", in: Anja Zimmermann (ed.), *Sichtbarkeit und Medium. Austausch, Verknüpfung und Differenz naturwissenschaftlicher und ästhetischer Bildstrategien* (Hamburg: Hamburg University Press, 2005), 173-174.
[202] Kessler and Lenk, "'…To not only tell, but also to show, to show plenty…'", 49.

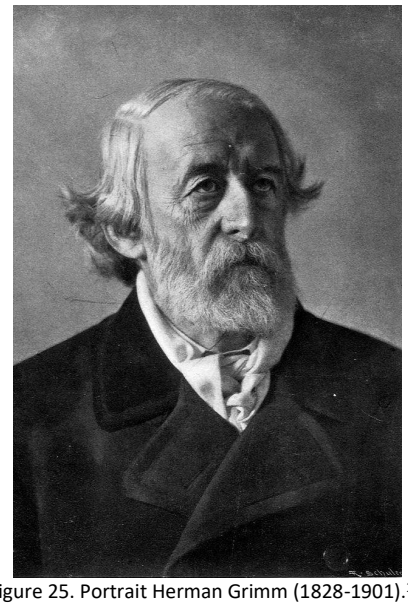

Figure 25. Portrait Herman Grimm (1828-1901).[203]

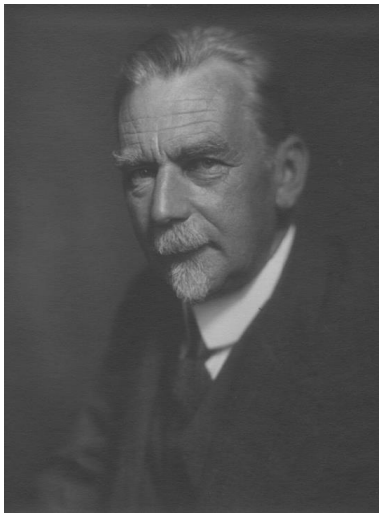

Figure 26. Portrait Heinrich Wölfflin (1864-1945). [204]

Standing on the shoulders of both Meyer and Grimm, Heinrich Wölfflin (Grimm's successor at the University of Berlin) further professionalized the use of the lantern for pedagogical purposes.

[203] Portrait of Herman Grimm extracted on 21 June 2023 from the website: https://en.wikipedia.org/wiki/Herman_Grimm.
[204] Portrait of Heinrich Wölfflin extracted on 21 June 2023 from the website: https://commons.wikimedia.org/wiki/File:Eduard_Wasow_-_Porträt_des_Kunsthistorikers_Heinrich_Wölfflin,_1924.png.

Generally, Wölfflin is recognized as one of the most ardent users of the lantern and one of the initiators of using double projection in the lecture hall.[205]

In comparison to the other two pioneers, we know relatively much about Wölfflin's teaching practices, thanks to many surviving lecture notes by students. The setting that emerges from these notes can, in my view, best be described as an immersive experience. As one of his students, Franz Landsberger, recalled:

> Wölfflin, the master of extemporaneous speaking, places himself in the dark and together with his students at their side. His eyes like theirs are directed at the picture. He thus unites all concerned and becomes the ideal beholder, his words distilling the experiences common to everyone.[206]

According to Landsberger it was the performativity of the lecture, through the interplay between Wölfflin and the projected artwork, that created the impression that the artwork was producing its own description or interpretation. However, it was Wölfflin, the expert, that invited the students to see what he saw.

Interestingly, this mode of knowledge transmission serves the same purpose as what philosopher and bacteriologist Ludwik Fleck had described as follows: "learning to see like a scientist was a matter of accumulated experience—not only of an individual but of a well-trained collective."[207] Although Fleck mainly focuses on the exact sciences, the handling of the lantern in the lecture hall by Wölfflin also indicates an emphasis on teaching his students how to see art historically, based on his own experience. The immersive potential of the lantern lecture, therefore, was the perfect opportunity to guide his students through the history of art in order to build up their experience by observing certain styles, characteristics, changes etc., and thus for them to acquire an "educated eye".[208]

For Wölfflin, teaching in art history revolved around the idea of *Sehen*, i.e., being able to make distinctions in art styles throughout history. To train his students in this way, and enabling them to acquire an "educated eye", he had to show them as many artworks as possible.[209] Not simply by throwing one image after another on a screen, but to look for their connections or their differences. Wölfflin was very much invested in finding a system that helped in distinguishing art

[205] See among others: Anthony Hamber, "The Use of Photography by Nineteenth-Century Art Historians", in: Helene E. Roberts (e.d.), *Art History Through the Camera Lens* (London: Routlege 1995), 113-114; Preziosi, 366; Rajesh Heynickx, "In the Eye of the Projector. Wölfflin, slides and architecture in postwar America", in: Elke Couhez and Rajesh Heynickx (eds.), *Architectural Education Through Materiality* (London: Routledge, 2021), 205; Zeynep Çelik Alexander, "Baroque Out of Focus: The Question of Mediation in Wölfflin", in: *New German Critique 133*, vol. 45, 1 (2018), 101; Nelson, "The Slide Lecture", 429.
[206] Franz Landsberger, quoted in Nelson, "The Slide Lecture", 419.
[207] Daston, "On Scientific Observation", 100.
[208] Anderson and Dietrich, "Introduction", in: Anderson and Dietrich (ed.), *The Educated Eye*, 6.
[209] Heynickx, "In the Eye of the Projector", 205; Alexander, "Baroque Out of Focus", 87-89; Adler, "Painterly Politics", 446.

historical styles. He became most famous for his book *Kunsthistorische Grundbegriffe* (1915), in which he identified the main connections, differences, and changes in the styles of Renaissance and Baroque artworks. In order to pinpoint these aspects he set up a system of opposing terms, such as "linear" and "painterly", "open" and "close". This book was largely based on the series of lectures that he gave at the University of Berlin and in which he used two optical lanterns in order to make 'direct comparisons'.[210] It thereby reflects both the pedagogical strategy employed in training his students and his use of the lantern as a tool to think with. As art historian Rajesh Heynickx puts it in his reflections on Wölfflin's work:

> Wölfflin's pioneering use of the lantern (…) testifies to art history's efforts to become an ordered, systematic discipline. What the microscope had been for biologists, the skiopticon [German term for the lantern], used in art history courses from the 1890s on, was for art historians.[211]

It was the ability of juxtaposing projected images that enabled students *how to see art historically*.

Now that we have established the history of the intrinsic value of the lantern for the establishment and development of the art historical discipline, it is time to cross the border to the Netherlands and investigate the relentless efforts by the Dutch art historians at the beginning of the twentieth century. The next part will turn the attention from pedagogical ideas towards their operationalisation and how they affected the composition of slide collections.

Part II. Creating the Dutch tradition

Compared to Germany, the establishment of art history within academia in the Netherlands came fairly late, in 1907, with the appointment of professor Willem Vogelsang at the University of Utrecht.[212] Although art history classes were already taught at universities, Vogelsang was the first who could devote his teaching practice solely to art history and aesthetics. Already the Higher Education Act of 1876, stipulated that art history and aesthetics should be taught in at least one of the four state universities, albeit in a fairly non-committal way.[213] With the appointment of Allard Pierson in 1877 at the University of Amsterdam as professor of aesthetics, art history, modern languages, and literature, art history acquired its initial academic status among other

[210] Alexander, "Baroque Out of Focus", *New German Critique 133* (2004): 101.
[211] Heynickx, "In the Eye of the Projector", in: *Architectural Education Through Materiality* (2021): 205.
[212] Although, if we want to discuss 'being late', England trailed far even further behind. There, an Art History chair was established as late as 1944. Preziosi, "The Question of Art History", 371.
[213] *Wet op het Hooger Onderwijs van 28 April 1876* (Amsterdam: J.C. Loman, 1876), ch. III, §2, section 43, 18; title IV, ch. II, section 2, 46.

subjects. However, due to the range of his task Pierson focused on the aesthetics of classical art.[214] The same was true for his successor, Jan Six. Four years after his appointment in 1896, however, he was the first to include modern art in his teaching. However, due to his broad teaching task and the good reception of his lectures on modern art, he decided to appoint Willem Vogelsang as *privaatdocent* to cover this topic.[215]

Figure 27. Portrait Allard Pierson (1831-1896).[216]

[214] Pierson's successor, Jan Six, held the title of professor of aesthetics and art history, however, he was an extraordinary professor until 1917. See more about this history: Nico de Klerk, "A long downward slide: art historian Willem Vogelsang (Turnhout: Brepols, forthcoming 2024); Annemieke Hoogenboom, "De introductie van Kunstgeschiedenis aan Nederlandse universiteiten: de voorgeschiedenis van de leerstoel van Willem Vogelsang", in: Ton Bevers, Antoon van den Braembussche and Berend Jan Langeberg (eds.), *De Kunstwereld: produktie, distributie en receptie in de wereld van kunst en cultuur* (Hilversum: Verloren, 1993), 78; Marlite Halbertsma, "De geschiedenis van de kunstgeschiedenis in de Duitssprekende landen en in Nederland van 1764 tot 1933", in: Halbertsma and Zijlmans, 70-71; RKD – Netherlands Institute for Art History. Archive Willem Vogelsang. Box IV. 1897. Folder 1. Newspaper article by one of Vogelsang's former students G.A. Snijder on 22 September 1932.

[215] Annemieke Hoogenboom, "De introductie van de kunstgeschiedenis aan de Nederlandse universiteiten", 88-89; Halbertsma, "De geschiedenis van de kunstgeschiedenis in de Duitssprekende landen en in Nederland van 1764-1933)", 70-71. The Dutch term *privaatdocent* refers to a lecturer that taught classes that were part of the curriculum of a particular university. Moreover, the students that attended the classes from *privaatdocent* needed to pay an additional fee.

[216] Portrait of Allard Pierson retrieved on June 21, 2023, from the website: https://www.dbnl.org/auteurs/auteur.php?id=pier003.

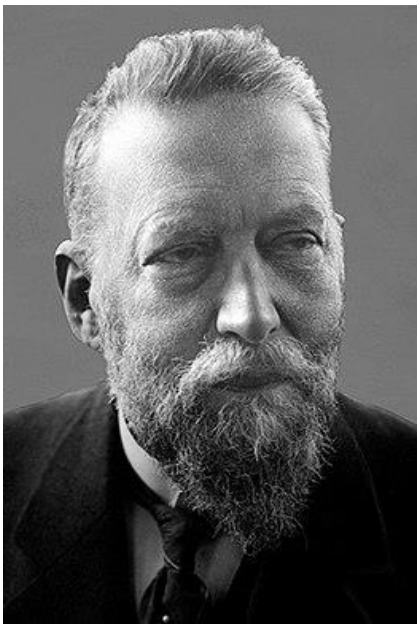

Figure 28. Portrait Jan Six (1857-1926).[217]

Vogelsang' appointment in 1907 therefore meant the creation of a chair in art history, fully devoted to aesthetics and art history. Although both Utrecht University and the University of Leiden were in the running, the decisive factor in choosing Utrecht had to do with commitments by third parties—*privaatdocent* archeology L.J Morell and professor of Law J. baron d'Aulnis de Bourouill—to make a large collection of books and plates available for teaching purposes.[218] The decisive role that these gifts played stresses not only the heavy reliance on books and visual materials, but also the effect of the limited financial clout state-funded universities had at the time. In turn, these private assurances meant that the state and the university did not have to spend too much money in setting up adequate conditions for the academic practice of the art historical discipline.[219] Yet, as we will see in this part of the chapter, the financial considerations continued to play a major role in the difficult relationship between art history and the academic culture. What also needs to be kept in mind, is the fact that, in Utrecht, it lasted until 1921 until students could earn a degree in art history.[220]

[217] Portrait of Jan Six retrieved on June 21, 2023, from the website: https://nl.wikipedia.org/wiki/Jan_Six_%28kunsthistoricus%29.
[218] Simultaneously, (in 1907) Wilhelm Martin (1876-1954) became professor by special appointment of Art History and Aesthetics at the University of Leiden. Annemieke Hoogenboom, "De introductie van kunstgeschiedenis aan de Nederlandse universiteiten", 89-91.
[219] Ibid., 83, 90.
[220] De Klerk, ""A long downward slide", 6.

As noted, Vogelsang studied art history in Germany, which is most probably also where he encountered and was familiarized with the use of the optical lantern.[221] In some publications it has been suggested that Vogelsang studied with Wölfflin, which could be the source of his encounter with the lantern. However, despite these claims, Vogelsang did not study with Wölfflin in Berlin or Basel, but rather was inspired by his thinking and was aware of his teaching practice.[222] So, instead of Wölfflin introducing him to the optical lantern, Vogelsang's encounter with projection during lectures was actually with Adolf Furtwängler (Fig. 29), the German archaeologist that he studied with in 1897.[223] Furtwängler was an advocate of providing his audience with photographs that showed different viewpoints. In his view, in order to grasp the essence of sculptures it was important to get a sense of walking around the sculpture in order to see all sides of it.[224] Photographs in that sense could simulate a visit to a museum.

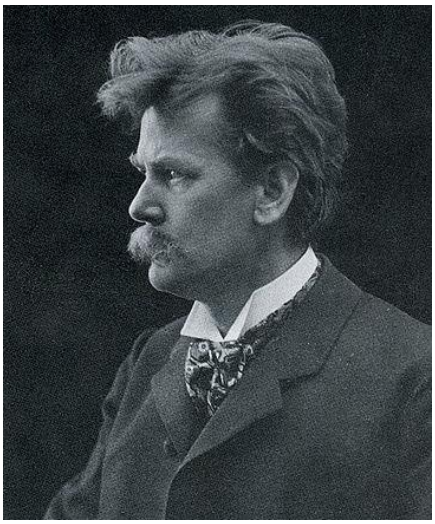

Figure 29. Portrait of Adolf Furtwängler (1853-1907). [225]

[221] Nederlands Instituut voor Kunstgeschiedenis. RKD. Archive Willem Vogelsang. NL-HaRKD.0287. Box 18. Student years. Notes on the professors that he studied with: Prof. Wickhoff (Wenen), Prof. Terey (Freiburg), Prof. Adolf Furtwängler (München) and Prof. Alois Riegl (Vienna).

[222] Here I draw upon the conclusions that were pointed out by Nico de Klerk in studying the work of Arnoud Odding and Annemieke Hoogenboom in: "A long downward slide" [8-10]. See Arnoud Odding, *Willem Vogelsang: achtienhonderdvijfenzeventig-negentienhonderdvierenvijftig:…ein durchaus paedagogischer Mensch* (Master thesis, Leiden University, 1994) footnote 16, where he states that Vogelsang most probably took classes with Wölfflin, 'probably in Basel'. Especially this last part makes his claim unconvincing. Moreover, the archival material does not support this claim. And Annemieke Hoogenboom states in her book *De Evolutie der Compositie* (2007) on page 11. This, however, is a misinterpretation of the phrase: "Wölfflin taught us", in his farewell address, in 1946, as the "us" in this sentence 'us' refers "to the practitioners of the discipline, not a polite authorial us"; De Klerk, "A long downward slide", [8-9].

[223] Adolf Furtwängler is particularly praised for his method of studying and dating vase shards. https://arthistorians.info/furtwanglera.

[224] Kerr Houston, *The Place of the Viewer: The Embodied Beholder in the History of Art, 1764-1968* (Leiden: Brill, 2019), 92.

[225] Image extracted on 1 June 2023 from the website: https://commons.wikimedia.org/wiki/File:Adolf_Furtwängler_2.jpg.

In one of Vogelsang's notebooks from 1897, when he was studying in Munich, there is a drawing (Fig. 30) of a lecture setting. In essence it shows the *educational dispositif* of a lecture given by Adolf Furtwängler, albeit not in *optima forma* (at least in its depiction by means of the drawing). In this drawing two of the poles of the *dispositif* are accounted for, 1) the performance context pole; and 2) the spectator pole. The missing element in the drawing is the textual pole, i.e., the projected image and the lecture text. The screen is depicted as a white circle at the front of the lecture hall, which signals that no slide is being projected. Still, all the other necessary elements in order to project are present. Above the screen we can distinguish the optical lantern with its chimney-like top (to release the warmth coming from the lamp) and the light coming from the front through the objective. In this way, Vogelsang highlights that the scene shown in this drawing is indeed that of a lantern lecture. At the same time, it is important to realize that in an actual performance the lantern was placed at the back of the room. This is also underscored by the pointer's shadow that falls on the screen.

The picture that is painted with this drawing highlights the importance of the professor being able to literally point out certain details in the projected artwork. Whether the pointer in the hands of Furtwängler was a common practice or that Vogelsang used it in a mere metaphorical way does not alter the fact that its presence in the drawing underscores the important didactical strategy employed to guide the eyes of the students.

> (…) very imperfect, I feel, as I do not have a series of images at my disposal to constantly "point out". But this would have been impossible for a large audience without lantern slides [anyway], and so I had to give you a somewhat ragtag collection of art-historical remarks than I would have liked to.[226]

As this comment by Vogelsang reflects, not having the possibility of 'pointing out' certain elements, developments etc., because of the lack of projected images, severely impeded the (or his) art historical teaching practice.[227]

[226] Willem Vogelsang, *Kunstwetenschappelijke opmerkingen. Rede uitgesproken bij de opening zijner lessen in kunstgeschiedenis* (Amsterdam: Scheltema en Holkema's Boekhandel, 1900), 37.
[227] However, this was not limited to Vogelsang, but also his colleagues were complaining. Wilhelm Martin, Art History in Leiden, and Elisabeth Neurdenburg, *privaat-docent* in Groningen since 1918, also addressed the difficulties in not being able to show slides. According to Martin, the lantern slides were 'invaluable' for teaching, whereas Neurdenburg took it a step further in saying that the discipline of art history could not exist without showing artworks. Wilhelm Martin, *Eenige opmerkingen over de waardering onzer schilderkunst in onze Gouden Eeuw. Rede bij de aanvaarding van het ambt van buitengewoon hoogleeraar in de kunstegeschiedenis aan de Rijks-Universiteit te Leiden uitgesproken den 23sten october 1907 door Dr. W. Martin* (Den Haag, 1907) 38; Elisabeth Neurdenburg, *Nog eenige opmerkingen over het onderwijs in de kunstgeschiedenis. Openbare les gehouden bij den aanvang harer lessen als lector in de kunstgeschiedenis aan de Rijk-Universiteit Groningen op zaterdag 19 october 1918* (Groningen: J.B. Wolters, 1918), 1.

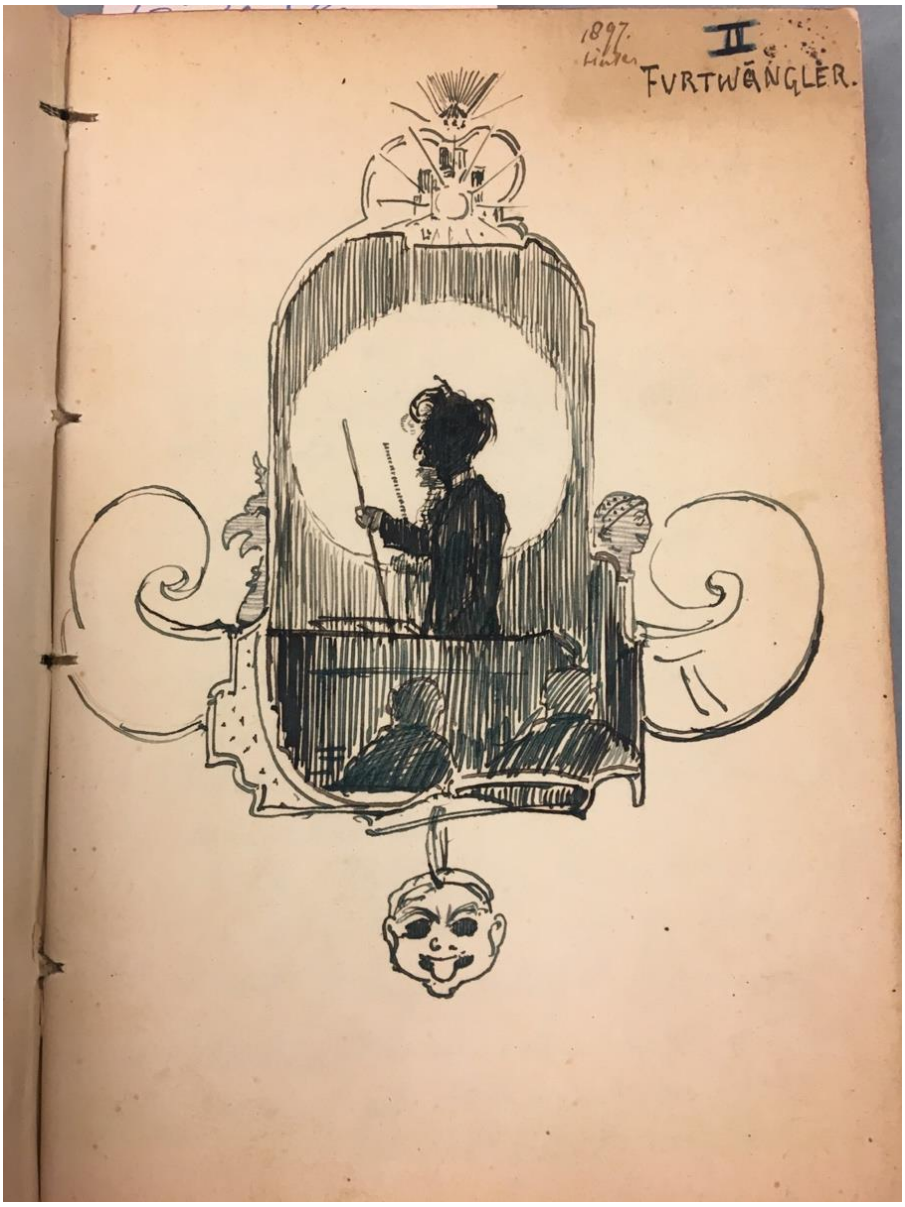

Figure 30. Drawing by Vogelsang of a lecture performed by Adolf Furtwängler at the University of Munich in the winter of 1897. (RKD Archive Willem Vogelsang). (RKD. Archief Willem Vogelsang (Archive Willem Vogelsang)).

The drawing reveals an additional element: the students are placed 'under' the light of the lantern beam in order not to disturb the projection. In the situation depicted here, this was also prevented by the placement of Furtwängler on an elevated stage next to the screen. Taken together, this drawing by Vogelsang proves his relatively early encounter with the lantern lecture in Germany and can be seen as a prelude to his desire to emulate this practice for his teaching practices.

Vogelsang saw his professorship as "a vital function for the benefit of the students" instead of using it as a "stage for [his] own study and publication."[228] This stance, however, also drew criticism from his colleagues over the years, since doing research and publishing new insights was believed to be a fundamental aspect of a respectable academic status.[229] But Vogelsang thought otherwise. His mission was to develop an instructive teaching style:

> (…) if the study of Art History wants to be revived here, we do not have to change the *strictly* good methods of research and exact publication of the discovered facts – that is well taken care of – but the way in which an auditorium or a circle of readers is informed, the manner of communication, of teaching, of drawing attention to that what matters most and what directly belongs to the core of this modern discipline, that is what should be revised.[230]

In his inaugural lecture in 1907, Vogelsang elaborated on the teaching that should guide academic art history. First, art history should provide an overview of the various material forms and developments that works of art have assumed over time. In doing so, it is important to begin with "an enumeration and description of the works of art" as well as "the enumeration of the artists, describing everything that is known about them in terms of factual data."[231] Once the students have acquired this general knowledge, the following task is to "compare works of art among themselves, both in their succession [diachronically] and synchronically", as this will ultimately allow to make connections between paintings or other art works.[232]

[228] Willem Vogelsang, *Veertig jaren kunstgeschiedenis aan de Universiteit te Utrecht. Afscheidscollege gehouden op 12 November 1946* (Utrecht: Kunsthistorisch Instituut der Rijksuniversiteit te Utrecht, 1947), 13. Even though this is expressed by Vogelsang in his farewell address, it is a clear indication of what he saw as his task over the course of his professorship. In similar terms, Vogelsang also stated in his inaugural address that the novelty of art history at universities demanded "fruitful education" that benefitted the understanding of the history of artworks. Willem Vogelsang, *Aesthetiek en Kunstgeschiedenis aan de Universiteit. Rede uitgesproken bij de aanvaarding van het hoogleeraarsambt aan de Rijks-Universiteit te Utrecht. Den 23sten September 1907 uitgesproken door Dr. W. Vogelsang* (Utrecht: A. Oosthoek, 1907), 7.
[229] Hoogenboom, *De evolutie van de compositie*, 9.
[230] Vogelsang, *Veertig jaren kunstgeschiedenis aan de Universiteit te Utrecht*, 8.
[231] Vogelsang, *Aesthetiek en Kunstgeschiedenis aan de Universiteit*, 8
[232] Ibid., 9.

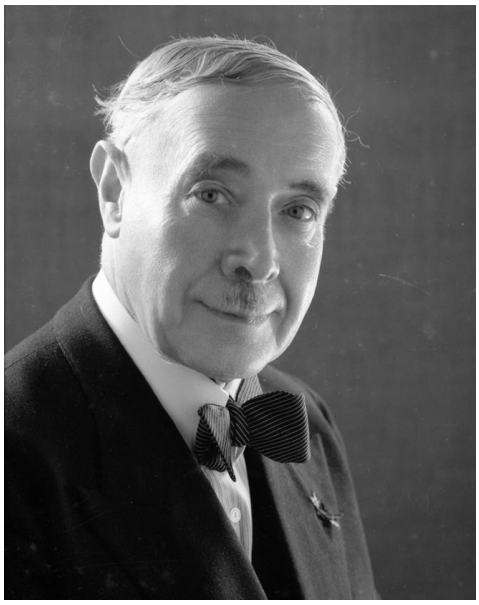

Figure 31. Portrait of Willem Vogelsang, Professor in aesthetics and art history at Utrecht University (1907-1946). [233]

Figure 32. Willem Vogelsang at his desk in the K.H.I. Notice the slides in the lower left corner. (Universiteitsmuseum Utrecht). [234]

[233] Image retrieved from Het Utrechts Archief. 106921. "Portret van Willem Vogelsang, geboren Leiden 1875, hoogleraar in de kunstgeschiedenis en esthetiek aan de Utrechtse hogeschool (1907-1946), overleden Utrecht 1954. Borstbeeld rechts." https://hetutrechtsarchief.nl/beeld/C57A32247DAA599484F3060CB70F257D.
[234] Image retrieved from the website: https://collectie.umu.nl/collectie/?diw-id=utralt_uu-collection_0285-4350. Inv. Nr.: 0285-4350. "Willem Vogelsang".

In other words, these two methods reinforce each other. The former was based on knowledge that needed to be transmitted from the professor to his students, making sure that they memorized it. Dutch pedagogue Rommert Casimir called this the "static method", suggesting a more passive attitude of the students.[235] Once this basic knowledge had been set in place, there was, in Casimir's conception, room for the "dynamic method", which, according to Vogelsang, in the case of art history had to be focused on looking at the historical context in which artworks were produced. One needed to understand the *Zeitgeist* in which an artwork had been created: what were the economic, political, religious etc., conditions at the time that Michelangelo created *David* for example? Therefore, art historical education should not only revolve around memorization and recognition of shapes, but also on identifying a period's own style. Art history needed to be focused on tracing the specific foundations of certain changes, developments, and impulses within art expressions of a particular time.[236] In Vogelsang's view, students needed to be trained to "see with the eyes (…) of another time period", they needed to be "force[d] (…) to become spectators" instead of only relying on hearing and writing when acquiring art historical knowledge.[237]

Visual teaching aids, particularly the projected, photographic lantern slides, were therefore indispensable to Vogelsang's teaching method. It provided him with a way of showing a wide range of artworks that opened up the possibility to make comparisons, based on patterns, similarities, differences in time periods, etc. Another factor favoring the use of the lantern, was that it (in some ways at least) solved the problem of geographic spread of the photographed objects. But making the optical lantern instrumental in instilling an 'art historical 'eye' in students did not go without a struggle.

Creating the right teaching settings

In order to train their eyes, Vogelsang exposed his students to as many artworks as possible: "[S]eeing and seeing again [is] the beginning and end of any art historical study."[238] However, despite his relentless efforts and entreaties university support for this goal was insufficient, especially in the early years of his career. First, as becomes clear from the annual reports that Vogelsang wrote to the university's Board of Curators, roughly between 1907 and 1921, show that he frequently complained about the knowledge level of his students. Whereas he stated in 1909 that he could not yet judge the development of the students, the following year he wrote:

[235] Inspectie-vergadering. "Franeker courant". Franeker, 25-09-1936, p. 5. Consulted on Delpher 05-06-2023, https://resolver.kb.nl/resolve?urn=MMTRES04:211458187:mpeg21:p00005.
[236] Vogelsang, *Kunstwetenschappelijke opmerkingen*, 21.
[237] Archief Kunsthistorisch Instituut van de Universiteit Utrecht. Inv.nr.: 203. Folder 216. College aantekeningen. "Collegium Publicum 1936". (Archive Art Historical Institute University Utrecht. Inv.nr.: 203. Folder 216. Lecture Notes. "Collegium Publicum 1936"). Vogelsang's view on the right method for art historical education in response to a newspaper report on a talk given by Rommert Casimir, 28.
[238] Vogelsang, *Kunstwetenschappelijke opmerkingen*, 44.

> Although one cannot complain about the diligence of some students, it must be said that there is a general lack of scientific initiative and tenacity. Mastering a new branch of science, orienting oneself, even fleetingly, through judicious cooperation in a subject that does not appear on the lists of the statutory examinations seems to be less a student's concern in this country than elsewhere.[239]

The most troublesome issue, according to Vogelsang, is that those types of secondary education that gave access to the university did not prepare students adequately for "memory work" (in Dutch: *geheugenwerk*), by which Vogelsang means refers to the knowledge of students about history in general, events that happened in specific eras or even years) or the ability to gain a deeper understanding.[240] This situation is confirmed in *Herinneringen aan den ouden tijd* (1957) by writer Annie Salomons, one of Vogelsang's earliest students, in which she recalls:

> He laid down reproductions from his own collection, because there was nothing at his disposal within the university. We had to describe what we saw. It may seem simple, but we had not yet learned actually how to give an account of details, let alone speak in public.[241]

As Salomons writes that at the time professors in the Faculty of Dutch literature gave "decent and boring" lectures in which "[the students] sat patiently for two hours, writing what the professor read to us […]".[242] In this brief sentence she asserted that in other classes there was little room for one's own reflections, or the possibility of independently thinking and making certain connections about cases that were presented. In another instance, Salomons recalls the lectures that Vogelsang gave on Thursday afternoons at the Botanical Laboratory: "He showed lantern slides, spoke long and thoroughly about every slide; and refreshed our memories the week after, so it could sink in properly."[243]

These reflections underscore the value attributed to the use of visual teaching aids, by both Salomons and Vogelsang himself in using them extensively. Through his teaching Vogelsang opened up a whole new world, "the world of seeing artworks properly", as Salomons writes.[244] In other words, Vogelsang's teaching practice encouraged students to rely more on their own senses and thoughts in what was 'put before their eyes'.

Despite the importance of the academic *lantern* lecture for his teaching, the setup and proper material basis of this pedagogical form still left much to be desired, as the abovementioned

[239] AKHI. UU. Archief Vogelsang. 1.3. notities, financiën, jaarverslagen. Box 1. "Jaarverslag aan het College van Curatoren, 1909-1910", 3.
[240] AKHI. UU. Archief Vogelsang. "Jaarveslag aan het College van Curatoren, 1908-1909", 3.
[241] Annie Salomons, *Herinneringen aan den ouden tijd. Aan schrijvers die ik persoonlijk heb gekend* (Den Haag: Bert Bakker, 1957) 136.
[242] Ibid., 134.
[243] Ibid., 137.
[244] Ibid., 137.

annual reports make perfectly clear. To fully comprehend what was at stake, I will further discuss his complaints about the working conditions he faced in this period.

Figure 33. Annie Salomons, Vogelsang's student. [245]

For the first few years Vogelsang delivered his lectures, by necessity and against his will, in rooms made available by professors of other disciplines: professor Went's Botanical Laboratory, as well as the Pharmaceutical Institute, professor Zwaardemaker's Physiological Laboratory, and even the Veterinary School. For his lectures, Vogelsang particularly made use of the Botanical Laboratory and the Physiological Laboratory. Besides the large number of students that attended his lectures (apart from art history students, medical students and students from outside Utrecht University attended his lectures as well) that demanded a large lecture hall, the main reason for

[245] Image retrieved on 5 June 2023 from the website: https://upload.wikimedia.org/wikipedia/commons/c/c3/Annie_Salomons.jpg.

this exile was the scarcity of optical lantern facilities.[246] However, Vogelsang's need to travel towards these lecture halls was a logistic nightmare, as he wrote in his annual report of 1914. Because of the necessity to use (visual) teaching aids for his lectures, the costs of transporting them to these venues would "eventually [...] prove to be too objectionable".[247] Moreover, as anyone who has lifted boxes of fifty slides can imagine, it would have been impracticable to carry them himself.

From 1908 to at least 1920 Vogelsang complained about this unworkable situation. Partly this had to do with taking up the devoted spaces of other professors, but also of their assistants who had to assist Vogelsang with operating the lantern during his lectures. Consequently, Vogelsang requested a building of his own, i.e., an Art Historical Institute.[248] This building had to include 1) "a large room where the books could be properly stored"; 2) a lecture hall that was designed like an amphitheatre that accommodated 60 to 70 students. Furthermore, it needed to have "writing and drawing boards" as well as the rights to "reproduction rights for two lanterns and two screens to support comparative education."[249]

Noteworthy here is of course his request for two lanterns and two screens, an indication of his familiarity with Wölfflin's method of using double projection. As we have already seen in the construction of Moll's laboratory, requests for the necessary teaching aids, especially the lantern, reveal a deeper, specific art historical aim, which on closer examination can do justice to a better understanding of the role that not only the lantern played, but also of the particular affordances of the slides projected during lectures. The use of two lanterns and two screens would make it possible to put the objects to be compared directly before the eyes of the students. The goal of the art historical lecture, then, was intimately connected the employment of the lantern, or rather two of them. As one lantern could show one work of art at a time, the comparative method could only succeed with the simultaneous—rather than successive—projection of two images. Unfortunately, despite knowing what he considered necessary for his lectures, there is no evidence that he actually got his two lanterns.[250]

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[246] AKHI. UU. AWV. "Jaarverslag 1909-1910", 1, 6; J.G. van Gelder, Elisabeth Houtzager en Beatrice Jansen (ed.), *Willem Vogelsang, 1875 9 augustus 1950 Commentarii* (Wormerveer: Meijer's Boek- en Handelsdrukkerij, 1950) 9.

[247] AKHI. UU. AWV. "Jaarverslag 1913-1914", 5.

[248] For the abbreviation of this institute I will use the Dutch initialism, K.H.I. (Kunsthistorisch Instituut).

[249] AKHI. UU. AWV. "Jaarverslag 1909-1910", 7. In Dutch: "reproductierechten voor twee lantaarns en twee schermen voor vergelijkend onderwijs". It is surprising that Vogelsang talks about 'reproduction rights' in regard to the lantern, since these rights were only applicable to the images transferred onto lantern slides. The most plausible explanation is that Vogelsang indeed meant that he needed reproduction rights for the images that he wanted to obtain.

[250] There is a photograph from 1970 that shows the lecture hall of the Art Historical Institute where two (modern) slide projectors are positioned at the back of the lecture hall. Thus, suggesting that still some fifteen years after Vogelsang's death this practice was important for art historical teaching practices. Image can be viewed on the website of Het Utrechts Archief: https://hetutrechtsarchief.nl/beeldmateriaal/detail/a590e7a1-66da-50b6-8931-286acbe8e770/media/395b26ae-b60c-57e3-3bb5-aa13bda73554?mode=detail&view=horizontal&q=collegezaal&rows=1&page=17.

Over the years, the acquisition of a building devoted to the study of art history remained problematic for Vogelsang and his students. As the *Utrechtsche Studenten Almanak* of 1912 reported, Vogelsang was not able to quietly prepare for his lectures and seminars:

> The Art Historical Institute is totally inadequate, because there is a great lack of space, the building is poorly soundproofed, which makes it difficult to study, and because it does not have a separate room for the director [Vogelsang], so that he is often forced to share a room with five or six visitors, which is inconvenient for his work and also prevents him from receiving anyone who wants to talk to him. This is done in one of the rooms of the Geographical Institute or, if this is not possible, in the garden in the summer, in the vestibule in the winter. As plans for a separate building have been suspended for the time being, it is necessary to make new temporary arrangements. [251]

Coinciding with the complaints about the lack of a dedicated building is the lack of space to store the necessary visual aids, such as photographic reproductions, books, and lantern slides. Also, there were no assistants available to Vogelsang who could help him organize all these materials. This had severe consequences for his teaching practices, as he reported in 1908. Despite having "thousands of reproductions" at his disposal, his students would not be able to make use of them, since they were not classified according to "masters and schools". Only when the reproductions would have been organized would they benefit the "comparative study" by students.[252]

Part III. The academic status of slide collections

It was not only important, then, to create the right teaching setting, i.e., the physical space where the lantern lectures took place. The building of an archive of classified and ordered slides as well as reproductions and other visual aids was equally fundamental for the training of future art historians. Vogelsang's quoted words also suggest that the usefulness and pedagogical value of the slide collection lay in its internal structure. The collection needed to be structured according to important art historical principles, such as artist, style, period, etc. The slide collection of the K.H.I. in Utrecht has (partly) survived and can be consulted at the RKD: Dutch Institute for Art History. Unfortunately, however, it is difficult to ascertain whether the collection of roughly 25.000 slides (see Fig. 34) represents the same state as it was used in the 1920s and thereafter. Still, some sort of system can be distilled from the remnants of the index cards in the boxes, indicating for example a certain artist such as Rembrandt or Michelangelo. Another interesting slide collection that has come down to us belongs to the K.H.I. at the University of Amsterdam, officially starting in 1928 under the supervision of professor Ferrand Whaley Hudig. This

[251] Vox studiosorum. Consulted on Delpher 07-06-2023, https://resolver.kb.nl/resolve?urn=MMUBU02:164327024:00002.
[252] AKHI. UU. AWV. "Jaarverslag 1908-1909", 4.

collection consists of roughly 20,000 lantern slides (see Fig. 35) and is currently housed at this university's Library-Special Collections Dpt.[253]

In this part I want to further discuss the methodical composition of both collections, the main motives they reveal and the strategies to acquire lantern slides for teaching purposes and as a way of creating an archive that would benefit both staff in their lecturing and students in their independent study. As we have seen when discussing the German 'early-history' of the lantern's use, it has become clear that the quality and the reliability of photographic reproductions of artworks was most important. They had to do justice to the original, but also have specific pedagogical qualities. By diving into the composition of the two slide collections under scrutiny here, I demonstrate the pedagogical considerations that underlie these collections and reflect on their archival implications for art historical purposes. Furthermore, what I want to highlight here, is that even though the lantern lectures cannot be reconstructed from surviving lecture notes, a closer glimpse into the materiality of the slides in combination with the main aims of the discipline allows us to better understand their deployment within academic teaching practices. In addition, the differences between both collections will be discussed.

Figure 34. Slide collection K.H.I. Utrecht University, at the archive of the RKD. (Photographed by Dulce da Rocha Gonçalves).

[253] Bijzondere Collecties Universiteit van Amsterdam. Diatheek Kunsthistorisch Instituut Amsterdam, UBA537. Allard Pierson. (Special Collections University of Amsterdam. Slide collection Art Historical Institute Amsterdam, UBA537. Allard Pierson). Information about the number of slides was extracted on June 26, 2023, from the website: https://archives.uba.uva.nl/resources/ubainv537.

Figure 35. Part of the slide collection of the K.H.I. of Amsterdam. (University of Amsterdam Library-Special collections). (Photographed by the author).

Both art historical slide collections are so-called institutional collections. This meant that they were used by different lecturers and researchers, as well as by students. Moreover, because these are sizeable collections, they were not only used during the lantern lectures, but in addition had an archival function.

In both Utrecht and Amsterdam there were three main ways of acquiring slides for the collection: 1) to have them made in-house, mostly by reproducing images from books; 2) by purchasing them from foreign and domestic specialized photographic companies (for example Giraudon, Alinari, Lichtbeelden-Vereeniging); 3) acquisition from third parties or gifts.[254] In order to better understand these collections it is worthwhile to zoom in on two of these strategies. The third one will be the focus of the analysis of one (small) part of the Utrecht-collection, whereas purchase from specialized companies will be the focus of the Amsterdam collection.

Slides and the academic self

Within the Utrecht-collection there is an interesting box of slides entitled "Aegypten" (Egypt), which also has a list with descriptions in addition to the slides (Fig. 36). This box contains slides

[254] Martin Versteeg, "Van privé naar professioneel: de Bibliotheek Kunstgeschiedenis van de Universiteit van Amsterdam", in: Roman Koot, Michiel Nijhoff and Saskia Scheltjens (eds.), *Kunstbibliotheken in Nederland: Tien korte schetsen* (Leiden: Primavera Pers, 2007), 72; Archive K.H.I. Willem Vogelsang. Annual report 1913-1914, (1914) 5.

that were most probably purchased by Wilhelm Von Bissing, who was a professor by special appointment in ancient art history in Egypt and Southwest Asia at Utrecht University, in 1922. Since it was an institutional collection, this should not be a surprising find. However, correspondence between Von Bissing, Vogelsang, the Board of Curators, and the Minister of Education, Arts, and Sciences, shows that there was more to it.

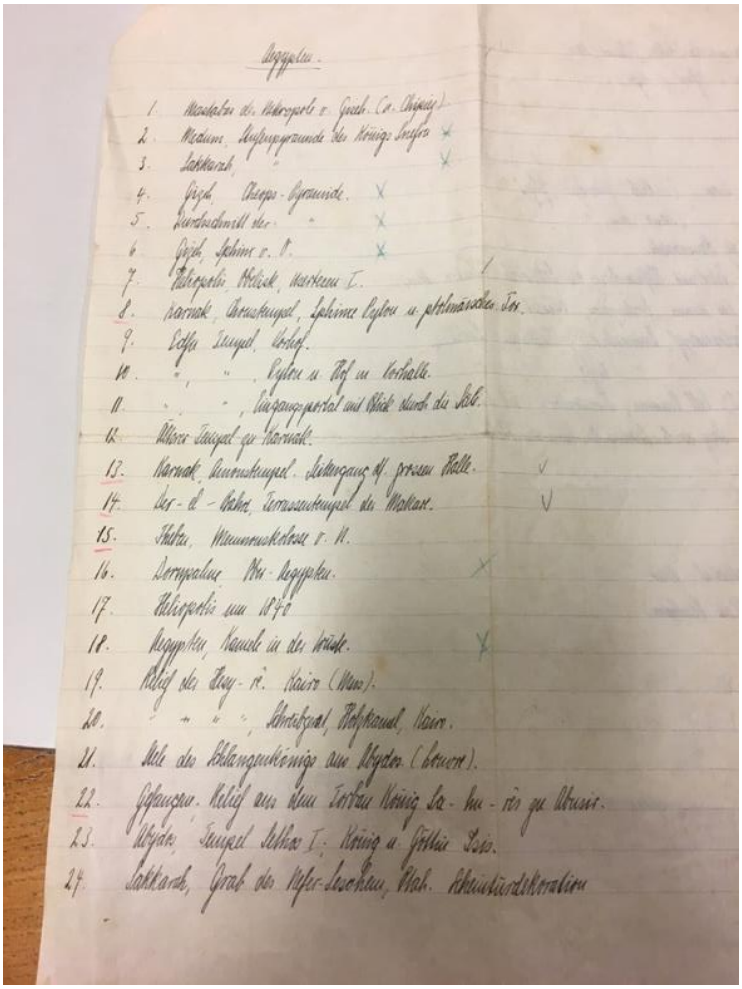

Figure 36. Description list of slides in box “Aegypten”. (Art Historical Institute Utrecht).

In addition to his professorship, Von Bissing had a full-time appointment as a lecturer at the Academy for Visual Arts in The Hague. As a professor by special appointment he had to give a weekly (lantern) lecture for which he mostly used his own private collection of Egyptian antiquities, books, casts, and lantern slides. As the newspaper *Het Vaderland* reported on the occasion of an exhibition in 1923, this was not just any collection, but:

> The Von Bissing collection is the largest existing, private collection. It is a life's work and organized systematically. All styles, all techniques are present. This exhibition, which contains perhaps one tenth of the collection, should give you an idea of its richness.[255]

In other words, this was a very specialized collection brought together by Von Bissing himself, partly during his many visits to Egypt. And since most of his commitments were still in The Hague, his collection was also housed there. However, this was inconvenient when he had to travel to Utrecht to give his weekly lecture with the objects and/or slides that he used for his lectures. Therefore, Vogelsang suggested to him to transfer some of his slides and casts to the K.H.I., so that he had them at his disposal without carrying them around too much.[256]

To add further weight to this idea, Vogelsang convened a meeting in 1923 (the same year that the K.H.I. acquired its own building) with Von Bissing, the Secretary of the Board of Curators, B.J.L. Baron de Geer Juthpaas, and the director of the Ministry of Education, Arts and Sciences, A.J.L. van Beeck Calkoen, to discuss the desirability and possibilities of facilitating such a transfer.[257]

According to the report, which was signed by all parties, they agreed that for the duration of Von Bissing's professorship at Utrecht University a part of his collection would be housed at the K.H.I., mainly for the benefit of the students. However, if Von Bissing would be discharged, or if he would pass away, the collection would become the property of the Institute. The meeting had further implications for Von Bissing's teaching and collecting practice. Out of his annual endowment of 3,000 guilders for the preservation and extension of his collection, he had to spend at least 200 guilders on buying new slides for the benefit of the Utrecht slide collection. And while, the slides would only be housed at the K.H.I. in Utrecht, they remained in the possession of Von Bissing as part of his own extensive collection.[258]

Only one month after this meeting, in January 1924, Von Bissing wrote a letter to the Board of Curators in which he stated that the outcome of the meeting was (partly) based on a misunderstanding, and that he wanted to clear up some things. He felt that he was being robbed of his, personal collection of books and slides, while this collection was something that "belonged

[255] ACADEMIE VAN BEELDENDE KUNSTEN. "Het Vaderland : staat- en letterkundig nieuwsblad". 's-Gravenhage, 10-06-1923, p. 3. Geraadpleegd op Delpher op 27-06-2023, https://resolver.kb.nl/resolve?urn=ddd:010008503:mpeg21:p003.
[256] Het Utrechts Archief. 59 College van Curatoren. Universiteit Utrecht. Kunsthistorisch Instituut. Inv.nr.: 2122. Brief W. Vogelsang aan College van Curatoren. "Verslag van de vergadering tussen Prof. Von Bissing, Prof. Vogelsang, B.J.L. Baron de Geer van Jutphaas en A.J.L. Van Beeck Calckoen", 14 December 1923, 2. (Het Utrechts Archief. 59. Board of Curators. University of Utrecht. Art Historical Institute. Inv.nr.: 2122. Letter from W. Vogelsang to the Board of Curators. "Report of the meeting between Prof. Von Bissing, Prof. Vogelsang, B.J.L. Baron de Geer Jutphaas (Secretary Board of Curators UU), and A.J.L. Van Beeck Calckoen (Chef Department Higher Education of the department of Education, Arts and Sciences)", 14 December 1923, 2.
[257] HUA. 59. CvC. UU. K.H.I. 2122. "Verslag van vergadering", 14 December 1923.
[258] Ibid.

to me scientifically (in Dutch: "van wat mij wetenschappelijk behoort").[259] What this letter shows is that his meticulously collected artefacts, books, and slides were not simply teaching material, they were reflecting his scientific status and practice.

Figure 37. Portrait Friedrich Wilhelm Von Bissing (1873-1956). [260]

There had to be, according to Von Bissing, a clearer distinction between which slides and books were acquired with the help of the government (through the provision of the endowment) and what he himself had collected and paid for—the latter belonged to him alone. In his reflections we find a deeper level of meaning attached to the material object of the lantern slides. As a collection, gathered and built by an expert, Von Bissing's slides also reflect his personal academic career of Von Bissing, while being simultaneously linked to his teaching practice in which he conveyed his ideas and knowledge to his students.

Vogelsang's motives for acquiring part of Von Bissing's collection, but also for asking him to add to the K.H.I. collection of Egyptian Art, initially appear to be based on a willingness to help

[259] HUA. 59. CvC. UU. Inv. Nr. 2122. "Brief van Von Bissing aan het College van Curatoren", 24 January 1924.
[260] Image extracted on 8 June 2023 from the website: https://nl.wikipedia.org/wiki/Friedrich_Wilhelm_von_Bissing#/media/Bestand:Friedrich_Wilhelm_Freiherr_von_Bissing.gif.

out a colleague. As we have seen earlier in this chapter, Vogelsang's lack of sufficient teaching aids and proper facilities had taught him that this had a negative impact on his teaching. And it seems that he wanted to allay Von Bissing's similar concern by pointing out that it was not a problem to (temporarily) transfer some of the material to the institute. However, the meeting apparently left Von Bissing with a bitter aftertaste, which led him to believe that Vogelsang had a hidden agenda. Indeed, it could have been that Vogelsang saw an opportunity to further shape the K.H.I. and add a specialized branch of artefacts that would build upon Von Bissing's expertise. In turn, this would obviously add to the status of the slide collection as well.

How things exactly turned out cannot be ascertained. What is clear, however, is that these slides ended up in Utrecht's collection (Fig. 38-39). The most important clue for this is the series of slides of Ancient Egypt—one of Von Bissing's main fields of interest—and the labels on the slides referring to Seemann, a German company specialized in art history photography. Furthermore, in his correspondence Von Bissing discloses having a special arrangement with Seemann to purchase slides at a cheaper price.[261] However, instead of being part of his own private collection, these slides could also have been duplicates or had been especially bought for the K.H.I. Nevertheless, this example reveals the status, arrangements, considerations, different interests, and potential conflicts that lurked in a collection of objects that were meant for teaching, yet simultaneously reflected a person's scientific or institutional status.

What is also interesting in this respect is that Von Bissing, in turn, relied on the expertise of yet another party, a photographic company specialized in (historical) artworks. Presumably this choice was based on the same considerations and principles that we have encountered before: clear images made by professional art photographers and the possibility of acquiring photographic images of geographically widespread artworks. Furthermore, these companies had a long history; Seemann for example had been founded in 1858, Alinari even earlier, in 1842. Over the years both had been able to build sizeable collections of photographs and negatives and acquire a good standing with their clients. These companies partly contributed to the ability of the first generations of professors engaged in the 'new' field of art history to gather large collections of photographically reproduced artworks for their teaching.

[261] HUA. 59. CvC. UU. Inv. Nr. 2122. "Brief van Von Bissing aan College van Curatoren", 24 January 1924.

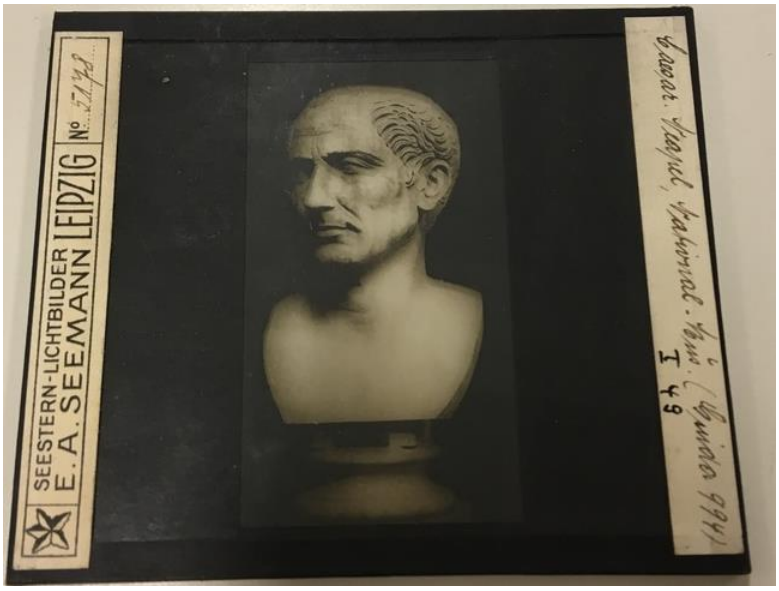

Figure 38. Lantern slide 'Aegypten' collection. (RKD-glasdia collectie K.H.I. Utrecht).

Figure 39. Latern slide 'Aegypten' collection. (RKD-glasdia collectie K.H.I. Utrecht).

Creating an "image-archive"

The case of the Amsterdam collection under the supervision of F.W. Hudig allows for an even deeper insight into the strategy of close cooperation with a specialized photographic and lantern slide company in order to put together a scientifically valuable, institutional collection of slides.

Ferrand Whaley Hudig was a so-called late bloomer as an art historian. After some peregrinations—one being working for his father's shipping company, as was expected of him—Hudig recognized that he needed to look for a task that was intellectually more challenging. Thus, in 1914, at the age of thirty, Hudig left for Germany to study art history.[262] After finishing his doctoral research, in 1918, Hudig returned to the Netherlands to become curator at the Dutch Museum for History and Arts in Amsterdam (which merged into the Rijksmuseum in 1924, although it had already moved in into its building in 1887).[263] He held this position until he became professor of special appointment for art history of the Middle Ages and Modern Era at the University of Amsterdam in 1928.[264] This chair was made possible by the Allard Pierson Foundation (hereafter A.P.F.) that was created in the same year.[265] The foundation was initiated by J.L. Pierson, the son of the renowned professor Allard Pierson. Its mission was to financially support three chairs that represented three subjects that his father taught: archaeology, ancient history, and art history. Together the chairs received a sum of 248,000 guilders, which they could spend on improving their institutes and thus acquire the teaching aids necessary for the training of future historical experts in these various fields.[266] In contrast to Vogelsang, Hudig found himself in a decidedly more favorable financial situation; it allowed him to make targeted investments in his preferred teaching setting.

Here again, it is striking to see that Hudig spent most of the money on lantern slides. Each year between 1929 and 1935, the annual reports mention the addition of new slides—the first year he even spent more money on slides than he received form the A.P.F.[267] Besides gifts, which also added to the growing lantern slide collection, Hudig's main strategy was to create a "*platen-archief*" (image archive), an aim he realized through a special arrangement with the

[262] Johanna Dorina Hintzen, "Ferrand Whaley Hudig", in: *Jaarboek van de Maatschappij der Nederlandse Letterkunde* (1938): 151-152. Interestingly, in 1914 Hudig thought it would be best to study abroad, even though Vogelsang had already been teaching art history since 1907. However, until 1921, students in art history could not obtain a degree. For further information on this state of art history, see: Nico de Klerk, "A long downward slide", 6.
[263] Barbara Laan, "Kunstnijverheid en interieur in het Nederlandsch Museum voor Geschiedenis en Kunst in het Rijksmuseum in Amsterdam: Ontstaan en opheffing van de cultuurhistorische presentatie 1875-1927" in: *Tijdschrift voor Interieurgeschiedenis en Design*, vol. 39 (2014-2016), 69-102.
[264] Hintzen, "Ferrand Whaley Hudig", 151-152.
[265] ALLARD PIERSON STICHTING. "De standaard". Amsterdam, 26-11-1928. Consulted on Delpher 27-06-2023, https://resolver.kb.nl/resolve?urn=MMKB23:001870049:mpeg21:p00003.
[266] Bijzondere Collecties Universiteit van Amsterdam. Archief Allard Pierson Stichting. "Jaarverslag 1929", 3. (Special Collections University of Amsterdam. Archive Allard Pierson Foundation. "Annual report 1929", 3.
[267] BC. UVA. Archief A.P.F. "Jaarverslagen 1929-1936". After a short illness Hudig died relatively young in 1937.

"Lichtbeelden-Vereeniging".[268] Already in 1921 Hudig wrote an article in the *Oudheidkundig Jaarboek* (*Antiquities Yearbook*) titled "Platen-Archief". This article was a response to the Art Historical Congress he attended that year in Paris, where a community of international art historians had gathered to discuss pressing matters, one of which was the efficient exchange of photographs. In the article Hudig pleaded for the creation of a centralized archive of art photographs and slides of artworks in Dutch museums that could be exchanged internationally. In Germany, Italy, and France such institutions were already common and, according to Hudig, it was time that the Dutch followed their example.

> As in Paris, Vienna, and Berlin, a central office must be created. It doesn't have to be palatial; well-ordered [glass] plates do not take up much space. The office should be headed by someone who is competent in photography and art history. To him all museums, committees, and societies must entrust their plates. To promote its initial growth, museums could easily acquire plates by obliging all those who make photographs in the museum to hand over their negatives after use. As in Germany, an agreement could be made with publishers.[269]

Interestingly, this quotation reflects a position similar to Wölfflin regarding the necessity of expert photographers who are able to provide the 'right' art historical images for such an archive.

Even though no such institution existed yet, Hudig does refer to the "Lichtbeelden-Vereeniging" (Lantern Slide Association, hereafter L-V) in Amsterdam. It already had an extensive collection of negatives and lantern slides for rent. Founded in 1898 to propagate and enable illustrated lectures, the association created a centrally housed lending collection of slides for all kinds of organisations and associations. In 1911, the new director of the L-V, Theordora Clementine de Gijselaar, introduced a new policy that targeted schools and universities, instead of associations by creating educational slide sets. The association appointed a new board of advisors, consisting of professors (including F.A.F.C. Went and Willem Vogelsang), schoolteachers, and other stakeholders who were asked to advise on relevant topics, images, and literature that could be used for the production of slides and accompanying texts.[270]

Hudig, then, benefitted some fifteen years later a great deal from the L-V's professionalization and focus on education, mainly because of its large collection of art historical slides. Hudig's plan of centralizing all Dutch art photographs and lantern slides never really took

[268] SC. UVA. Archive A.P.F. Annual reports 1929-1935.
[269] F.W. Hudig, "Platenarchief", in: *Oudheidkundig Jaarboek. 3e Serie van het Bulletin van den Nederlandschen Oudheidkundigen Bond*, 1 (1921), 334. Consulted on Delpher 27 June 2023, https://resolver.kb.nl/resolve?urn=MMUBVU08:001240001:00242.
[270] Internationaal Instituut voor Sociale Geschiedenis (IISG). Documentatie Cultuur Nederland. Box 12.8. Cultuur (V-Z) Folder 8. "Vereeniging tot het Houden van Voordrachten met Lichtbeelden." (International Institute for Social History (IISG). Documentation Culture Netherlands. Box 12.8. Culture (V-Z) Folder 8. "Association for the Organisation of Lantern Lectures").

off, not in the least because people, such as Vogelsang, were not in favor of this plan.[271] However, when he was professor at the University of Amsterdam, seven years after he published the abovementioned article, it seems that Hudig tried to create something similar in his own K.H.I., albeit mostly focused on training his students. According to the annual report of 1930 of the A.P.F., he set up an arrangement with the L-V for lending, and sometimes the acquisition of, slides. Part of this deal was the storage of the lantern slides at the A.H.I, while they remained the property of the L-V. This arrangement ensured a regular (annual) influx of new slides, while it simultaneously helped the L-V to extend its collection without incurring extra costs of "storage and administration".[272]

The prominent collaboration with the L-V is evident in the slide collection that can be accessed today. Briefly, I want to discuss two examples of slides that I have retrieved from the Amsterdam collection and that shed light on both the involvement of the L-V and the reconstruction of art historical principles based on the traces of trading of the slide.

Being part of the thought collective

It is important to keep in mind that the L-V, in its arrangement with Hudig, acted as an intermediary. For example, in the archive of the L-V bills of Fratelli Alinari, the specialized photographic company from Italy mentioned earlier, can be found (Fig. 40). This suggests that the L-V built a slide collection based on the catalogues of a number of internationally operating, European companies that covered a wide range of topics (not just artworks), and made it accessible to Dutch lecturers or professors to use in their teaching practices. This practice is also visible in the K.H.I. Amsterdam slide collection still consultable today. In a subcategory of the collection, artworks from Ravenna, one of the slides shows a label in its frame referring to both Alinari and the L.V., exemplifying the business model of acquiring photographs from a specialized Italian company and make lantern slides from them.

One of the slides from the Amsterdam-collection (see Fig. 41) reflects this practice of international exchange of photographs, where the L-V acts as intermediary, eventually transforming the photographs, in its own photographic studio, into lantern slides that it subsequently integrated into its collection. Besides the high-quality photograph of a detail of the Basilica of San Vitale in Ravenna enclosed in the slide's frame, what is most interesting is the inserted label at the bottom of the frame: "Foto Alinari – Florence. Lichtbeeld Lichtbeelden-

[271] D.P.M. Graswinckel, "Mededeelingen en korte berichten", in: *Oudheidkundig jaarboek. 3e Serie van het Bulletin van den Nederlandschen Oudheikundigen Bond,* 7 (Utrecht: A. Oosthoek, 1927), 154. Consulted on Delpher 27-06-2023, https://resolver.kb.nl/resolve?urn=MMUBVU08:001249001:00001.
[272] BC UVA. Archief A.P.F. "Jaarverslag 1930", 6.

Vereeniging." What needs to be noted first is that the label's text was not visible when this image was projected with a lantern, only the photograph was.

In other words, all these references, titles, numbers etc., were meant for the user who wanted to compile a slide lecture and needed to be sure about the items to be shown. In essence, what the label is telling us is how copyright worked, starting from the 1910s onwards. This slide reflects the actual practice of the L-V contacting Alinari, requesting certain photographs of art objects from their collection based on the catalogues it published. Once it received the photographs it was allowed to make lantern slides, but they had to acknowledge the original producer of the image.[273] This reflects the distribution network connected to its practices under the copyright law of 1912, which explicitly states that when a slide or photograph would only be used for study purposes it was not required to make explicit reference to its provenance/producer. But, since its core business was renting slides to other parties, it had to include its provenance. On a final note, this slide and its referencing system also suggest that the valuation of photograph and lantern slide was virtually the same, in that their provenance needed to be accounted for in both material forms.

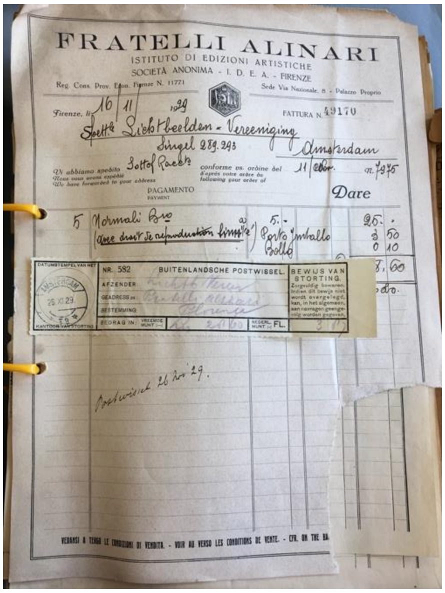

Figure 40. Account of the specialized photographic company "Fratelli Alinari" in Italy. [274]

[273] No. 600. Drukwerken. Auteursrecht. Wet van 23 September 1912 (Nederlandsch Staatsblad No. 308), houdende eene nieuwe regeling van het auteursrecht. *Staatsblad van Nederlandsch-Indië*. Ch. 7. Section 6, 5-6.
[274] Archief Rijksakademie voor Beeldende Kunsten, Amsterdam. Archief Lichtbeelden Instituut: Box 4. Folder: Rekeningen. "Auteursrechten 1925-1931". Rekening Fratelli Alinari, 16 November 1929. (Archive State Academy for Arts, Amsterdam. Archive Lantern Slide Association: Box 4. Folder: Accounts. Copyright 1925-1931. "Account Fratelli Alinari", 16 November 1929).

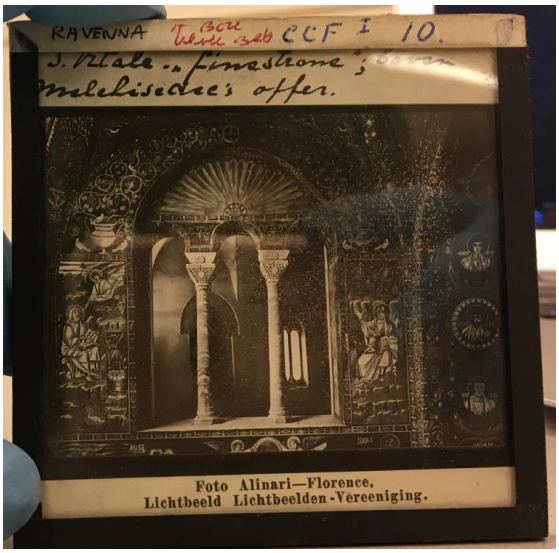

Figure 41. Lantern slide from the collection of K.H.I. Amsterdam. This slide showcases copyright principles of the 1910s. [275]

Besides the slides' traces of international networks, distribution practices as well as provenance regulations, there are slides in both K.H.I. collections that exhibit 'disciplinary visualities', i.e., photographic images or sequences of images that expose the then current ideas about how to acquire knowledge about styles, or the specifics of sculptures, the development of an artist etc. The first example that I want to show, is a series of photographic lantern slides Michelangelo's *David* (Fig. 42-43). What is remarkable about this series of slides is that without knowing what exactly was discussed through them, their didactic purpose is immediately clear.

Interestingly, starting with the publication of *Meisterwerke der Griechischen Plastik* (1893), Adolf Furtwängler spurred a discussion about how to photographically capture sculptures; in this book he included series of several images of one sculpture that showed the various "viewpoints of these sculptures", allowing the reader-viewer a complete sense of the artwork.[276]. One result of this work was a series of articles by Wölfflin titled "How One Should Photograph a Sculture" (1896).[277] Although, Wölfflin recognized the importance of photographing works of art, in the case of sculptures he often found the photographs that were made by "the uncultivated" problematic, as they were not able to capture the intended essence of the sculpture.[278] According to Wölfflin, it was important to "guide the viewer back to seeking out the

BC UVA. Diatheek K.H.I.A. UBA537. Allard Pierson. Slide indicating the purchase of the photograph by the Lichtbeelden Vereeniging from Alinari in Florence.
[276] Houston, *The Place of the Viewer*, 93.
[277] Grimm, "Die Umgestaltung der Universitätsvorlesungen", 282-284; Houston, *The Place of the Viewer,* 92-93; Heinrich Wölfflin, "How One Should Photograph a Sculpture", transl. from the German by Geraldine A, Johnson, in: *Art History*, vol. 36, 1 (February 2013), 52-71.
[278] Wölfflin, "How One Should Photograph a Sculpture", 53, 66, 68.

view that corresponds with the artist's conception. It is not right [to say] (sic) that a sculptural monument can be seen from all sides."[279] Remarkably, Wölfflin, does make a distinction between sculptures that are made in the "good tradition" and those that have "no single side", clearly preferring sculptures that showcase a certain essence.[280]

Figure 42. Lantern slide of David – front and backside of sculpture. (Bijzondere collecties UVA. K.H.I.A.). [281]

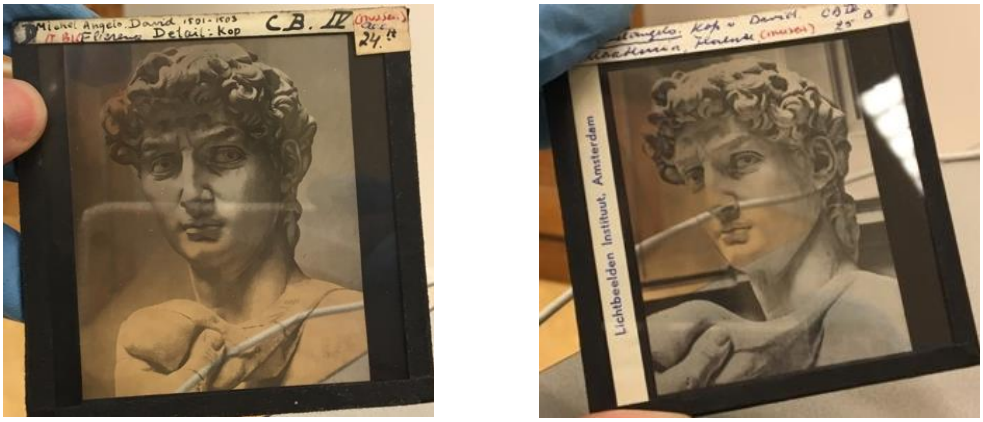

Figure 43. Different angles of David's fase. (Bijzondere Collecties UVA. K.H.I.A.).

The slides from the K.H.I. collection, showing *David* not only frontally, but also from the back, as well as the face from different angles, might not have pleased Wölfflin—unless he would have argued that this was a sculpture that does not have "one single side". However, from a didactical point of view, the ensemble of these (projected) images used for teaching did stress the various sides of *David*, creating a sense of 'walking around it' to highlight the various details of this work.

[279] Ibid.: 53.
[280] Ibid., 53.
[281] BC. UVA. Diatheek K.H.I.A. Uninventoried. Box 1-112.

It allowed the students to "see for themselves", while being guided by the lecturer, as if they were present at the site itself.

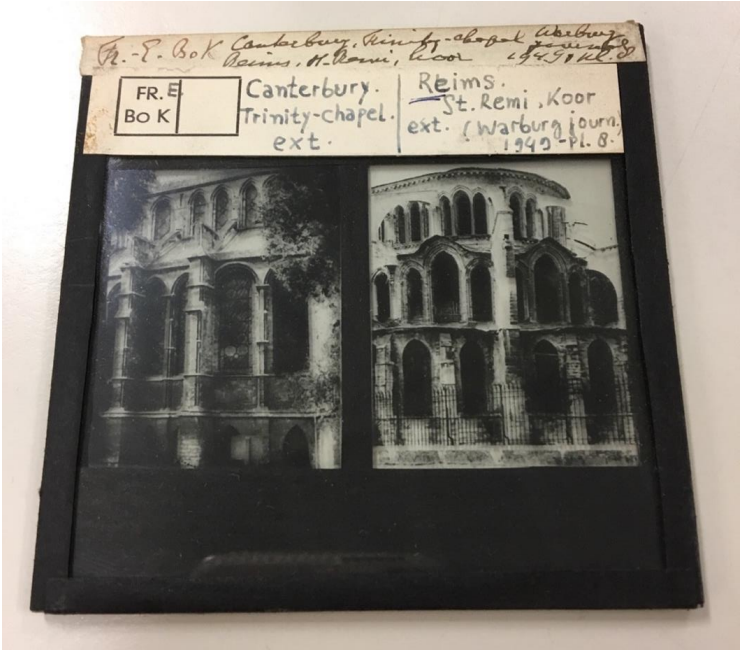

Figure 44. The "double-projection" lantern slide. (RKD-Glasdia Collectie K.H.I.U.).

The final example is, in my view, a 'typical' art historical slide; it is part of slide collection in Utrecht (see Fig. 44). What I mean here with *typical* is the way in which the information in the slide is presented. Since the comparative method is so fundamental to studying art history, in understanding its contexts, (dis)similarities, and developments, this slide represents this method in the form of one single lantern slide. Directly captured within one single frame of a lantern slide are two different buildings, one in England (Canterbury) and another in France (Reims), two different buildings that are miles apart geographically connected through photographic technology. The affordances of these types of slides seem obvious, as they offered students an opportunity to make observations based on what was projected on the screen. Instead of switching between two slides, this combined slide offered a direct comparison that could be made. What is even more interesting, however, is the fact that this slide actually simulated a common teaching practice. Even though there is uncertainty about who used double projection first in illustrated lectures in Germany, it is clear that both Heinrich Wölfflin and Adolph Goldschmidt made use of two optical lanterns during some of their classes.[282] They used two lanterns in order

[282] Alexander, "Baroque out of Focus", 101.

to compare similarities or differences between works of art of architectural structures in simultaneously projected images. As noted, in the annual reports Vogelsang wrote he pleaded repeatedly for two lanterns that would accommodate his comparative education—possibly to no avail.[283] The presence of these slides in the institutional collection of Utrecht University, however, strongly suggests that these slides were purposefully made to recreate this way of making comparisons as closely as possible for the use of a single lantern.

Conclusion

The enormous number of art historical slides of both Utrecht University and the University of Amsterdam that have survived, highlight the importance that these teaching objects had in art historical teaching practices in the beginning of the twentieth century. As described by art historian Robert S. Nelson, "art history *is* the illustrated lecture", to which I would like to add that this discipline was invested through its teaching practices in creating a particular 'seeing style'.[284] Moreover, a seeing style that differed greatly from what had gone before because of the new possibilities that were offered by the employment of the optical lantern and its lantern slides. Although it might be unimaginable to the modern art historian to not be able to show a wide array of artworks during a lecture, its emergence in the 1910s in the Netherlands, significantly changed the outlook of the discipline in Dutch universities. Because of the availability of slides, professors were able to show various artworks from all over Europe and sometimes even beyond. Furthermore, their ensemble in a lantern lecture, allowed professors to group certain works of art, to study them in detail by juxtaposing them on a screen. The students were exposed to various paintings, in which their eyes were trained to see art historically.

Consequently, the emphasis on exposing students to as many (relevant) artworks as possible, to become experts, also required large investments in creating an academically adequate slide collection, since this formed the basis of knowledge claims made by the professor in the lecture hall. Both Vogelsang and Hudig relied on their professional network in the acquisition of slides. Based on the labels on the framework of the slides a diffuse picture of provenance arises. When scrutinizing these extensive slide collections, their materiality reveals the various ways in which these slides were acquired: on the one hand a large part of the slides were bought from commercial parties—albeit through an intermediary as seen in the case of Hudig—that were specialized in the photography of artworks, while on the other hand, it gives a glimpse of the exchange—forced or voluntarily—of the slides that were deemed imperative for art historical

[283] AK.H.I. UU. AWV. 1.3. "Jaarverslag Vogelsang, 1908-1909", 2.
[284] Nelson, "The Slide Lecture", 415.

teaching practices. In the case of the dispute between Von Bissing and Vogelsang, it has become clear that the importance that was attached to slide collections by the professor involved, was not simply based on their employment as teaching objects, but that they also revealed the expert-status of the collector itself. Thus, stressing Von Bissing's academic self, a way of selling himself as a specialist in the field of ancient (art) history.

Taken together, to create an art historical 'seeing style', Vogelsang and Hudig needed to rely on expertise that partly came from their own preferences and focal points, while simultaneously drawing upon the work that had been done by others, albeit specialized commercial companies or experts within a specialist field. Interestingly, as we have seen in the final example of this chapter, the 'art historical slide', also shows how the slides themselves can reveal specific didactical strategies, as a way of materializing the comparative method that was imperative for the study of art history. These examples enable the reconstruction of how comparisons were made in training students in discerning architectural styles, recognizing the style of a particular painter, but also to understand the development of artworks over longer, historical periods of time. For teaching practices then, the reliability of the image that was projected lay first in the choices made by the professor in advance, and secondly in their guidance of the students in how to look at these projected images that made artworks present. This is what is what the art of lecturing by means of projected images entailed in establishing art history as a full-blown scientific discipline in the Netherlands.

The training of new generations of art historians relied very heavily on new reproduction techniques that brought distant and geographically widespread objects of study, i.e., artworks, to the premises of a lecture hall/art history institute. In the next chapter, however, we will see what the lantern offered dentists for demonstrating the pathologies of their patients in teaching their students 'how to practice' dentistry. Instead of only learning how to recognize pathological conditions and diagnose patients, they also had to learn how to perform certain procedures, which also called for a different approach in training students. This can also be observed in their treatment and usage of the optical lantern.

Chapter 3.

Dentistry: a scientific craft

The preparatory force of the optical lantern

> Of the few lecture hours that are given, one can primarily expect additional comment to what is discussed in the outpatient clinic and further discussion treat specific dental topics.[285]

As far back as 1876, with the Act on Higher Education, there was still much debate within the dental field about the exact content of the discipline. The most pressing question at the time was whether dentistry should have its own status or simply be a branch of the medical sciences. The origin of this issue lies in the nature of dentistry as a discipline that was based on both "craft and science", as R. Anema put it in 1903.[286] Based on many writings, journal articles, committee reports, and political debates, the conclusion is that the question of how to organise dental education was very prominent in the late nineteenth, early twentieth centuries.

The early Dutch history of dentistry was highly influenced by the state of affairs overseas, particularly in America, the first country that founded a school dedicated to dentistry. But more importantly, many of the early Dutch dentists and lecturers studied in the United States, including the ones central to this chapter: J.E. Grevers and J.A.W. van Loon.[287] The reason was that the training of future dentists in the Netherlands was lagging far behind North America, but also England and Germany for that matter. At least until the year 1903, members of the Dutch Dental Society advised their students to study abroad, to later return with enough knowledge to acquire the title of dentist and practice their profession in the Netherlands.[288] In America, moreover, future Dutch professors and teachers may well have been inspired by the use of photography and photographic slides as part of their research and training.

In the past few decades, especially around important commemorative dates of the discipline (and the profession) itself, several studies have been published that trace the history of the frameworks that have been developed over time to give dentistry its 'rightful' place within the

[285] R. Anema, *Tandheelkunde als Wetenschap en Handwerk* (Leiden: S.C. van Doesburgh, 1903), 362.
[286] Ibid., 359.
[287] A.A.H. Hamer, "John E. Grevers", in: *Nederlands Tijdschrift voor Tandheelkunde* (1918), 247, https://www.ntvt.nl/sites/ntvt/uploads/historisch_archief_artikelen/1918/05/Gecomprimeerd_NTvT_25_1918_247-251.pdf.; M. de Boer, "Justus Antoni Wilhelm van Loon. Zijn verdiensten als lector in de orthodontie aan de rijksuniversiteit te Utrecht (1911-1940)", in: *Nederlands Tijdschrift voor Tandheelkunde*, vol. 100 (1993), 75.
[288] Bijzondere Collecties Universiteit Utrecht. Archief Rijksuniversiteit. Folder HS. 28. 15-1. "Verslag van de Nederlandse Tandheelkundige Vereeniging over de toekomst van het tandheelkundige onderwijs aan Nederlandse universiteiten", 1903, 2-5. (Special Collections University of Utrecht. University Utrecht Archive. Folder HS. 28. 15-1. Report from the Dutch Dental Society about the future of dentistry at Dutch universities (1903) 2-5); A.M. Mertens, *Iets over Tandheelkunde en ons Tandheelkundig Onderwijs* (Den Haag: Nederlandsche Boek-en Steendrukkerij, 1905), 24.

academic structures.[289] Although many of the authors include "education" in their title, they concentrate mostly on the composition of the curriculum, more particularly on practical subjects. However, regarding the content of teaching, the difference between lectures and practical teaching is only reviewed in passing. Most of the emphasis is put on the necessity for dental students to pass both a theoretical and a practical exam, the question being which subjects needed to be included for dental students. During a parliamentary debate on a dentistry bill, in May 1876, Dutch MP Godefroi, a doctor himself, argued that, a thorough knowledge of the human body notwithstanding, a dentist does not need to know how to amputate a leg. Rather:

> The dentist must know the impact that his treatment of a tooth or molar has on the whole human body; therefore, this principle is taken into account in the examination that needs to be conducted. (...) Furthermore, the surgical part of dentistry, such as tooth extraction, the insertion of teeth and molars, as well as making and fitting dentures, demands a special skill set and proficiency that physicians do not possess and do not want to possess, since they do not perform these types of surgery.[290]

As this quotation clearly shows, it is the special skill set that needed to be developed through the dental curriculum as set up within the academic organizational structure. Dental education's purpose was to improve the future dentist's ability to treat diseases affecting the oral and maxillofacial regions, particularly to restore deformities that mostly involved surgical procedures. Therefore, the teaching practices had to revolve around a mixture of technique and science. In this chapter, I will dive deeper into the discussions about, and their implementation—including frequent changes—in, the dental curriculum between 1876 and 1913. Moreover, I address how the idea of dentistry as a discipline at the crossroads of craft and science was translated into a specialized curriculum. How did specialized subjects acquire their position within the academic structure? What ideas about the specific skill set that students needed to acquire can be retraced to the slide collection that is central to this chapter? In what ways did the optical lantern contribute, support or benefit the more practical emphasis of the discipline? How were slides used to make a specific argument or case?

This chapter will be divided into three parts. In the first part the debates about the legislative framework deemed necessary are briefly explained. What specific ideas underpinned

[289] See for example: Fer de Maar, *Van tandmeesters tot tandartsen: 100 jaar tandheelkundig onderwijs in Nederland* (Amsterdam: 't Koggeschip, 1977); D. Kortenhoeven, *Verboden voor onbevoegden. Een studie over de voorstellen tot verruiming van het wettelijk kader van de medische en paramedische beroepsuitoefening* (Utrecht: Nederlands Huisartsen Instituut, 1982); G.J. van Wiggen, *In meer eerbare banen. De ontwikkeing van het tandheelkundig beroep in Nederland van 1865-1940* (Amsterdam: Rodopi, 1987); M.J. van Lieburg, "Het tandheelkundig beroep in Nederland vóór 1865", in: *Nederlands Tijdschrift voor Tandheelkunde*, vol. 98 (July 1991), 271-277; O. Hokwerda, "Opleiding en bevoegdheid van tandartsen in de Nederlandse wetgeving", in: *Nederlands Tijdschrift voor Tandheelkunde*, vol. 104 (September, 1997), 328-331.
[290] Binnenland. "Kamer-Overzicht. Zitting van Donderdag 11 Mei". *Zutphensche Courant*, May 18, 1876. https://resolver.kb.nl/resolve?urn=MMRAZ02:000318078:mpeg21:p00006

the necessary changes? How did this eventually lead to the academic embedding? In the second part, the slide collection of John E. Grevers, lector at the University of Utrecht, is introduced and discussed. This collection provides clear insights into the emphasis of the curriculum, the role of textbooks for the composition of slide collections, while it also sheds light on the close connections between the development of a relatively new scientific field and its new areas of research and the importance of networking. In the third part, two specific lantern lectures will be discussed: 1) a lecture presented by J.E. Grevers in 1896; and 2) a lecture series by the German orthodontist Alfred Körbitz, which was reworked into a textbook by the Dutch orthodontist J.A.W. van Loon in 1908.

Part I. Legislative framework

In 1865 dentistry was first included in the academic organizational structure, albeit as a subsection of medical studies. One of the most important premises of this setup was the idea of "eenheid der stand" (unity of status), a safeguard against quackery. The enactment of this legislation, called "Medical Practice Act" (in Dutch: "Wet op de Uitoefening der Geneeskunst"), was meant to ensure that the exams were the same for all medical students, but also that from that point onwards, exams and admission into the medical profession could only be achieved when studying at a university or the Athenaeum.[291] But at the same time, and more importantly for our context here, it led to the training of practitioners, to educate qualified people that acquired the proper skills to practice the trade and were therefore more trustworthy in actually treating people.[292] Yet, as O. Hokwerda remarked, there was still no curriculum that was specifically directed at educating students in dentistry.[293] The introduction of this law had no immediate effect on the dental profession. One of the main problems was that few medical students pursued the profession of dentist, as a Dutch politician expressed in 1874: "The medical laws have been in place for nine years and only one dentist has been examined as a doctor here at The Hague".[294] There were even fears of a dearth of qualified dentists, as MP Godefroi reveals as he continues:

[291] Wachelder, *Universiteit tussen vorming en opleiding*, 136; M.G. Groen, *University Education in the Netherlands 1815-1980. Legislation and Civil Effect* (Eindhoven: Technische Universiteit Eindhoven, 1988), vi.
[292] Antonie M. Luyendijk-Elshout, "Medicine", in: Walter Ruëgg (ed.), *A History of the University in Europe: Volume 3. Universities in the Nineteenth and Early Twentieth Centuries (1800-1945)* (Cambridge: Cambridge University Press, 2004), 579; Kortenhoeven, *Verboden Toegang voor Onbevoegden*, 22.
[293] Hokwerda, "Opleiding en bevoegdheid van tandartsen in de Nederlandse wetgeving", 328.
[294] Tweede Kamer der Staten-Generaal. "Ontwerp tot wijziging der geneeskundige wet". *Algemeen Handelsblad*, #13465. June, 14, 1874. https://resolver.kb.nl/resolve?urn=ddd:010100739:mpeg21:p005.

> At the moment there are a few old dentists left who are still allowed to practice, but when they are dead and gone there will be a lack of dental help if this absurd application of the principle of unity of status is not reversed.[295]

In other words, the legislation of 1865 had not resulted in the desired effect, rather it turned out to be counterproductive, at least as far as dentistry was concerned. Therefore, a new legislative framework had to be established to clear the way for teaching and training dentists in a more specialized curriculum.

Despite the fear of creating a precedent that would invite other medical specialists to create their own separate status within academia, nevertheless the 1876 Act on Higher Education facilitated the development of dentistry as a medical specialism. Apart from the growing demand for qualified dentists, Godefroi also emphasized the need for dentistry students to obtain specific knowledge regarding "pulling teeth, inserting teeth, making and fitting dentures".[296] Academic dental training needed to bridge the world of specialized medical knowledge by directing the focus on those parts of the human body that were most relevant to dentistry, and the practical skill set that was indispensable to the performance of medical interventions such as the ones mentioned above.

The Higher Education Act specified that dentistry should be taught in at least one of the state-funded universities in the Netherlands. This honor was granted to the University of Utrecht, where in 1877 Dr. Theodoor Dentz was appointed as the first official lector in dentistry. In 1895 he also became director of the Dental Institute.[297] The Dental Institute was established after a building was made available at the Wittevrouwenstraat in Utrecht. The Institute was used for training students, but also for treating patients (in part functioning as an outpatient clinic).[298] The students who were admitted to Dentz's clinical classes had to have passed their theoretical exams first, an exam that could be taken at any of the medical faculties in the Netherlands. To complicate things even more, this theoretical exam was not part of a dental educational program, but was

[295] Tweede Kamer der Staten-Generaal. "Ontwerp tot wijziging der geneeskundige wet". *Algemeen Handelsblad*, #13465. June, 14, 1874. https://resolver.kb.nl/resolve?urn=ddd:010100739:mpeg21:p005.
[296] Binnenland. *Provinciale Overijsselsche en Zwolsche courant*. May 13, 1876. https://resolver.kb.nl/resolve?urn=MMHCO01:000068753:mpeg21:p002.
[297] *Wet tot regeling van het Hooger Onderwijs* (1876) 18-19; The University of Amsterdam was also taken into consideration. However, the professor of surgery, Tilanus, was not up for the job. Vervolg der Nieuwstijdingen. "Voordracht van Hoogleeraren aan de Amsterdamsche Universiteit". *Algemeen Handelsblad*. September 10, 1877. https://resolver.kb.nl/resolve?urn=ddd:010103313:mpeg21:p003; See also: Binnenland. "Tweede Kamer". *Algemeen Handelsblad*. #14154. May 13, 1876. https://resolver.kb.nl/resolve?urn=ddd:010972867:mpeg21:p001; "Kamer-Overzigt". *Dagblad van Zuidholland en 's Gravenhage* 12 mei 1876. https://resolver.kb.nl/resolve?urn=MMKB19:000888112:mpeg21:p00002; See also: "De Utrechtsche Universiteit, 1815-1936". Oosthoek,1936. Consulted on Delpher, 20-09-2023, https://resolver.kb.nl/resolve?urn=MMKB06:000008588:00013; H. Burger, *De tandheelkundige opleiding* (Amsterdam, 1907), 398.
Dr. Th. Dentz was a descendant of a dentist-family from Amsterdam, already practicing since the eighteenth century. He was the first of his family to study medicine at a university and eventually graduating from university and acquiring his title as dentist.
[298] J.M. Klinkhamer, "Dr. Th. Dentz", in: *Nederlandsch Tijdschrift voor Tandheelkunde* (1914): 639-640.

based on independent study, which sometimes required the help of a private tutor. In 1878 the medical faculty of Utrecht established a curriculum that functioned as a program of classes in six basic subjects: anatomy, physiology, histology, general pathology, pharmacy, and dental pathology.[299] The main focus of Dentz, however (once the students had passed their theoretical exam), was to prepare his students for their practical exam. This included more dentistry-specific subjects, such as surgical dentistry and the fitting of dentures and artificial teeth. Even though these subjects were part of the exam requirements, these skills could not always be properly taught or demonstrated because of a shortage of patients, or corpses for that matter.[300] As H. Burger commented later, the law still included severe flaws which led to students to having a very low level of their area of 'expertise' in their area of specialization.[301] Finally, the students of Dentz were also not yet recognized yet as students, instead they were called "auditors" ("toehoorders"), i.e., people that paid a fixed fee to attend a number of classes or lectures. As a result of all these factors the number of dentistry students remained relatively low until the 1910s.[302]

The Dental Advisory Boards: concrete ideas for reorganization

Notwithstanding the fact that dentistry was part of the medical faculty, the political interventions and the enormous number of articles that were published at the end of the nineteenth century discussing dental education and legislation, dental education itself still left much to be desired. The most obvious example, as noted, was the Dutch Dental Society's advice to aspiring Dutch dentists to study abroad; indeed, many of them went to America or Germany for their training.[303] If this was to change, clearly an academic program was needed in the Netherlands that would have at its disposal all the means and hours necessary to train students to become professional dentists.

In 1906, by order of the Minister of Home Affairs, Abraham Kuyper, a broad advisory committee was appointed that was charged with the task of "preparing proposals to amend the conditions for obtaining the qualification of dentist" and "reorganization of dental education at University Utrecht".[304] Members of this committee were prominent figures from the field itself,

[299] P.H. Buisman, "Ontstaan en ontwikkeling van het tandheelkundig onderwijs (1877-1940)", in: De Maar, 47.
[300] Dr. Th. Dentz regularly addressed complaints to the Exam Committee about the large amount of time that he 'wasted' on finding enough material/bodies for his students to perform their exams on. See Buisman, 46.
[301] H. Burger, *De tandheelkundige opleiding* (1907), 398; excerpted offprint of *Nederlandsch Tijdschrift voor Geneeskunde*, vol. 7; Buisman, "Ontstaan en ontwikkeling van het tandheelkundig onderwijs (1877-1940)", in: *Van tandmeesters en tandartsen.* (1977): 45-46.
[302] H. de Groot, "Openingsrede uitgesproken door Dr. H. de Groot", in: *Nederlands Tijdschrift voor Tandheelkunde*, 11 (1927), 828.
[303] Bijzondere Collecties Universiteit Utrecht. Archief Rijksuniversiteit Utrecht. Folder HS. Inv.nr.: 28. 15-1. "Verslag van het Nederlandsch Tandheelkundig Genootschap over de toekomst van tandheelkunde aan Nederlandse universiteiten aan de minister van Binnenlandse Zaken" (1903) 2-5; A.M. Mertens, *Iets over Tandheelkunde en ons Tandheelkundig onderwijs*, 24.
[304] BC. UU. Archief Rijksuniversiteit Utrecht. 28. 15-1. "Afschrift minister van Binnenlandse Zaken", September 1906.

among others: Theodoor Dentz, John E. Grevers, A.A.H. Hamer (Chair of the Dutch Dental Society), and Hendrik Zwaardemaker (professor of physiology at Utrecht University).

Within six months after their appointment, in January 1907, the committee reported on their main conclusions and recommendations regarding the reorganization of dental teaching practices. First, the admission requirements: after finishing their training at the H.B.S. or *gymnasium*—secondary school types that give access to university-level education—the student had to pass both physics (natuurkunde) exams (propaedeutic and undergraduate (or BS—Bachelor of Science). This measure was mainly necessary to guarantee that students acquire a general level of medical knowledge. Furthermore, this ruling also facilitated a shorter duration of study, since it was no longer focused on finishing the medical doctor's exam first, which took seven years.[305] Hence, both the theoretical and the practical exam could be fully focused on the acquisition of knowledge and skills that were fundamental for the dental profession only. The dental curriculum, according to the committee, should therefore be designed as follows:

I. Theoretical exam.

a. pathological dissection of teeth, oral cavity and adnexa, including bacteriology of the oral cavity;
b. Principles of theoretical surgery;
c. special pathology and therapy of the teeth and gums;
d. Pharmacology;
e. theory of conservative and prosthetic dentistry, both with practical demonstrations.[306]

The practical examination had to be organized as follows:

II. Practical exam.

f. Diagnostics and therapy of dental and oral diseases;
g. Operative conservative dentistry;
h. Orthodontics
i. Prosthodontics.[307]

Additionally, the report stated that the manufacture of dentures and artificial teeth should no longer be left to so-called dental technicians, as they lacked the knowledge regarding human anatomy and physiology.[308]

[305] BC. UU. 28. "Rapport der Commissie tot het voorbereiden van voorstellen tot wijzing der voorwaarden". (1907) 1, 4.
[306] BC. UU. ARU. 28. "Rapport der Commissie tot het voorbereiden van voorstellen tot wijzing der voorwaarden". (1907) 3.
[307] Ibid., 3-4.
[308] Ibid., 4.

The biggest difference with the earlier situation, however, was the increased importance of prosthodontics and orthodontics within the discipline of dentistry.[309] What is especially interesting regarding these two subjects is that both had to do with restoring the mouth and jaw structures, dentition, and its appearance. As we will see later in this chapter, much attention was being paid to laying the foundations of how, by means of new techniques, the 'normal' could be accessible for all. However, to actually implement these innovations an expansion of the teaching staff was needed. Therefore, the committee argued that it was necessary to appoint three lectors and three assistants. Similarly, the Dental Institute also needed to accommodate the larger number of teaching subjects, the (expected) growing number of students, as well as the increased emphasis on practical education. In addition to two outpatient rooms, both a small and a big one; space for a workshop for casting plaster models, and facilities to make and develop X-ray photographs, it demanded an amphitheater-style lecture hall with room for 60 students and which offered the possibility of "projecting lantern slides".[310] Here, we have the blueprint of the efforts made in subsequent years to turn dental education into a scientific discipline with its own specific angle, i.e., that of practical craftsmanship.

In what follows in this chapter, I will elaborate on the significance of prosthodontics and orthodontics, which were taught by John E. Grevers and J.A.W. van Loon. As my research in various archives shows, these two men were key players in sharing knowledge regarding these new subjects in the Netherlands. In doing so, I link these new subjects to the instrumental role played by the optical lantern in disseminating such practical knowledge.

[309] Earlier, several dentists had already advocated the inclusion of these subjects. See: Anema, *Tandheelkunde als wetenschap en handwerk*, 27, 44-45; H. Réthy, *Universitaire opleiding tot de mond-en tandheelkundige specialiteit* (Haarlem: De Erven F. Bohn, 1906), 36.
[310] BC. UU. ARU. 28. "Rapport der Commissie tot het voorbereiden van voorstellen tot wijzing der voorwaarden". (1907) 5, 7.

Figure 45. J.A.W. van Loon standing left of J.E. Grevers. [311]

Part II. Grevers' claim to fame through his lantern slides

As a young boy, growing up with a father who had his own dental practice, John E. Grevers aspired to follow in his father's footsteps. After spending his evenings with the local goldsmith, learning the tricks of the trade, eventually, like his brother before him, he went to America, to study dentistry. He stayed there from 1872 through 1877, much longer than he had anticipated.[312] After he had returned to the Netherlands, he earned himself the nickname "the American". It is suggested that this was partly due to the fact that Grevers spoke better English, or at least that he made more sense in English, than he did in his mother tongue, Dutch.[313] Another explanation is that he was so much influenced by the American way of teaching and training students of dentistry

[311] Photograph retrieved on 13 July 2023 from the website of Het Utrechts Archief. Catalogue number: 105947. "Groepsportret van lectoren van het Tandheelkundig Instituut te Utrecht." https://hetutrechtsarchief.nl/onderzoek/resultaten/archieven?mivast=39&mizig=287&miadt=39&milang=nl&mizk_alle=%22J.A.W.%20van%20Loon%22&miview=gal.
[312] Hamer, "John E. Grevers", 247. https://www.ntvt.nl/sites/ntvt/uploads/historisch_archief_artikelen/1918/05/Gecomprimeerd_NTvT_25_1918_247-251.pdf.
[313] Buisman, "Ontstaan en ontwikkeling van het Tandheelkundig onderwijs (1877-1940)", 53.

that his efforts to reorganize the Dutch curriculum were attributed to his experiences overseas. Grevers established a dental practice of his own in Amsterdam in 1886, before he was asked to be the assistant of professor Tilanus and become the director of the urban dental clinic connected to the University of Amsterdam. Next, in 1893 Grevers became the first *privaatdocent* in dentistry in the Netherlands, a position he would occupy until 1908.[314]

In 1908 Grevers was asked by Hendrik Zwaardemaker to become the successor of Dentz at the University of Utrecht. In his reply to Zwaardemaker Grevers was at first very resolute: "No".[315] The position he had at the University of Amsterdam was higher in status, especially in combination with his directorship of the outpatient clinic. Furthermore, as Grevers explained, he felt that the state of education at Utrecht left much to be desired; if he did take the job, it needed to be thoroughly revised. Furthermore, a lector he had less hours to spend on teaching than he had in his position as *privaatdocent*. In this letter, Grevers brought up another important aspect, namely his very extensive slide collection of a 1,000 lantern slides and "many microscopic specimen".[316] In mentioning this collection Grevers seems to have suggested two things: 1) to emphasize the importance he attached to his teaching practice, which was completely different from what had been the standard in Utrecht; 2) to try to position, if not sell, himself. It was not only a way to set himself apart from what, until then, was the common teaching practice, but he also showed that he had the material that would contribute to the practical training of students. What is furthermore interesting—and reminiscent of Egyptologist F.W. Von Bissing, in the previous chapter, and his attitude with regard to the meaning of the slides for his academic status—is that in Grevers' case too, the slides are endowed with a certain academic stature: they contain specialist knowledge that would potentially contribute to raising the level of education. In the end, however, Grevers did accept the invitation to become lector at Utrecht. According to historian P.H. Buisman, Zwaardemaker or another prominent figure in the university must have promised him the prospect of becoming *privaatdocent* or even professor by special appointment (although this never happened).[317]

[314] Hamer, "John E. Grevers", 248-249.
[315] BC. UU. ARU. Collectie Zwaardemaker. Correspondentie. "Brief van Grevers aan Zwaardemaker" (n.d.). (Special Collections University of Utrecht. Archive University. Collection Zwaardemaker. Correspondence. "Letter from Grevers to Zwaardemaker" (n.d.)). Probably in the year 1908, since it is about the succession of Dentz, who received his honorable discharge in 1908.
[316] Ibid.
[317] P.H. Buisman, "Johannes Eilert Grevers 1855-1955", in: *NTvT* (1955): 6. https://www.ntvt.nl/sites/ntvt/uploads/historisch_archief_artikelen/1955/01/Gecomprimeerd_NTvT_62_1955-3-8.pdf.

Figure 46. Portrait John E. Grevers in his study.[318]

In this part of the chapter I will investigate the slide collection as a reflection of the ongoing state-of-the-art research as part of the scientific discipline of dentistry. I will give two examples of series of slides within this collection that are consultable at the Museum Vrolik in Amsterdam.[319] The analysis will consider the practice of taking images from textbooks that are worth transforming into lantern slides and the use of new photographic technologies, such as X-ray and photomicrography. This, additionally, also sheds light on the personal preferences of Grevers in his own field of expertise.

Grevers' extensive use of slides must stem largely from his long stay in America, where slides had been used in dental education for quite some time. In the most important journal, *The Dental Cosmos* (running from 1860-1936[320]), dentists or oral surgeons submitted many articles on the advantages of showing slides for educational purposes. The earliest one I found on the lantern's use dates from 1864:

[318] Image retrieved from: J.A.W. van Loon, "In Memoriam. Johannes Eylert Grevers", in: *NTVT* (1933), 216. https://www.ntvt.nl/sites/ntvt/uploads/historisch_archief_artikelen/1933/03/Gecomprimeerd_NTvT_40_1933_212-228.pdf.
[319] Museum Vrolik is a medical museum that is based in the Academic Medical Center (AMC) in Amsterdam. Initially its collection was built upon the private collections of Gerard Vrolik and his son Willem Vrolik. But was later extended by the collections of other professors of the University of Amsterdam. Its focus is mainly on collections that deal with anatomy bot of human beings as well as animals. For more information, see: https://www.museumvrolik.nl/over-ons/.
[320] Information about *The Dental Cosmos*, was retrieved on 15 August, 2021 from the website: https://onlinebooks.library.upenn.edu/webbin/serial?id=dentalcosmos.

> […] to demonstrate to a large class at once all those delicate delineations and minute distinctions of microscopic structure which must otherwise either be left to the private labor of the student, or be at once imperfectly and painfully exhibited by a long and fatiguing process.[321]

As I have mentioned throughout this dissertation, the argument of simultaneousness as an important quality of the projection of slides is omnipresent, so it is no surprise to find it in dentistry, too. But in searching through the *Dental Cosmos* a more profound meaning is given to teaching dentistry with the lantern. A good example is the following quote from an article by professor of oral surgery, Matthew Cryer:

> […] there is something more in teaching than merely standing before a class and lecturing upon a given subject. It must be presented in such a manner that the student shall grasp it – shall make his own the information that the teacher imparts. […] Instruction embraces reception by the student as well as presentation by the teacher; this dual quality is the object and essence of teaching in the correct sense of the term. […] During the past ten years I have tried various methods of teaching the internal anatomy of the face, and I think I have been successful through the use of the method of making sections of the head in various directions, then photographing and making slides from the same for use with the projecting lantern. It is found that students become more interested in the lectures when pictures of the specimens are thrown upon the screen than when the specimen is held in the hand or when the head is placed upon the table.[322]

What is particularly striking in both quotations on the use of the optical lantern is that they account for objects that were transformed into lantern slides as well as with what specific photographic technique this came about. They both explicitly state that the greatest benefit of projection was that it enhanced the instruction of students about objects or structures invisible to the naked eye by guiding them collectively through the projection.

Grevers himself was exceptionally interested in the technique of photography. For example, he was a member of the Amateur Photography Society (Amateur Photographie Vereeniging) and in that capacity he also lectured about the "Frena Camera" in 1895 (Fig. 47).[323]

[321] Henry Morton, "Polarized Light", in: *The Dental Cosmos*, vol. 5, 1 (1864), 559-561. Retrieved on 6 August 2021 from the website: https://archive.org/details/dentalcosmos5186whit/page/560/mode/2up?q=lantern+slid. The leading journal at that time, *The Dental Cosmos* reports of a lecture that made use of lantern slides to demonstrate specimen as early as 1864. In further editions of the magazine, the mentioning of slides, lanterns, and specimen is frequent and normal, an indication of the prevalence of the optical lantern in dental and surgical teaching practices.

[322] Matthew Cryer, "The Practical Teaching of Anatomy in Dental Schools", in: *The Dental Cosmos*, vol. 45, 11 (1903), 842-843.

[323] Lux: Photo-Tijdschrift, "Maandelijksche Vergadering". Vol 6, 13A (83) (15 October 1895), 550, https://resolver.kb.nl/resolve?urn=MMNFM01:015832023:00002.

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THE "FRENA."

The various hand cameras of the "Frena" pattern (Messrs. R. and J. Beck), one of which is shown by Fig. 668, have deservedly won a high reputation. They all take forty notched flat films,

THE "TELEPHOTO CORNEX," "DAI CORNEX," AND "ZAMBEX."

Beck's "Telephoto Cornex" hand camera is available for use in the ordinary manner, while by means of an instantly adjusted extension, shown open

Fig. 668.—"FRENA" BOX PATTERN HAND CAMERA.

which are placed in the magazine in a pack, just as received from the makers, and, by an ingenious changing system of alternate notches and teeth, are exposed and removed into a receiving chamber

Fig. 667.—VOIGTLÄNDER'S "BRUNSWICK" HAND CAMERA.

Fig. 669.—"FRENA" FILM HOLDER.

by Fig. 670, it can be employed for telephotography. Besides the usual finders,

Figure 47. Frena Camera, shown in The Book of Photography (1905) by Paul N. Hasluck. [324]

Apart from 'regular' photography, Grevers was also interested in X-ray photography. What is more, according to one of his colleagues, A.A.H. Hamer, Grevers was the first person in the Netherlands to be in the possession of an X-ray apparatus.[325] X-ray photography was a promising new technology at the end of the nineteenth century, because of its ability to produce "faithful representations [...] of organs otherwise imperceptible to the eye"/"natuurgetrouwe afbeeldingen [...] van organen die anders voor 't oog onwaarneembaar zijn."[326] This would mean, moreover, that Grevers was one of the earliest adopters of X-ray photography, since the first applications in dentistry were reported to have taken place in 1896 by Dr. Walkhoff in Germany.[327]

In Grevers' slide collection there are two slides that display X-ray photographs of teeth (see Fig. 48 and 49). Yet, there is no evidence that these photographs were taken by Grevers. In fact, the frames of these slides strongly suggest that Grevers bought them in England, from the company owned by J. Moore, in Birmingham.[328] This indeed seems more likely, since he was a frequent guest at various international conferences, including England, where he might have bought them on one of his trips. Still, these slides are very particular, because of the way in which

[324] Paul N. Hasluck, *The Book of Photography: Practical, Theoretic and Applied* (London: Cassell and Company, 1905), 508.
[325] Hamer, "John E. Grevers", 250.
[326] G.C. Bosch, "De Röntgen'stralen in de Tandheelkunde", in: *NTvT* (1899), 308. It should be noted that organs are not visible through X-ray photography. This quote also reflects the *Zeitgeist*, the novelty of this technique, i.e., discovering what it could show and for what purposes this could best be used.
[327] Judit Forai, "History of X-Ray in Dentistry", in: *Revista de Clínica e Pesquisa Odontológica,* vol. 3, 3 (2007), 208; Van Wiggen, *In meer eerbare banen*, 35.
[328] Collectie Museum Vrolik. Collectie John E. Grevers. Uninventoried. Glasdia collective J.E. Grevers. Box VIII. "Reductio/Retentio/Dent.Accessori". (Collection Museum Vrolik. Collection John E. Grevers. Uninventoried. Lantern Slide Collection J.E. Grevers. Box VIII. "Reductio/Retention/Dent.Acessori"). Slide with copper label entailing two cut out X-ray photographs. The frame shows the name of J.Moore of Birmingham and a serial number: No. 144501.

the X-ray is inserted into the frame. However, this may of course also have to do with the fact that this technology was still very new and not necessarily made with an eye to transform them into slides. According to historian G.J. van Wiggen, it took until the Second World War before every dental practice had an X-ray apparatus at its disposal.[329]

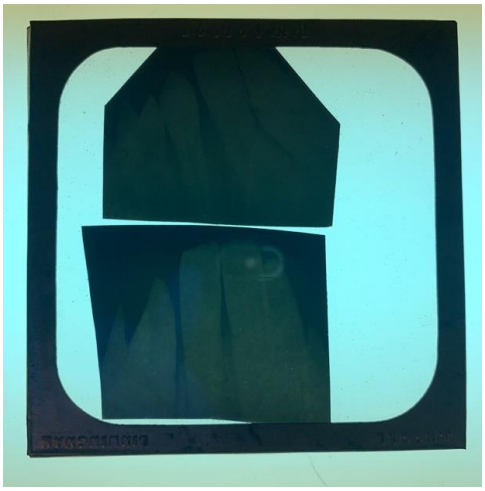

Figure 48. Two X-ray photographs in one slide frame. (Museum Vrolik, Collectie Grevers). (Photographed by the author).[330]

Figure 49. Fig. 49. Focus on the frame of the same slide, with the text: J. Moore. Birmingham. (Photographed by the author).[331]

[329] Van Wiggen, *In meer eerbare banen*, 35.
[330] CMV. Collectie Grevers. Uninventoried. Box VIII "Reductio/Retentio/Dent.Accesori".
[331] Ibid.

Another important technique in the study of dentistry, and also part of Grevers's collection of slides is photomicrography. This technique was (becoming) indispensable for medical practices, as the American doctor, W.C. Bordon, stated in 1896:

> With the extensive use of the microscope in medicine and scientific research the need has been felt of obtaining exact pictorial records of many objects seen. Drawings, either free-hand or by aid of the camera-lucida, are extensively used, but they are of necessity always more or less diagrammatic and often fail to give the necessary exactness, both from the possibility of eliminating the personal equation of the draughtsman and from the inability to reproduce the appearance of organic structure by line and stipple.
> Photographic processes, on the other hand, give pictures which in detail of form and structure are second only to the objects themselves; and the value of good microphotographs as aids in teaching and for comparison for further publication, is generally accepted as unequalled, and their use is becoming more and more common.[332]

What is important in this quotation is the difference that is being made between drawings and photographs in reproducing microscopic observations. Bordon suggests that as a teaching aid the photomicrograph is the best possible way to transmit knowledge about the structure of objects that are invisible to the naked eye.

Photomicrography, in contrast to X-ray, already existed in the 1830s and became known through the pioneering work of Alfred Donné and Leon Foucault. When they published their *Cours de microscope* (1845), they also reviewed the didactical affordances of these photomicrographs, stating: "these plates will especially aid the teaching of microscopy".[333] Due to technical complexities in these early days, however, it took until the 1880s, through the pioneering work of Robert Koch, that it "revolutionized the project of photomicrography and brought it to use into wide acceptance in scientific journals".[334] For Koch, the value of photomicrography fundamentally lay in the fact that the photograph offered a possibility to discuss the exact same object—a specimen captured at a specific moment under the microscope—while guiding of the gaze of the people one is working with.[335] By extension, this argument could indeed be translated into a lecture, or more specifically a classroom situation, where the photographic recording of a microscopic specimen under the microscope (captured under specific conditions, such as

[332] W.C. Bordon, "Practical Microphotography", in: *Medical Record*, vol. 49, 18 (1896), 617.
[333] A. Donné and L. Foucault, *Cours de Microscopie. Anatomie microscopique et physiologique des fluids de l'économie. Atlas exéctué d'aprés nature au microscope daguerreotype* (J.B. Ballière: Paris, 1845) quoted in: Maria Estela Jardim and Marilia Peres, "Photographing microscopic preparations in the nineteenth century: Techniques and Instrumentation", in: Marcus Granato, Marta C. Lourenço (eds.), *Scientific Instruments in the History of Science: Studies in Transfer, Use and Preservation* (Museu de Astronomia e Ciências Afins, Rio de Janeiro, 2014), 300-302.
[334] Karl-Magnus Gustav Brose, "Photomicrography and the Problem of Scientific Realism", in: *INTAGLIO: University of Toronto Art Journal*, vol. 1 (2019), 42.
[335] Robert Koch, "Zur Untersuchung von pathogenen Organismen", in: *Mittheilungen aus dem Kaiserlichen Gesundheitsamte* (Berlin: Reichsgesundheitsamt, 1881), 10-11. https://archive.org/details/s3728id1338102/page/2/mode/2up.

magnification) allowed for the calibration of the eyes, thereby ensuring that a particular phenomenon was viewed in the way that the professor intended.

The micrographs transferred onto lantern slides in the collection of Grevers are preserved in a wooden box labelled "hypoplasia caries" and depict cases of "hypoplastic teeth", teeth that suffer from the underdevelopment of enamel (see Fig. 44-50).[336] Their presence in the slide collection indicates their use for lecturing. And indeed, based on an article written by dentist Hamer in 1918, we can conclude that Grevers did lecture on—among other things—on "hypoplasia dentalis" before the Dutch Dental Society.[337] In addition, in one of the folders from his archive housed at the Special Collections of the University of Amsterdam, I have retrieved notes written on a number of sheets of papers that together form a complete, written out text, as well as brief descriptions of the visual aids that he used for his research but probably also one of his lectures. The discussion in the written texts suggests that it was a preparatory text for a research paper that he presented for this occasion. However, this does not exclude the possibility that this in part might have also been used in his teaching, especially because the slides ended up in the collection that was also connected to his teaching activities.

In 1916, Grevers started to study the condition of hypoplasia, which was partly motivated by a series of articles published by two American dental scientists, G.V. Black and Frederick S. McKay, who researched the lesion of mottled teeth ("a chronic endemic form of hypoplasia of the dental enamel caused by drinking water with a high fluoride content when a child is in the time of tooth formation"[338]).[339] According to Black and McKay, mottled teeth were an endemic condition that occurred in "certain well-defined geographical areas" among people who were either born or grew up there.[340] Part of this assertion was based on the belief that artesian water was one of the important contributing factors in causing this lesion.[341] In Grevers's reflections in his notes, he expressed his doubts about this opinion. First, because since the publications of Black and McKay

[336] CMV. Collectie Grevers. Lantern slide collection. Box "hypoplasia caries".
[337] Hamer, "John E. Grevers", 250. The year in which Grevers lectured about this is unknown, however, it must have been after 1916, because then he started his own investigations into this topic.
[338] Definition extracted from the online medical dictionary: https://medical-dictionary.thefreedictionary.com/mottled+tooth.
[339] Frederick S. McKay and G.V. Black, "An Investigation of Mottled Teeth: an Endemic Developmental Imperfection of the Enamel of the Teeth, Heretofore Unknown in the Literature of Dentistry", in: *The Dental Cosmos*, vol. 58, 5 (May 1916), 477-484; The following articles were published in June, July, and August of the same year, 1916. https://quod.lib.umich.edu/d/dencos?rgn=full+text;size=25;sort=occur;start=101;subview=short;type=simple;view=reslist;q1=Mckay.
[340] McKay and Black, "An Investigation of Mottled Teeth", in: *The Dental Cosmos*, vol. 58 (May, 1916), 477.
[341] Frederick S. McKay, "Progress of the year in the investigation of mottled enamel with special reference to its association with artesian water", in: *The Journal of the National Dental Association*, vol. 5, 7 (1918), 721-750. As becomes clear from this article as well as a letter in the archive of John E. Grevers, Grevers and McKay exchanged specimen as part of both their (connected) investigations. According to the letter Grevers received from Mckay in 1916, he received some specimens of mottled teeth, whereas Grevers send McKay photographic images of patients exhibiting mottled teeth. BC. Archief J.E.Grevers. Box B-8. Letter from Frederick S. McKay to Grevers. August 12, 1916.

it had become apparent that the occurrence of mottled teeth had also been observed in European countries, such as Switzerland. And second, Grevers did not agree with the assertion that artesian drinking water alone could cause mottled teeth. He was convinced that it also had to do with a congenital defect of the enamel, i.e., hypoplasia.[342]

Inserted in the Grevers's notes are eleven micrographs, which were "kindly photographed by Wertheim Salomonson", and all depict specific cases of hypoplastic teeth.[343] This reference to J.K. Wertheim Salomonson—became *privaatdocent* in radiology in 1899 and would later become the first professor in neurology and radiology in the Netherlands, appointed in 1915—emphasizes the character of this text as a research report that not only presented his results, but also accounted for the producer of the images, thus demonstrating the importance of close cooperation between different scientific specialists.[344] Apart from these images being inserted in the notebook, some of these micrographs were also transferred onto lantern slides (fig. 50-57). Unfortunately, the notes do not reveal what exactly Grevers (might have) discussed during their projection. Yet, it is plausible to conclude that within the context just discussed these images functioned as a way of participating in the debate on the causes and symptoms of mottled teeth, particularly focusing on hypoplasia. Moreover, these images depict the material that he used to further study the occurrence of hypoplasia:

> Thanks to the kindness of Dr. van Loon, I possess a tooth taken from a 12-year-old boy that, in our opinion, exhibits characteristics corresponding to Black & McKay's description. And tracing my collection, I believe I have found a few more specimens that match the characteristics described to us by Black & McKay.[345]

This fragment clearly shows the investigative phase Grevers was in at this point. And again we find an example of the close cooperation between him and one of his colleagues, in this case J.A.W. van Loon (whom I will further discuss in the final part of this chapter). Mentioning Van Loon and the specimen that he received from him also serves the purpose of justifying his findings. Additionally, by referring to his own collection, he also offers "proof" of the research presented by

[342] BC. UVA. Archief J.E. Grevers. Box XIII. B-8. "Aantekeningen mottled teeth" (n.d.) 40-43.
[343] Ibid., 60.
[344] Van Wiggen, *In meer eerbare banen*, 35; Geo J. Ziegler, "Periscope of Medical General Science in Relation to Dentistry", in: *The Dental Cosmos*, vol. 12, 10 (1870), 558. Retrieved form archive.org on 29 July 2021. https://archive.org/details/dentalcosmos1218whit/page/558/mode/2up?q=%22Photography+in+medical+instruction%22. In this article Ziegler states that European hospitals and colleges were employing "skilled photographers" who manly photographed patients or specific types of "manifestations of disease or surgery". The use of Salomonson points to the use of a "skilled photographer" by Grevers in order to make faithful images. Most probably Grevers and Salomonson knew each other from the time when they were both teaching at the University of Amsterdam. Further information about Wertheim Salomonson can be retrieved from: https://resources.huygens.knaw.nl/bwn1880-2000/lemmata/bwn2/wertheim.
[345] BC. UVA. Archief J.E. Grevers. Box B-8. "Aantekeningen mottled teeth" (n.d).

Black & McKay, by making himself a witness of similar examples as supplied by the two other men.[346]

Since this is the only notebook that deals with the topic of hypoplasia, to grasp how exactly these slides might have been used for teaching would require more contextualization. Yet, the fact that these slides belong to the larger collection that Grevers used for his teaching makes it plausible that they were integrated in some of the courses. This topic most likely would have been part of a course in histopathology, a field that studies the "diseases of [dental] tissues" through the microscope; in a lantern lecture these images might have been used to demonstrate the symptoms and structure of such teeth.[347] The *Verslag van den staat der hoooge-, middelbare en lagere scholen* from 1917 (reporting on the academic year 1916-1917) mentions that Grevers gave a course in "patho-histology of dentition".[348] The inclusion of this specific topic was most probably part of the theoretical education that was deemed fundamental in training students specialized technical skills "in everything that occurs in practice".[349] As a recent, state-of-the-art research topic, but more importantly, as a particular dental lesion occurring with various patients worldwide, this topic needed to be grasped by students in their preparation for their future dental practices.

[346] The study by Black and McKay was published in the *Dental cosmos* in 1916. An interesting page from this article shows the similarities between the images of Black and McKay and those made by Salomson at the request of Grevers: see: https://www.flickr.com/photos/rosefirerising/372706836/in/photostream/.
[347] Definition of histology retrieved from the website: https://www.ncbi.nlm.nih.gov/books/NBK557663/#:~:text=Medical%20Histology%20is%20the%20microscopic,the%20tissue%20may%20have%20undergone..
[348] *Verslag van den staat van het onderwijs in het Koninkrijk der Nederlanden over 1916-1917. Eerste deel hooger- en middelbaar onderwijs* (1918), 24. Consulted on Delpher on 19-09-2023, https://resolver.kb.nl/resolve?urn=dts:1496001:mpeg21:0003. In the following years Grevers gave courses in histology, anatomy of teeth, and pathology of teeth, which could also have been dealing with this phenomenon.
[349] C. van der Hoeven, "Tandheelkundige Opleiding", in: *Nederlands Tijdschrift voor Tandheelkunde*, vol 8, 8 (1914), 482, https://www.ntvt.nl/sites/ntvt/uploads/historisch_archief_artikelen/1914/08/Gecomprimeerd_NTvT_21_1914_480-483.pdf.

Figure 50. Original microphotographs made by Dr. Wertheim Salomonson as requested by Grevers. I. Thick cross-section of a tooth. II. Longitudinal section of tooth. (Bijzondere Collecties UVA. Archief Grevers). (Photographed by the author). [350]

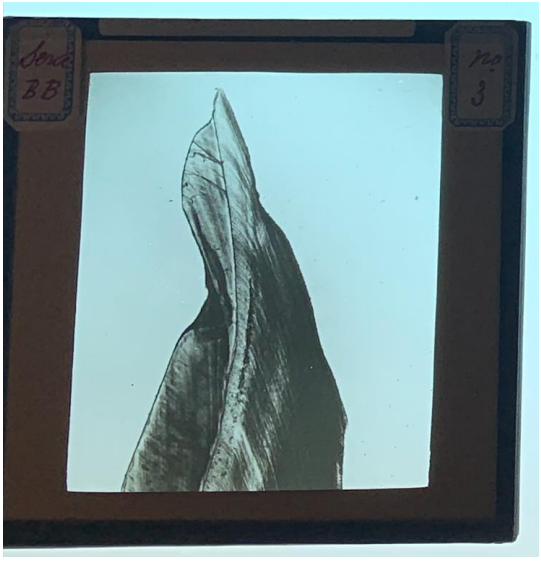

Figure 51. The lantern slides of microphotograph I. (Collectie Museum Vrolik). (Photographed by the author).[351]

[350] BC. UVA. Collectie Grevers. Box XIII B-8. "Aantekeningen mottled teeth" (n.d.) 10.
[351] CMV. Collectie Grevers. Box "Hypoplasia. Caries", slide number 3.

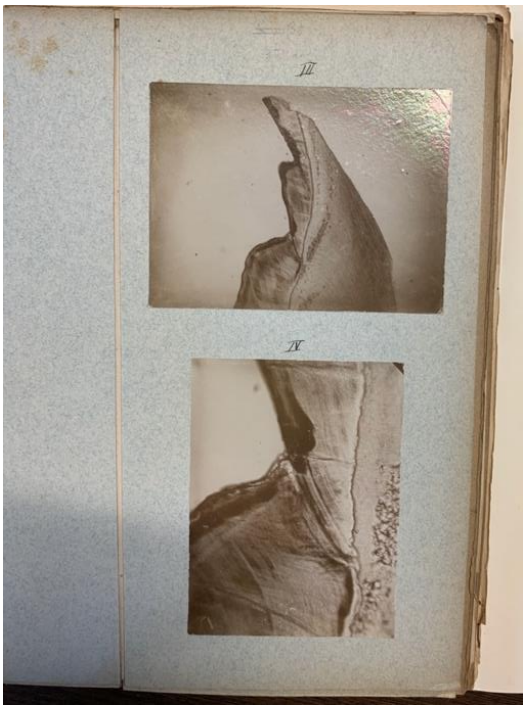

Figure 52. Microphotographs made by Dr. Wertheim Salomonson. III. Two deficiencies, weak enlargement. IV. Same as III. Stronger enlargement. (Bijzondere Collecties UVA. Archief Grevers). (Photographed by the author).[352]

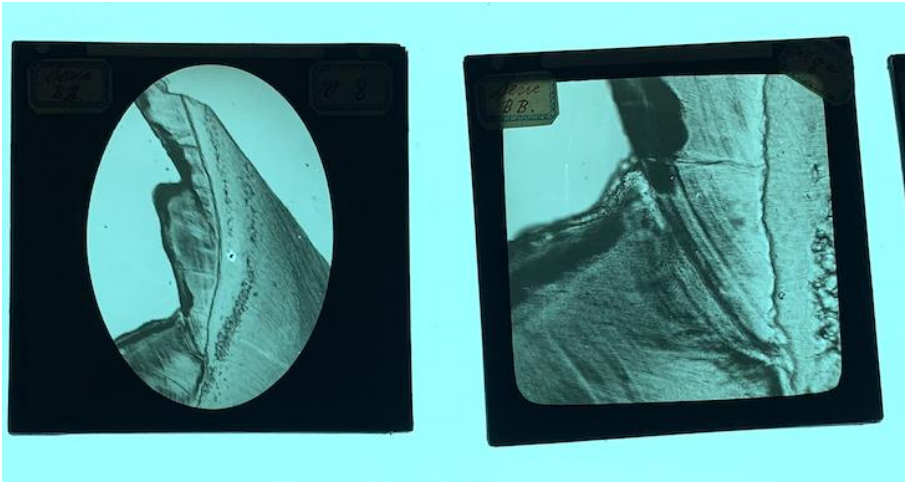

Figure 53. Lantern slides of microphotographs by Salomonson, notebook number III and IV. (Museum Vrolik. Collectie Grevers). (Photographed by the author).[353]

[352] BC. UVA. Collectie Grevers. Box XIII B-8. "Aantekeningen mottled teeth" (n.d), 11.
[353] CMV. Collectie Grevers. Box "Hypoplasia. Caries".

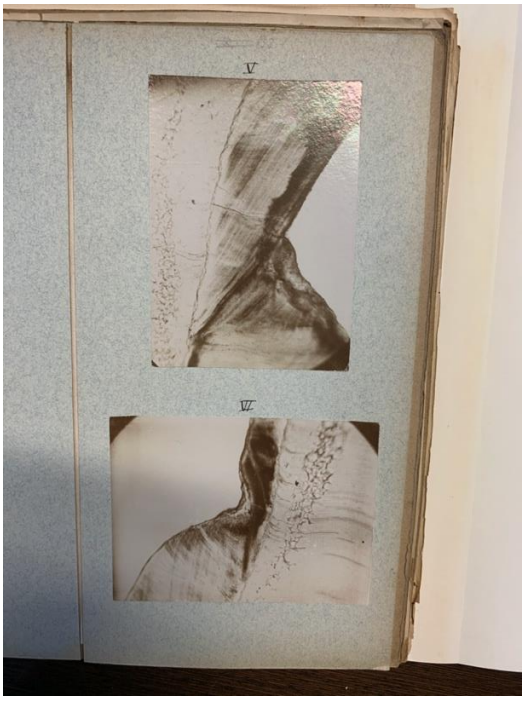

Figure 54. Microphotographs by Dr. Wertheim Salomonson. VII. (On the bottom left the original photograph, on the right the lantern slide) In this specimen the hypoplasia expanded over a large part of the dentine. Upper part shows abnormality; lower part shows norm. (Bijzondere Collecties UVA. Archief Grevers). (Photographed by the author). [354]

Figure 55. Lantern slide after the microphotograph after image VI. [355]

[354] BC. UVA. Collectie Grevers. Box XIII B-8. "Aantekeningen mottled teeth" (n.d), 13.
[355] CMV. Collectie Grevers. Box "Hypoplasia. Caries", slide number 7.

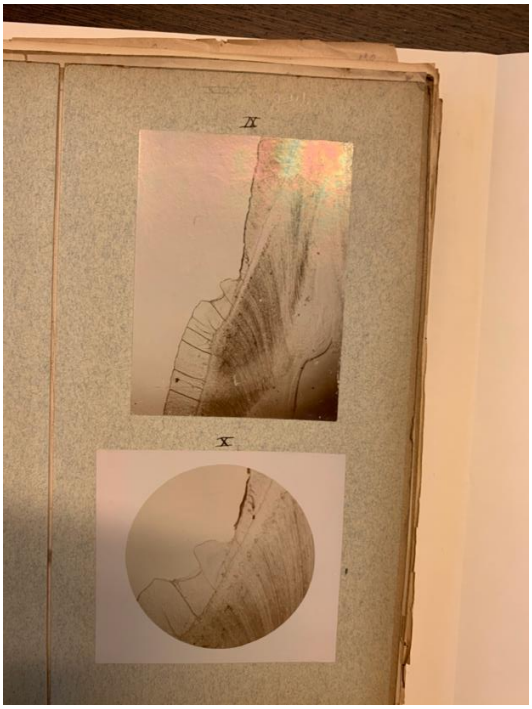

Figure 56. Microphotographs from hypoplastic teeth by Wertheim Salomonson.IX. A special thin cross section of a hypoplastic incivivus (lower jaw) X. The defect under strong enlargement. In this specimen the line of Isigmondy is nicely visible. Despite the fact that IX and X do not clearly show it, all the other speciments demonstrate the Interglobal space of Czermack. (Bijzondere Collecties UVA. Archief Grevers). (Photographed by the author).[356]

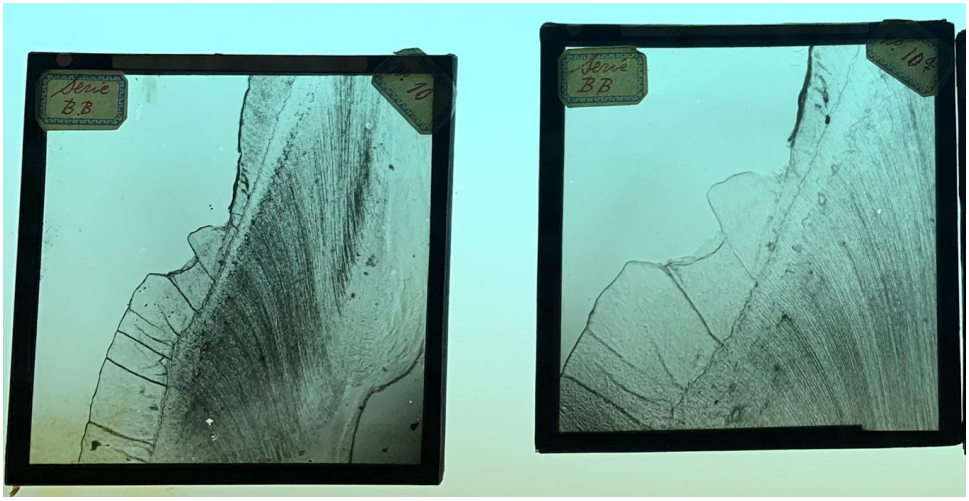

Figure 57. Two lantern slides after microphotographs IX and X. (Collecie Museum Vrolik. Collectie Grevers). (Photographed by the author).[357]

[356] BC. UVA. Collectie Grevers. Box XIII B-8. "Aantekeningen mottled teeth" (n.d), 14.
[357] CMV. Collectie Grevers. Box "Hypoplasia. Caries", slide number 10 and 10a.

It is important to note, however, that the specific approach that Grevers took in discussing his research results in the lantern lecture that he gave at the Dutch Dental Society might have differed from how he treated this topic when presenting this subject to his students. For one, the rhetorical strategies with which Grevers referred to his colleagues, such as Salomonson and Van Loon, might have been inadequate when addressing his students. Nonetheles, discussing the pioneering work of Black and McKay, by comparing their cases with the ones that he had investigated, must also have been important for students in understanding the mechanisms of the thought collective in moving forward in acquiring knowledge about "everything that occurs in practice". Moreover, the micrographs themselves created a specific way of looking at teeth or lesions. It might have set the standard for observations through the microscope, recognizing hypoplastic teeth, i.e., knowing what to look for in diagnosing this condition. Indeed, these projected images, by calibrating the eyes of the students, functioned as gateways into the realm of microscopic study, one of the crucial parts of the specialism of dentistry.

This example shows how ideas, techniques, methods, and new questions are prompted by the dental thought collective at large. In this sense, professors were advocates of their thought collective, invested in ensuring the trickling down of this knowledge through their academic teaching practices in preparing students for their future profession. What the inclusion of examples from real-life patients or original specimen underscores is the fundamental connection between theory and practice. These images, as part of the 'seeing style' applied by Grevers, trained students in grasping what the characteristics of hypoplastic teeth are, more importantly, how to recognize this phenomenon when looking through the microscope.

As we have seen in the previous chapter about art history, the provenance of the various lantern slides in institutional collections was heterogeneous. In Grevers's case, in addition to the inclusion of images based on innovative photographic techniques, most of the images—both drawings and photographs—in the slide collection were extracted from books—both drawings and photographs. The emphasis on visualizations from books is striking, but not uncommon.[358] A developing scientific field, based on growing specialization, demanded from its teachers that they were aware of new research, new methods, etc. Hence, the large book collection—"one of the most comprehensive in the dental field", according to Hamer—that Grevers brought together during

[358] For example, in perusing a collection of chemistry slides attributed to professor J.M. Bijvoet the same reliance on extraction from books was visible. On March 13, 2023, Frank Kessler and I visited the Chemistry department of Utrecht University to go through the collection of lantern slides that has been handed down. Professor J.M. Bijvoet was particularly known for his research into the analysis of chemical structures by means of X-rays.

his career.[359] The next example that is central here will show the unique case of the interplay between specialist literature and the visual teaching aid of lantern slides.

Prosthodontic dentistry

The entire Grevers collection consists of seventeen, varied-size boxes. Two of those boxes are devoted to prosthodontics, the subject (as mentioned in the first part of this chapter) that occupied an important place within the dental curriculum. Remarkably, these boxes also had a name written on the wooden exterior, that of "Cl. Martin", referring to Claude Martin, the French dentist who was well-known at the time for his groundbreaking work on prostheses. This was especially sparked by his book *De la prothèse immédiate*, first published in 1889.[360] In this work Martin demonstrated his newly developed method of placing prostheses directly into the cavity left by resection surgery (surgical removal of part of an organ or structure). Prior to the invention of this method, the resection of a tumor in the mouth, for example, was followed by a period of recovery before the prosthesis was inserted. However, this procedure itself caused additional problems: tissue surrounding the cavity might have adapted to the new situation, so that when the prosthesis was implanted extremely painful adjustments were required. On top of that, the recovery period also caused severe discomfort during eating and drinking. Therefore, dentists like Martin were working to find a method that would reduce the patients' discomfort.

The book *De la prothèse immédiate* contained 230 illustrations (both drawings and photographs) that showed different types of condition he had encountered in his practice, followed by showing the solutions in the form of prostheses that he used in surgery. Going through Grevers's boxes of slides with the name of Martin on it, one notices that most of them correspond to the images used in the book.

[359] Hamer, "John E. Grevers", 250.
[360] Claude Martin, *De la prothèse 129esection. Applique a la resection des maxillaires* (Paris: G. Masson, 1889). Consultable online via archive.org: https://archive.org/details/delaprotheseimm00martgoog/page/n8/mode/2up.

Figure 58. Negatives of some of the photographs used by Martin for his publication in 1899. (Collectie Museum Vrolik. Collectie Grevers). (Photographed by the author).[361]

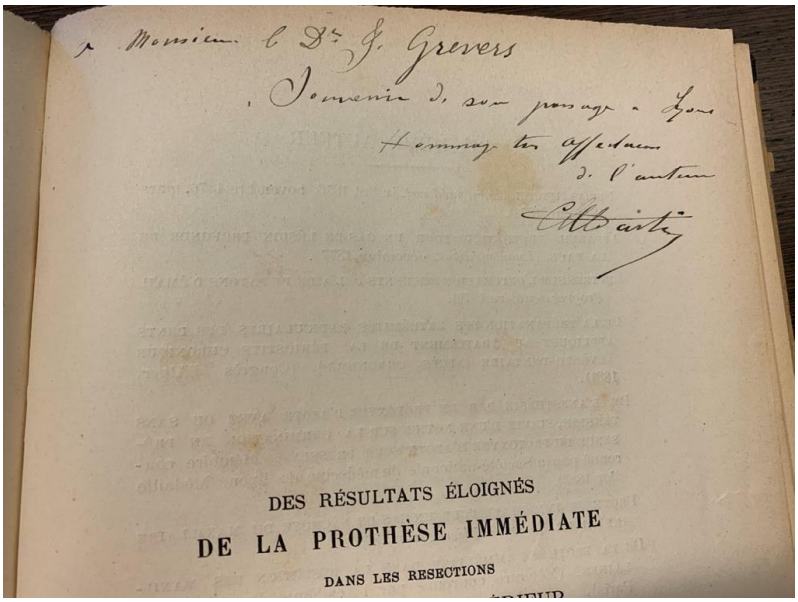

Figure 59. Note by Claude Martin to Grevers on top of the page: "A monsieur Dr. J. Grevers, Souvenir de son passage a [sic] Lyon. Hommage trés affectueux de l'auteur Cl. Martin." (Bijzondere Collecties UVA. Archief Grevers). (Photographed by the author).[362]

[361] CMV. Collectie Grevers. Box. XXIV. Neg. Prothese. Cl. Martin.
[362] In the book from Claude Martin the "Geschenk Grevers 130esections" situated at Bijzondere Collecties UVA, belonging to the Archief Grevers.

However, the materials show an even deeper connection to the work of Martin, apart from the lantern slides, as one box also contained the glass negatives of some of the images (see Fig. 58). The first question is: how did Grevers obtain these original negatives? This finding suggests that there was a personal exchange between Grevers and Martin regarding the photographic material. Although no extensive documentation has survived regarding a meeting between Grevers and Martin, an important indication can be found in Martin's book in the Grevers collection, the title page of which reads: "A Monsieur Dr. Grevers. Souvenir de son passage a [sic] Lyon. Hommage très affectueux. Cl. Martin" (see Fig. 59).[363] Even though this remark refers to the book itself, it cannot be ruled out that Grevers also received the negatives during his visit to Lyon, where Martin's clinic was.

But then a new question arises: why did Grevers receive these negatives in the first place? Why would Martin give them to one of his international colleagues when the photographs concerned his own patients and his own research? In answering these questions, I cannot escape some speculation: with the idea of the epistemic image in mind, we may understand this gift as part of the visual exchange of ideas, more particularly the idea that these images contributed to further discussion, further elaboration, and to monitor the spread of this specialized knowledge. One consideration by Martin could have been that, in discussing his work with Grevers during his visit and learning about his desire to teach his students about it or to further develop the method, he wanted to make sure that the material he used for that met his own—i.e. Martin's—standards. Another explanation could be that Martin wanted Grevers to share his work in the Anglo-Saxon world, in which he was very active (Grevers regularly visited international conferences in America, England, but also in France and Germany).[364] The reason why this is likely, is because Grevers held a lantern lecture about Martin's method at the 1896 International Meeting organized by the Dutch Dental Association (Nederlandsch Tandheelkundig Genootschap), the Eastern Counties Branch of the British Dental Association, and the Dutch Dentists Society (Nederlandsche Tandmeesters-Vereeniging).[365]

Before further analyzing the lecture to see how Grevers used the slides, and more specifically, for what purpose, I want to draw attention to a remarkable aspect. While the positive before-and-after images of treatments—the published photographs in Martin's book and Grever's lantern slides (Fig. 60-61) —are identical, when we compare both to the negatives (Fig. 58, second

[363] Fig. 26. Martin, *Des résultats éloignes de la prothèse 131esection dans les 131esections du maxillaire inférieur* (Paris, 1893) 3.
[364] Buisman, "Johannes Eilert Grevers 1855-1955", 5.
[365] "Handelingen der Gecombineerde Vergaderingen van het Nederlandsche Tandheelkundig Genootschap, de Eastern Counties Branch der British Dental Association en de Nederlandsche Tandmeesters-Vereeniging gehouden op 28, 29 en 30 juni 1896 te Amsterdam en Utrecht", in: *NTvT* (1897), 39-44, https://www.ntvt.nl/sites/ntvt/uploads/historisch_archief_artikelen/1897/01-02/Gecomprimeerd_NTvT_4_1897_29-51.pdf.

row on the right), a difference becomes apparent: the absence of the oval framing surrounding the bust of the woman.

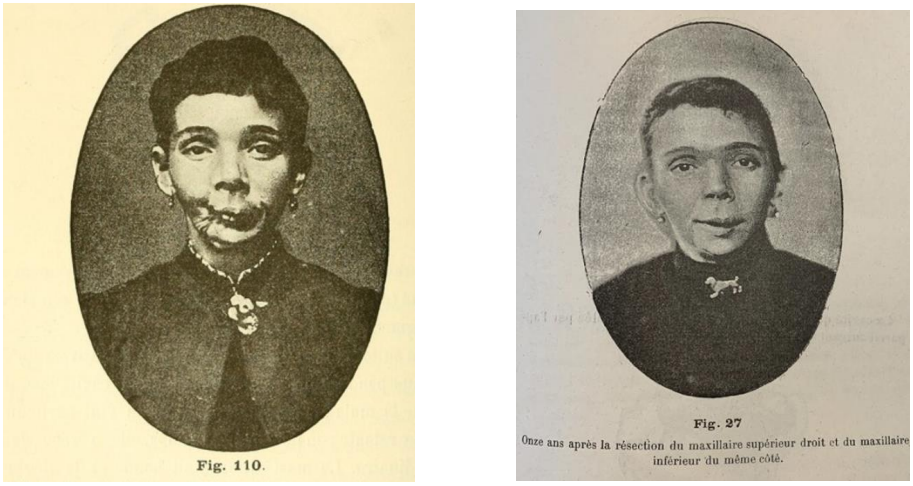

Figure 60. Before and after image of retention surgery in Prothèse Immédiate (1893) by Martin. [366]

Figure 61. Lantern slides of one of Claude Martin's patients, from the Grevers collection at Museum Vrolik. (Photographed by the author). [367]

In the process of transforming the photograph into a photographic lantern slide this would not necessarily lead to the oval framing of the image, much less so as Grevers was in the possession of the negative, which had no oval framing. However, the fact that he made one by means of the black paper used to frame these slides suggests that he did so with a purpose, i.e., that it had an

[366] Compare with the negative of these images as shown in Fig. 58: second row on the right. Martin, *Des résultats éloignes de la prothèse 132esection dans les 132esections du maxillaire inférieur* (1893) 76.
[367] CMV. Collectie Grevers. Box XIV "Prothese/Immediate". The so-called before-and-after images.

additional meaning. As I will argue, the oval framing was part of the strategy to humanize the person portrayed. Photographs of patients are hardly ever neutral depictions of people; rather, they are objects used for registration, diagnosis or observation. Scholar Kathy Newman writes in her study of a photo album containing photographs of wounded American Civil War soldiers in 1865:

> The oval frame and the image contained within it create the boundaries between these wounded "others" and ourselves. These photographs prescribe what is "normal" by representing what is not, while simultaneously creating a new social category that is at once marginal and heroic: the "disabled" veteran.[368]

Newman's case study is based on a collection of photographs that depict wounded soldiers and not their treatments. As she remarks, most of the captured soldiers were beyond salvation.[369] The opposite is true in Martin's photographs of his patients, since they serve precisely to show the successful results of his treatment. He therefore could employ the before and after images as a way of proving the effectiveness of his newly developed method of the *prothèse immédiate*. Here, the oval frame, too, creates a boundary between the "sick other" and us, yet at the same time it recognizes the humanity of the patient.

On the other hand, historian Rory du Plessis, who studied photographs taken from mentally ill patients in the 1890s from the Grahamstown Lunatic Asylum, stresses the narrative of these photographs that go "beyond [the] clinical", as they also have a strong connection with the "portrait genre".[370] What struck Katherine Rawling in her research on photographs of the mentally ill in the nineteenth century was the fact that they have "much in common with non-institutional photography, that is, photography of the professional studio or domestic setting."[371] In the photographs of Martin the reference to portrait photography is also present. The most telling reference is the fact that the patient is neatly dressed, suggesting that she really wanted to look her best for the photograph. Again, for the 'purely scientific' purpose of the photograph intended by Martin, the clothes are irrelevant. However, in presenting his results to a larger public, or selling his method, he may have felt the need to stress the examples as real human beings.[372]

According to Du Plessis, the construction of the photographs of mentally ill patients contributed to their creating an image of themselves:

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[368] Kathy Newman, "Wounds and Wounding in the American Civil War: A (Visual) History", in: *The Yale Journal of Criticism*, vol. 6, 2 (1993), 66.
[369] Ibid., 64.
[370] Rory du Plessis, "Beyond a Clinical Narrative: Casebook Photographs from the Grahamstown Lunatic Asylum, c. 1890)", in: *Critical Arts*, 29, sup1 (2015), 91.
[371] Katherine Rawling, *Visualizing mental illness: gender, medicine and visual media, c. 1850-1910,* (PhD thesis., Royal Holloway, University of London, 2011), 215.
[372] Newman discusses the fear of the surgeon that has had a long history in the medical profession. Therefore, these professionals also had to stress their reliability. Newman, "Wounds and Wounding in the American Civil War", 76.

> Accordingly, it may be argued that the individuals adopted an idealized self as a form of agency, in an effort to assert claims to subjectivity, personhood and status that transcend the clinical records of illness aetiology and therapeutics.[373]

Elaborating this point made by Du Plessis, it might also have been a reciprocal exchange between patients and doctors, at least when looking at the example of dentistry. Claude Martin benefitted especially from the look of the 'after' images, showing that his method had been a success in restoring the 'normality' of the countenance of his patients' faces as of the functionality of the jaws. The patients themselves must have been informed about the purpose of these photographs. Moreover, in the case of Martin, it was not simply about showing the damage done to the face, rather it was about how to restore the human countenance to its 'normal' state. Therefore, the proper clothing and pose was no accident, but affirmed the personhood in front of the camera. Instead of dehumanizing the patient, by simply showing their condition, zooming in on the tumor in the face or a missing part of the jaw, Martin chose to emphasize the human being as central to the camera.[374] This is a direct strategy in 'normalizing' the patients, by making them familiar to the spectator or reader.

So, what about Grevers keeping the oval framing around the portrait of the woman? (see Fig. 63). To be clear, there is no obvious scientific reason for Grevers to have retained the oval framing of the photos and slides. But then again, he was in the possession of the negatives of these images, which would have given him the freedom not to adopt the oval shape. So, there must have been more to it that made Grevers consciously choose to retain the framing in Martin's book. There could be two plausible explanations. First, this way of presenting the information in the slide served as some sort of 'copyright'. If, for example, he had personally received the negatives, this automatically meant that the ownership of the negatives and the photographs made from them had also been handed over. Yet, by retaining the oval frame, Grevers may have indirectly referenced the published work of Martin and accounted for the origin of the photographic material. This automatically leads to the second, more pedagogical explanation, i.e., that it was important for Grevers to refer his students to the images' origin. The frame might have helped students to recognize the visual style as belonging to the work of Martin, while simultaneously Grevers might have had followed the same motive as Martin, namely that of humanizing the demonstrated patients.

Part III. Reasoning with slides

[373] Du Plessis, "Beyond the medical narrative", 97.
[374] Sarah Kate Gillespie, *The Early American Daguerreotype: Cross-Currents in Art and Technology* (Cambridge, MA: MIT Press, 2016), 141.

After discussing the deeper meaning and connotations attached to the type of photographs used in dental practice, the next part I will focus on the way in which the slides were used within the new fields of prosthodontics and orthodontics. Both these subjects' main aim is restoration or recovery; in prosthodontics (as we have seen) is about restoring the mouth and jaw structures, dentition, and their appearance, while orthodontics is about restoring the 'natural' arrangement of the teeth. Apart from the lantern lecture presented by Grevers in 1896 at the occasion of the combined meeting, the second section will also analyze a course with lantern slides in orthodontics taught by the German professor of dentistry Alfred Körbitz, later reworked by the Dutch orthodontist J.A.W. van Loon. Together they elucidate the ways in which (different) audiences are addressed in an educational context. As Kessler has shown, there is a "variety of educational situations which do share some characteristics, such as the transmission of knowledge or ideas, but which differ with respect to others".[375] Dependent on the setting in which the lecture is given, in this case a lecture performed by means of the optical lantern can differ according to the setting that it is performed in, the audience it addresses, the overall aim of the performance, and the effects that the projected images could have.

As we have seen, dentistry is a practical discipline, focused on restoring deformities of the oral region. The emphasis on practical skills, the ability of the dentist to perform his main tasks is also reflected by the slides featured here.

A slide-driven debate

In 1896 Grevers gave a lantern lecture about "Prothèse immédiate" during the Combined Meeting of Dutch and English dental organizations. By using this title, Grevers explicitly referred to Martin's book, thereby proffering a discussion about state-of-the-art literature and research.[376] The report makes mention of the usage of a "large number of lantern slides", and Grevers announced: "It shall be my endeavor, by means of a number of lantern slides, to show you how artificial jaws must be constructed and how to adapt them to various cases."[377] In order words, the slides were used to transmit knowledge about the practical aspects of dentistry.

> For, to my mind, although it is not strictly necessary that the dentist should be able, or let me say should make the prosthetic pieces himself; he, at least, should and must know how to make them and to have a clear idea what purpose it must fulfill [sic].[378]

[375] Kessler, "The Educational Magic Lantern *Dispositif*", 183.
[376] J.E. Grevers, "Prothése Immèdiate", in: *Handelingen van de Gecombineerde Vergaderingen van het Nederlandsche Tandheelkundig Genootschap, de Eastern Counties Branch der British Dental Association en de Nederlandsche Tandmeesters-Vereeniging gehouden op 28, 29 en 30 Juni 1896 te Amsterdam en Utrecht*, in: *NTVT* (1897). [accessed 20 August, 2021] https://www.ntvt.nl/sites/ntvt/uploads/historisch_archief_artikelen/1897/01-02/Gecomprimeerd_NTvT_4_1897_29-51.pdf.
[377] Ibid., 40.
[378] Ibid., 39-40.

Although, the report does not explicitly refer to certain slides, it is possible to ascertain, based on the collection of slides in combination with the descriptions from the report, to find out which slide Grevers must have used.

After putting much emphasis on the importance of acquiring or possessing practical skills, Grevers discusses the problematic consequences of deterioration, particularly of the lower jaw: "1. Impossibility of mastication; 2. Difficulty in swallowing and impossibility of retaining saliva; 3. Impaired phonation (…)."[379] As he makes clear, when speaking about prosthetic dentistry one cannot leave out the great impact that Martin had on the field. Therefore, his method should be taken as a starting point. Any application of a prosthetic is a restorative treatment, it offers a remedy for various adverse reactions due to tumors or bacteria, which in some cases lead to the partial loss of the jaw. The method developed by Martin settled some of these adverse reactions, because the prosthesis was placed immediately during resection surgery. This method by Martin added a "marvelous" new dimension to such surgeries, according to Grevers. It not just made the surgery 'easy', it also "attenuated its severity".[380] However, after complimenting Martin on his great contribution to the field, Grevers added some critical notes based on examples from the clinic of professor Rotgans in Amsterdam, again by using lantern slides.[381]

While showing the next slide (Fig. 62), Grevers said: "In the slide, now on the screen you will see that the jaw is provided with a system of canals. Cl. Martin lays great stress and importance on these canals [sic]."[382] But while he continues to show this image, in the following sentence he retracts his support for Martin in this matter by saying: "In my experience – which is limited – these canals do not seem to be so very essential and influential."[383] The idea was that the canals would ensure the drainage of blood and other fluids that interfered with the healing process. Accordingly, the slide is not simply an illustration of what is explained by Grevers; rather, it is part of a bigger argument that he builds up to his own view on how to deal with the matter of cleaning the oral region after surgery.

[379] Ibid., 40-41.
[380] Grevers, "Prothèse immédiate", in: *NTVT* (1897): 41.
[381] In 1893, Jacob Rotgans became professor of surgery at the University of Amsterdam.
[382] Ibid., 42.
[383] Ibid., 42.

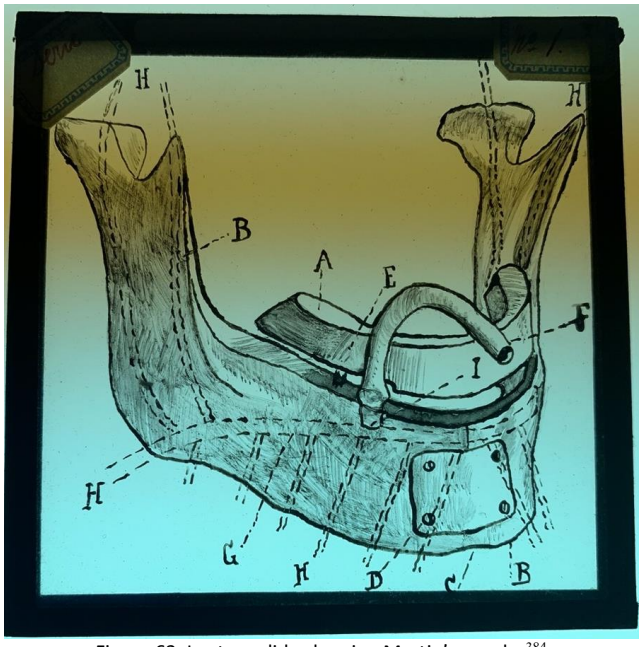

Figure 62. Lantern slide showing Martin's canals. [384]

Although Grevers experience was "limited", he presents evidence of his own experience by showing a series of slides from several cases professor Rotgans and he had treated at the clinic of the University of Amsterdam. Even without having the exact slides that Grevers referred to in his lecture, it is interesting to note is that he tried to direct the attention of his audience to specific areas of the image. In presenting a case from the "practice of Prof. Rotgans" he states: "To the left you will see a predominance of the lower jaw extending from the roots of the first molar left to the cuspid on the right".[385] He further explained several cases according to their defects caused by the type of tumor they show. However, unfortunately, no explanation is given of the procedure that subsequently was followed. A reference is only made to what part of the lower jaw was removed. So, here we encounter a discrepancy between the performance of a lecture and reports written after its presentation of facts. One can only assume that Grevers gave these cases more body by highlighting their details and particularities. Grevers ended his lecture by showing slides that, as he said, "will call your attention to some difficulties [in the procedure of constructing and fitting prosthetics] that may be met with and the means to overcome them."[386] Without further elaboration on these difficulties and how to overcome them, the report closes with Grevers emphasizing the variety of cases dentists face in their daily practice, which made it impossible to

[384] This lantern slide is drawn after the image in Martin's book. Instead of photographing the book, apparently Grevers preferred to make a drawing to probably have a good quality image to project. CMV. Collectie Grevers. Box "Cl. Martin".
[385] Grevers, "Prothèse Immèdiate", in: *NTVT* (1897): 42.
[386] Ibid.

discuss all the possible treatments and procedures. This is also one of the reasons why Grevers "abstained from speaking about what Cl. Martin calls "*prothèse immédiate*"', apparently because this was a too limited view.

To sum up, this short report on a lecture given by Grevers on "*prothèse immédiate*" is an example of how lantern slides could provide a way of refuting, or at least nuancing an existing, maybe even leading theory in the field of dentistry. The images that Grevers used were partly motivated by offering a credible counter-perspective on the same deformities. It gave him the possibility to lean on the work undertaken by Martin, while demonstrating his own view on the matter at hand.

J.A.W. van Loon: learning how to diagnose

In the final part of this chapter, I want to shift attention to the other newly introduced subject in dental teaching practices: orthodontics. Internationally this field gained a foothold in the academe at the beginning of the twentieth century, mainly through the work of the American dentist Edward Angle.[387] As he stated in 1902, orthodontics was "woefully neglected", both in "teaching and in practice".[388] According to Angle, part of this neglect had to do with the fact that not all students were able to "ever become sufficiently proficient to practice it successfully."[389]

> Whoever would succeed in its practice must love and cultivate art, especially that highest type of art, the human face. He must enthusiastically love his work and strive for the highest ideals. Then will he be willing to work to overcome difficulties, and will have the courage of his convictions and succeed where other would only fail disastrously.[390]

The 'art' of orthodontics revolved around correcting deformities that developed in the oral region. This specialism was mainly concerned with treating malocclusion, which is defined as "a deviation of the teeth or a mal-relationship of the dental arches outside the accepted range of normal."[391]

As becomes clear, the discourse which was used to describe orthodontic issues greatly revolved around the concepts of "ideal", "normal", "deviation", etc. Consequently, having clear ideas about what was meant by these terms, both theoretically *and* visually, was crucial for being trained as a future orthodontist—even today its practice is described as being able "[t]o recognize

[387] Internationally Edward Angle is recognized as the "father of modern orthodontics". See among others: Sheldon Peck, "A Biographical Portrait of Edward Hartley Angle, the First Specialist in Orthodontics, Part 1.", in: *Angle Orthodontist*, vol. 79, 6 (2009), 1021-1027; Sheldon Peck, "The contributions of Edward H. Angle to dental public health", in: *Community Dental Health*, vol. 26 (2009), 130-131.
[388] E.H. Angle, "Orthodontia", in: *Dental Register*, vol. 56, 10 (1902), 528.
[389] Angle, "Orthodontia", *Dental Register* (1902), 528.
[390] Ibid., 529.
[391] Definition of malocclusion retrieved from the online dentistry dictionary on 15 July, 2023 from the website: https://www.oxfordreference.com/display/10.1093/acref/9780199533015.001.0001/acref-9780199533015-e-2549?rskey=JTjBKX&result=2549.

a malocclusion, [therefore] a clinician needs to understand ideal and normal occlusion."[392] But, as Dutch orthodontist H. Boersma wrote in 1968:

> An ideal situation is rarely found in human teeth. It is only achieved when many conditions are met. It is often not realized or insufficiently understood that, among other things, the shape and dimension of all teeth must be attuned to each other. When this is not the case, all kinds of abnormal situations occur.[393]

Still, the ideal is a necessary pillar in making a diagnosis as well as a treatment plan that allows to restore the malocclusion to a normal occlusion.

In what follows I demonstrate how the use of "ideal" and "characteristic" images helped students in acquiring knowledge about the proper way of diagnosing. To do so, I want to look at two examples of these type of images in a lantern lecture series in Orthodontics by the German professor Alfred Körbitz in 1908. In contrast to the images that we have seen in Grevers's lecture on prosthetics, these images are not epistemic images in the sense that they established or produced collective empiricism; rather the images under scrutiny here were meant to train students in how to make observations that were aimed at diagnosing orthodontic abnormalities. In this brief case I will demonstrate that the goal of the display of a multitude of images in the context of a lecture course, performed by Körbitz, was 'calibrating the eyes' of future orthodontic practitioners.

Körbitz's course was reworked into a textbook by one of his students, the Dutchman J.A.W. van Loon, who became the first lector in orthodontics in the Netherlands in 1911 at the Dental Institute in Utrecht.[394] Here, I will follow what historians of science Lorraine Daston and Peter Galison have shown in their book *Objectivity* about the role of the ideal and characteristic in acquiring medical knowledge:

> Typical images dominate the anatomical, botanical, and zoological atlases of the seventeenth. Through the nineteenth centuries (and sometimes long after) [...] Two important variants, which we shall call the "ideal" and "characteristic", also appear in atlas illustrations of this period. The "ideal" image purports to render not merely the typical but the perfect, while the "characteristic" image locates the typical in an individual. Both ideal and characteristic images regularize the phenomena, and the fabricators of both insisted upon pictorial accuracy.[395]

[392] Robert N. Staley and Nell T. Reske (eds.), *Essentials of Orthodontics: Diagnosis and Treatment* (2011) 3.
[393] H. Boersma, "Disharmonie van mesio-distale afmetingen der gebitselementen in de bovenkaak ten opzichte van die in de onderkaak", in: *Nederlandsch Tijdschrift voor Tandheelkunde*, vol. 75 (December 1968), 836.
[394] UIT DE STAATSCOURANT.. "Algemeen Handelsblad". Amsterdam, 01-07-1911, p. 1. Consulted on Delpher 22-07-2023, https://resolver.kb.nl/resolve?urn=ddd:010338490:mpeg21:p001.
[395] Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books), 70.

Initially, Van Loon was trained as a medical doctor at the University of Amsterdam under the supervision of the well-known anatomist Lodewijk Bolk. After having been his assistant for one year, Van Loon wanted to take up the study of orthodontics. However, in the Netherlands there was no possibility to do this and therefore, on the recommendation of Grevers, he decided to go abroad. First, he went to America and then to Germany to study with Körbitz at the *Berliner Zahnärztliche Klinik* with Körbitz.[396] A promising student, Van Loon was invited by Körbitz to accompany him to Prague, where the latter would teach a course on orthodontics from 6 to 20 December 1908. As Körbitz stated in the introduction of the *Kursus*, he secretely hoped that one of the students would write a report that would form the basis of a textbook that could be used by students.[397] When reading the notes that Van Loon had taken, Körbitz was so impressed that he decided to use this as the basis for the textbook that he aspired to write. Thus Van Loon took on the task to rework his lecture notes, combined with the manuscript and photographic materials professor Körbitz had given him access to, into a textbook in orthodontics for future students.[398] According to Körbitz the available textbooks did not suffice on the topics that he had discussed during his course.[399] Eventually the book was published in 1909, entitled *Alfred Körbitz' Kursus der Orthodontie* [hereafter *Kursus*], 'nach den Aufzeichnungen' of J.A.W. van Loon'. The textbook, counting 100 pages, contained 167 figures, both drawings and photographs of plaster models. The high number of images indicates the importance of the visual element within this course. Most importantly, the use of lantern slides is made explicit in the textbook through phrases such as: 'Dies wird an markanten Fällen bezw.[sic] Lichtbildern veranschaulicht.'[400] Remarkably, in the context of the textbook this type of reference is unnecessary, if not misleading, since the reader looks at book illustrations instead of projected images. Van Loon could have contented himself with using the term 'figure' to refer to the visual material. Furthermore, it does not become clear from the textbook when exactly Körbitz made use of lantern slides. However, it is plausible that the context of the lecture course performed abroad would make the use of the lantern slides the most efficient way of transmitting knowledge: instead of bringing plaster models, which would have taken up much space, it was easier, more efficient, and less burdensome to take along three or four wooden boxes containing 167 slides (approximately 50 per box).[401]

[396] REDACTIE "De eerepromotie van Dr. J.A.W. van Loon", in: *NTVT: educational edition* (1927): 850.
[397] Alfred Körbitz, "Geleitwort", in: J.A.W. van Loon, *Alfred Körbitz' Kursus der Orthodontie. Nach den Aufzeichnungen von J.A.W. van Loon, Med. Doct. D.D.S.* (Berlin: Berliner Zahnärztliche Poliklinik, Institut für Fortbildungskurse, 1909), 3.
[398] J.A.W. van Loon, *Kursus*, 110.
[399] Körbitz, "Geleitwort", 3.
[400] Van Loon, *Kursus*, 12.
[401] A similar example will be discussed in the next chapter in the case of botanist F.A.F.C. Went's lecture in the United States.

Körbitz started his course by presenting a case that showed the severe and damaging consequences of a dental practitioner who lacks the knowledge required to practice orthodontics adequately. He demonstrated what happens when an orthodontist does not have the right skills to treat deformities of the teeth. Most importantly, this case stressed the paramount importance of observational skills, thereby immediately highlights the importance of the 'seeing style' that will eventually induct the students into the orthodontic though collective.

The case he presented opened with the projection of a "characteristic" photographic image of a particular case (Fig. 63) that, according to Körbitz, depicts a situation that seems to "simply" point to the lack of space in the area of the incisors. He continued that, based on this observation, the 'logical next step was to use rubber bands or other retention devices that would help to "push them [the incisors] apart, turn them and arrange them in a neat row" (Fig. 64).[402] Although, at first glance this might be the right treatment based on the initial observation, Körbitz added: "So it seems!", because the result would have been anything but successful.[403] The reason for this, Körbitz explained, is the fact that the diagnosis had been made with "layman's eyes", because it only focused on one aspect of the irregularities—i.e., focusing only on the elements that are immediately visible to the naked eye.

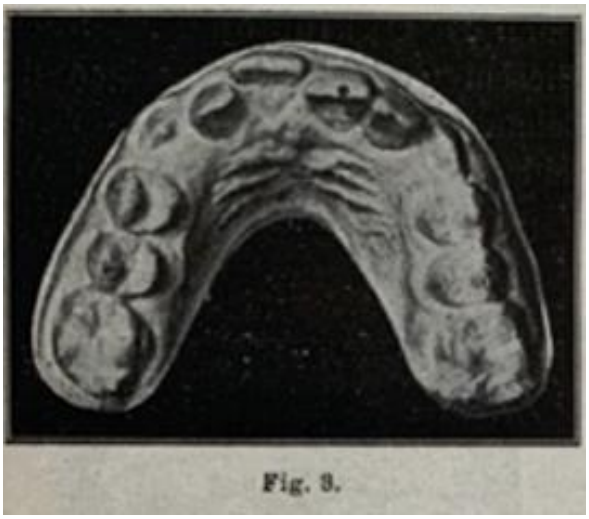

Figure 63. Photographic image of a plaster model in Kursus der Orthodontia (1909). [404]

[402] Van Loon, *Kursus*, 9.
[403] Ibid., 9.
[404] Ibid., 9.

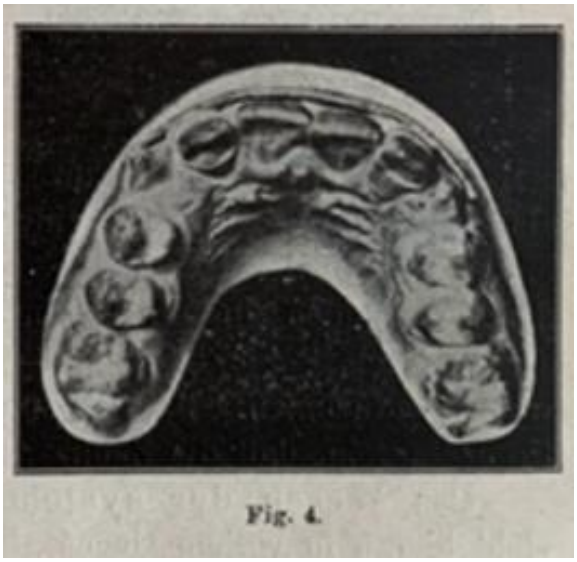

Figure 64. Photographic image of 'treatment' of the lack of space of the incisor. [405]

As we have seen in this chapter, even medical professionals were often seen as "laymen" in the dental field, because their training lacked the specialized knowledge required to be a dental specialist. They knew too little of the oral region and its irregularities to actually know what to do when confronted with such a case (vice versa, of course, the same applied to dentists). Consequently, this would, according to Körbitz, lead to conclusions based on what could be detected from this plaster model alone (Fig. 63).

The strategy pursued by Körbitz in presenting this case was to highlight not just the importance, but the necessity of developing an 'educated eye', an eye sensitive to the peculiarity of the case at hand. The educated eye of the student would not only base its diagnosis on asking the right questions, such as: "What irregularities are present?" or "Which condition do we want repair?", but also on the understanding that what can be seen "is only a symptom that cannot be eliminated without recognising and treating the causal conditions that have produced this symptom and will continue to produce it."[406] By presenting this case through the demonstration of these two images, Körbitz trained his students by means of a particular 'seeing style': he calibrated the eyes of his students while pointing to—and pointing out—the severe consequences of misdiagnosis due to a lack of knowledge and insight. In this way, he strengthened the awareness of his students of the importance of not only looking but observing in a more comprehensive rather than a merely symptomatic way.

[405] Ibid., 9
[406] Ibid., 10.

After this discussion, Körbitz went on to show an idealized image of the oral region which features both the muscles and the teeth (Fig. 65 and 66). This image was used as a reference point: it is the ideal representation of "a state of rest or equilibrium as long as there is an orderly and complete interaction of the forces."[407] However, as soon as this "state of rest" is disturbed, "movement enters (…) and this reveals the presence and influence of the previously latent forces."[408] In turn, those forces, those mechanisms should be known by the future orthodontist in order to make well-informed diagnoses and come up with a functional treatment plan. Therefore, this type of ideal image in a textbook focused on the *practice* of orthodontics, only becomes meaningful when it is contrasted with an image that is the opposite of this ideal state (see fig. 67). The juxtaposition of these images, whether projected sequentially or side by side in the textbook, is meant to stress the visual contrast between balance and irregularities, between the ideal and the deviations. In turn, these images functioned similarly to what Daston and Galison have called the "drill of the eye", or as I would suggest in the context of teaching practices, 'tuning of the eyes'.[409] As such, it constituted a particular way of training the eye, not only revolving around recognizing deformities, but also concerned with becoming a skilled observer who can distinguish between specific deformities and its causes.

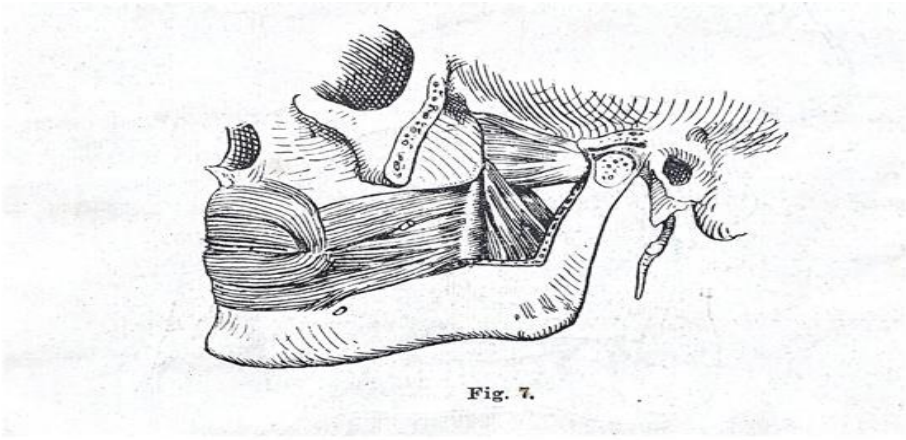

Figure 65. Figure 7 in Kursus, representing the 'normal' state of muscles surround the mouth.[410]

[407] Ibid., 12.
[408] Ibid.
[409] Daston and Galison, *Objectivity*, 24-26.
[410] Van Loon, *Kursus*, 11.

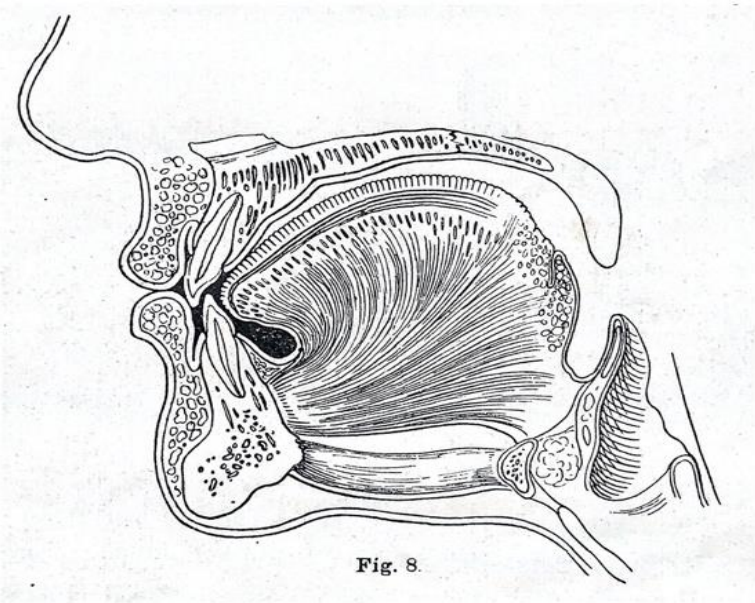

Figure 66. Figure 8 in Kursus, representing the 'normal' state of the mouth region. [411]

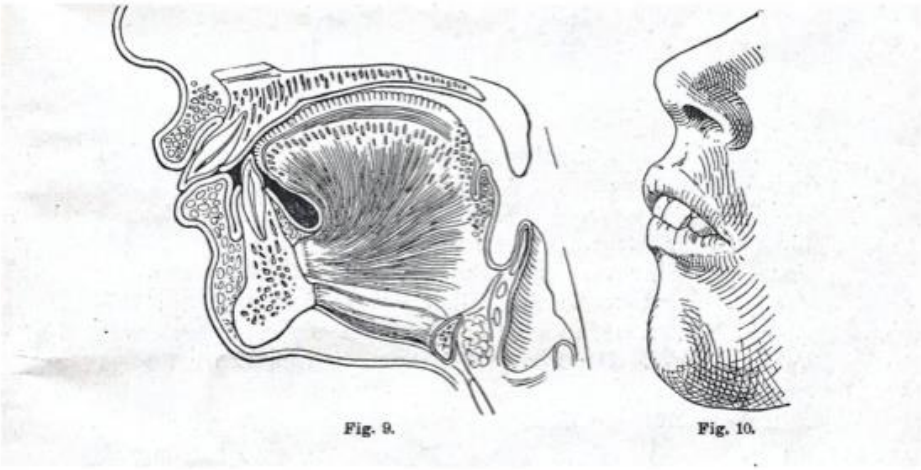

Figure 67. Figures 9 and 10 from Kursus. Representing the malocclusion of the upper jaw. [412]

[411] Van Loon, *Kursus*, 12.
[412] Van Loon, *Kursus*, 13.

This involved the training of an 'educated eye' that is both visually and theoretically informed about the causal relations present in the patient that is treated.

The remaining part of the book concentrates on demonstrating particular cases from Körbitz's clinical practice. After dealing with some common irregularities, he also discusses various orthodontic devices that are necessary in restoring the irregularities in a lasting way. All this is a prelude to dealing with casuistry, in which he and his students jointly went through the process of diagnosing and drawing up a treatment plan. On the basis of photographic images of plaster models taken from actual patients he guided his students through this process. As the first example of Körbitz showed, preparing students for their future practical work—dealing with real-life patients—demanded the right preparatory input. What had been the biggest criticism to the dental field in general was the inadequate treatment of patients, leading to more damage and unnecessary pain. Therefore, the thorough preparation of students, the development of an educated eye that would go beyond what was observable was crucial in academic teaching practices. And this practice was inseparable from the use of visual teaching aids. Indeed, the demand for *simultaneous* viewing, of calibrating the eyes of future professionals, made the optical lantern the proper instrument of transmitting this crucial and specialized knowledge.

Conclusion

The establishment of a specialist discipline in an existing academic system involves not only determined specialists that train students, such as John E. Grevers and J.A.W. van Loon, but also, and very importantly, a solid network of people who are striving towards the same goal. It necessitates setting the specialism apart from the existing methods, and—in the case of orthodontics—clearly demonstrating and explaining why the practical skills are so pivotal in training future orthodontists. The significance of the images that were used for training future dentists, as this chapter has shown, is twofold. On the one hand the slides offer insights into the (changing) curriculum of dentistry at the beginning of the twentieth century, while they simultaneously stress the importance of the engagement of the thought collective at large in *shaping* the training of future members.

The close cooperation between Grevers and Salomonson in the production of photomicrographs or the exchange of negatives between Martin and Grevers, point an towards awareness of the fact that these scientists needed each other in order to take steps to forward their discipline. It was their expertise, their construction of new methods, ideas, and the visualizations of that knowledge that invited others, not in the least their students, to build upon them, or to discuss them further. It is through the transmission of ideas coming from expert members of the thought collective that students get acquainted with the day-to-day practice of

their future profession. This will eventually equip them in dealing with real patients themselves in the clinic.

As the cases in this chapter have shown, the practical courses lent themselves well for instructing by means of the optical lantern. The projected (photographic) image not only provided 'real-life' examples, but they also opened up the possibility of showing before-and-after images. This type of illustration belongs to a category of offering visual 'proof' off the successful results of new methods of treatments as the case of Martin and Grevers has shown. Visual instruction in dentistry therefore required students to fully grasp the topic at hand. This meant, principally, an understanding their research object as well as the objects of their clinical practice as actual human beings. Therefore, dental training involved creating an awareness that the diagnosis students would make, or the treatment they administered directly affected the condition of the patient. Taken together, by using targeted material, relying on their own experience, addressing authorities, and critically examining them, these professors made the visual strategy the heart of their teaching task.

These two examples of lantern lectures within the field of dentistry were difficult to reconstruct—and only tentatively at that—, as not all manuscripts of the lectures nor all the slides projected at these occasions have been retrieved. However, in the next chapter I will discuss three examples of lectures given in various disciplines, that I actually *was* able to reconstruct. This allows me to focus solely on the role that the projected images played in the creation of a scientific *thought collective*, a collective that needs maintenance in order to survive as a sustainable community. Therefore, the study of the visual material is crucial for our understanding of scientific pedagogy and thus the role of teaching aids therein.

Chapter 4.

Visual strategies employed by the *thought collective*

In the previous chapters we have seen the many different aspects that were involved in the performance of an academic lantern lecture at the beginning of the twentieth century. Not only in terms of logistics and architectural design, but also in acknowledging the pedagogical affordances of adding the visual dimension to the transmission of scientific knowledge. In this final chapter then, the focus will be shifted to the role and functions of the projected images themselves. In what ways were these images not only integrated within the structure of the lecture, but more importantly *how* did they train students to become experts within a certain scientific discipline? Self-evidently, it is impossible to extract a general taxonomy of how images were integrated into academic lectures in general. First, because different disciplines require different teaching skills: while in art history students are taught to compare and identify painters' styles, for instance, in botany they are trained to gain a better understanding of, say, plant movement. Secondly, academic lectures—specifically their content—heavily depend on the levels of the academic curriculum. In other words, whether the lecture is part of an introductory course, where concepts, theories, and methods still need explanation, or if they are performed before a group of advanced students that are asked to set up their own experiments, makes a difference in the didactic aims pursued and, by extension, this also has considerable consequences for both the types of images that are used and how they are treated within the overall structure of the lecture.

As I will argue, it is exactly these different formative stages of university education that are crucial in understanding the specific role of the projected images in a lecture. Hence, it is important to recall the Fleckian definition of a thought collective: "a community of persons mutually exchanging ideas or maintaining intellectual interaction [...]."[413] This concept accounts for the need to be inducted into the collective through scientific training, but also for the exchange among more experienced members who develop new ideas and safeguard established parameters of the collective. However, expert members too are constantly educated, even at a more advanced stage in the thought collective, as is nicely illustrated by an excerpt from the inaugural lecture by professor of psychiatry Cornelis Winkler in 1893:

> My dear students! I am no stranger to you. As a child of this university myself, as an assistant, as a lecturer, I have seen generations of students come and go. [...] What my education will bring, you know better, being the proper judges you usually are, than I. We will, I hope, work together. Me, learning from your fresher, younger views, not yet constrained by the straitjacket of preconceived opinions that are based on previous experience. You, from me, because I am

[413] Fleck, *Genesis and Development of a Scientific Fact* (1979) 39.

> several years of work ahead of you, and because it is a good thing when a little more experience checks any wild precipitation.[414]

In other words, as historian of education, David Kaiser, has formulated so adequately: "Scientists are not born, they are made."[415] In essence, a scientific thought collective is a self-sustaining entity that needs constant reaffirmation through scientific education. Therefore, this chapter will focus on what it took to become (or to be 'made' into) a scientist. I present three examples of how academic lantern lectures, in different disciplines, at different levels of expertise, were used to teach students how to see with the eyes of their respective collective.

The three lantern lectures that I discuss represent the three formative stages that I discern within the thought collective: the introductory level, advanced level, and the professional level. To illustrate the ways the academic lantern lecture conveyed knowledge at these levels I use examples from the discipline of astronomy, psychology, and botany. As noted in the introduction of this dissertation, the presence of slide collections alone is not enough to reconstruct how particular slides were integrated into lantern lectures. The images need to be contextualized through lecture notes or other published texts that shed light on their specific role and function in scientific training. Still, the way in which lecture notes, for example, expose the use of slides are not all equally comprehensive, mainly resulting from the fact that the teacher—as an expert—knows what and how he wants to structure the academic lantern lecture. Therefore, additional, circumstantial evidence in the form of, for instance, textbooks is necessary.

In reconstructing the (actual) lantern lecture performances the heuristic framework of the pedagogical dispositif is particularly helpful in understanding the interplay between the rhetorical strategies that are pursued in addressing different target audiences for example. It enables one to connect the dots and fill in the blanks left by missing archival material by virtue of the implications that the performative situation has for the overall knowledge transfer. Although the main focus here will be on the textual pole, the implications brought to the fore by the other two poles are crucial as well. As Eef Masson has argued, the setting of the lecture creates a particular receptive attitude towards what is happening inside its premises:

> A classroom, I would argue, is an environment in which the rhetorical dimension of the exchange that takes place necessarily takes center stage. […] the ultimate purpose of classroom

[414] Cornelis Winkler, *De beteekenis van het Onderwijs in de Psychiatrie voor de Geneeskunde. Redevoering bij de aanvaarding van het Hoogleeraarsambt aan de Rijksuniversiteit te Utrecht* (1893) 37. Winkler was, according to a newspaper report from 1902, the one who introduced the 'new educational system', i.e., teaching by means of the optical lantern, within the University of Amsterdam. STADSNIEUWS.. "Algemeen Handelsblad". Amsterdam, 14-10-1902, p. 2. Consulted on Delpher op 17-04-2023, https://resolver.kb.nl/resolve?urn=ddd:010649209:mpeg21:p002.

[415] David Kaiser, "Introduction. Moving Pedagogy from the Periphery to the Center", in: David Kaiser (ed.), *Pedagogy and the Practice of Science: Historical and Contemporary Perspectives* (2005): 1.

> interaction is to make pupils acquire the knowledge and skills that are commonly considered to the field of formal education.[416]

Masson's argument applies equally to lecture halls and students, as the rhetorical dimension "is inextricably bound up with the role of the teacher, which task it is to make the content acceptable (as didactic matter) to the audience addressed."[417] In addition, pupils or students—the spectator pole—are implicitly assigned the role of "wanting or needing" to learn.[418] This means that, in order to understand and reconstruct the role played by images and the visual strategies pursued, we need to have an idea of: 1) the specific performative occasion (performance context pole: i.e., where, what); 2) the lecturer's goal (textual pole—intrinsically linked to the survival of textual documents); 3) target audience (spectator pole: first year students, advanced students or a group of scientific peers). In what follows, I will discuss two examples of how a lantern lecture can be reconstructed based on partial information and end with an example that allows full reconstruction.

Textbooks versus lectures

As noted, when trying to understand the function of lantern slides within academic education we cannot do so without other sources, such as lecture notes or textbooks, providing information that is necessary to interpret the specific role of the images. While researching the lantern slide collections for this thesis it immediately became clear that many images were actually copied from textbooks, either written by the professors themselves or from other prominent scientists. An important reason for this practice is explained by historian Peter Baggen, who states that the genre of the academic lecture (in Dutch: 'hoorcollege') as we still know it today emerged out of a change in the 'educational ideal' that underpinned university education until around 1860 in the Netherlands. He convincingly argues that there was (and probably still is) a close relationship between an educational ideal and the form taken by education. In the mid-nineteenth century, university underpinnings went from an encyclopedic towards a more specialized ideal.[419]

According to Baggen, a secondary effect of the new educational form of the *hoorcollege* was the writing of textbooks. Textbooks were a corollary of extempore speech, literally talking at its own pace, which, in contrast to the 'dictation speed' of the *dictaatcollege*, made taking notes more difficult.[420] Here Baggen suggests that the textbook had a very direct relationship with the lectures (being a published version of them), but as I will argue in this chapter, the relationship

[416] Masson, *Watch and Learn* (2012) 134-135.
[417] Ibid., 135.
[418] Kessler, "The Educational Magic Lantern Dispositif", 181-182.
[419] Baggen, *Vorming door wetenschap* (Delft, 1998) 30.
[420] Ibid., 60, 80-82.

between textbooks and academic lectures is more complex than this. First of all, this has to do with the difference in the performative situation between attending a lecture and reading a textbook. The former is a collective experience, whereas the latter is often restricted to individual self-study. By extension, as this chapter will also show, the role of the teacher in guiding the students' eye or thought process is a fundamental pedagogical characteristic of the (lantern) lecture in contrast to the specific affordances of the textbook. Yet, it is important to recognize that these two pedagogical forms did have a complementary relationship in training students to become part of the thought collective, since they acted together as a way of familiarizing students with the main objects, methods, and concepts of their field of study. Furthermore, the 'seeing style' is conveyed at various levels but also in various material forms. So, in comparing the pedagogical forms of the lantern lecture and the textbook I aim their respective affordances.

The introductory level: Nijland and the historical tradition of astronomy

One of the voluminous slide collections researched for this project belongs to the academic observatory Sonnenborgh in Utrecht, which at the beginning of the twentieth century was led and renovated by professor A.A. Nijland. In going through the collection, both physically as well as through the digitized versions of the slides, I was confronted with my own status as a nonmember of the astronomical thought collective. Despite the captions, especially in the online database, that 'explain' of what the images depict, it did not always become clear to me what I was looking at. As Fleck wrote in his 1947 article "To look, to see, to know": "In order to see one has first to know […] Otherwise we look but do not see, we look intently at too many details without grasping the observed form as a definite entity."[421] In other words, any researcher not belonging to this thought collective would first need to be taught *how* to look at these images, what to pay attention to, which elements are essential and which are inessential to the astronomical discipline.[422] Still, there was a 'series' of slides—depicting historical portraits of astronomers—that did allow me to uncover the function that they might have had in Nijland's lecturing practices, and his visual strategy. Moreover, in combination with a similar set of portraits in the psychology collection, attributed to professor Heymans in Groningen, I was able to discern the various purposes these projected portraits could serve. Here, I will first treat the case of Nijland and his use of historical portraits.

In 1898 Albertus Antonius Nijland was appointed professor in astronomy at Utrecht University as well as director of the comparatively 'small' observatory Sonnenborgh. This observatory mainly focused on teaching practices, while Nijland conduct his own research into

[421] Fleck, "To look, to see, to know", in: Cohen and Schnelle (eds.), *Cognition and Fact*, 129.
[422] Ibid., 130; Daston, "On Scientific Observation" (2008): 107.

variable stars.[423] In the early years he was confronted with an increase in the number of students attending his lectures. Since the implementation of the *Academische Statuut* in 1877, chemistry students also took classes in astronomy, so instead of lecturing for four students he was confronted with twenty.[424] As we have seen with Moll and his botanical laboratory, to accommodate the growing number of Nijland's students a renovation of the Observatory was necessary, more importantly a purpose-built lecture hall. The renovation was completed in 1909; it included a suitable lecture room with projection facilities (see Fig. 69).[425] The wooden cupboard-like construction in the back must have functioned as the platform where the optical lantern was placed upon and the amanuensis would stand there to change the slides at Nijlands's signal, while he himself was positioned in front of the students, next to the screen (or rather the white wall).

Figure 68. Professor Nijland during one of his lectures at Sonnenborgh.(Utrecht University, Collectie Nijland). [426]

[423] David Baneke, "'Als bij toverslag.' De reorganisatie en nieuwe bloei van de Leidse Sterrewacht, 1918-1924", in: *BMGN- Low Countries Historical Review*, vol. 120, 2 (2005): 211.
[424] A.A. Nijland, *De geschiedenis der Utrechtsche sterrenwacht. (Overgedrukt uit het Utr. Prov. En Sted. Dagblad van Donderdag 7 October 1909)* (1909) 7-8; Robert H. van Gent, "Vier eeuwen de hemel geobserveerd en in kaart gebracht: Utrechtse collecties oude sterrenkundige drukken" (2009): 162. https://webspace.science.uu.nl/~gent0113/publications/bijzonder_onderzoek_22.pdf. The *Akademische Statuut* stipulated that students would not graduate within their faculty, but in a specific subject. Thus, this was another measurement in disengaging with the encyclopedic ideal. See for example: P.A.J. Caljé, "'De omkeer in 't studentenleven': De pogingen tot hervorming van het studentenleven rond 1920", in: *Groniek*, 118 (1992) 87.
[425] A.A. Nijland, "Wiskunde, Sterrekunde en Astronomische Observatorium door Dr. A.A. Nijland" in: *De Utrechtsche Universiteit, 1815-1936. Tweede Deel* (N.V. A.Oosthoek's Uitgevers Maatschappij,1936) 307. Consulted on Delpher 12-09-2023, https://resolver.kb.nl/resolve?urn=MMKB06:000008588:00013.
[426] Image retrieved from the website: https://repertorium.library.uu.nl/collectie/nijland/.

Figure 69. Photograph of the lecture hall of Sonnenborgh. According to the website of Sonnenborgh, the interior of the lecture hall is exactly the same as it was in 1909 after the renovation. (Website Sonnenborgh Observatory). [427]

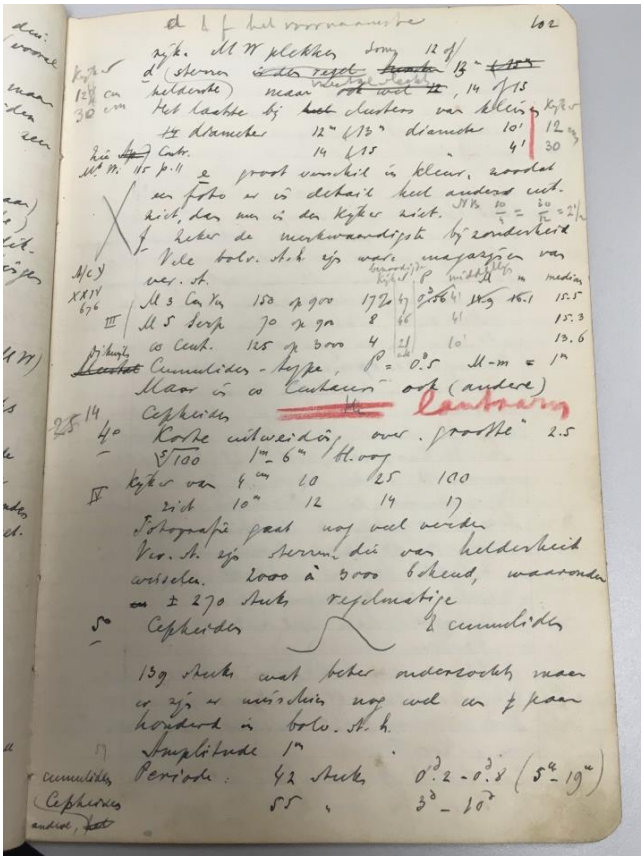

Figure 70. Excerpt from one of Nijland his notebooks, in which he explicitly refers to the use of the "lantaarn" (Universiteitsmuseum Utrecht, Archief A.A. Nijland). [428]

[427] Information and image extracted from the website: https://www.sonnonborgh.nl/vergadering-seminar-lezing.
[428] Universiteitsmuseum Utrecht. Archief A.A. Nijland. Folder 2.3. Eclipsexpedities 1912-1914-1927-1929. College aantakeningen. Natura Dux Nobis. Box 1569. "Notitieboek VI", 102. (University Museum Utrecht.

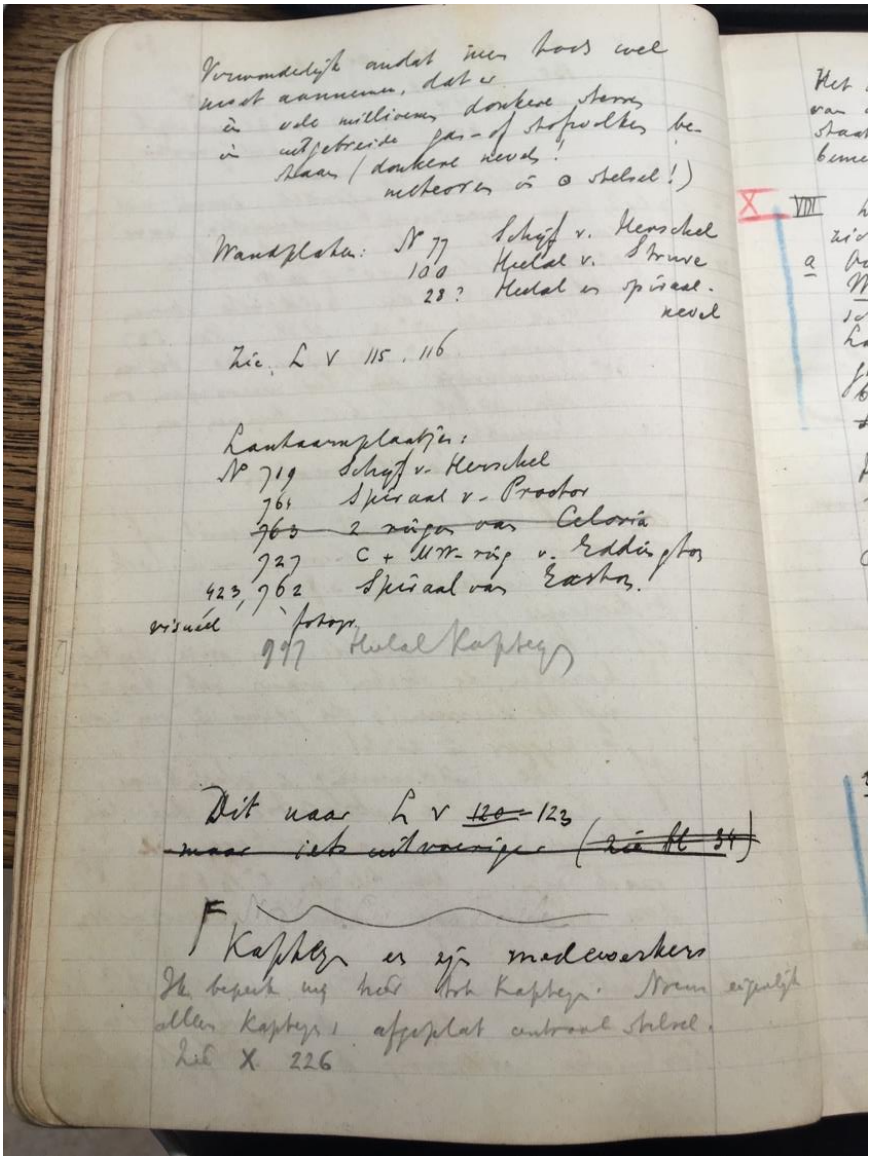

Figure 71. One of the pages of a notebook of Nijland showing his list of lantern slides that he used for a particular lecture within his lecture course: De Bouw van het Heelal (The Construction of the Universe). (Universiteitsmuseum Utrecht, Archief A.A. Nijland). (Photographed by the author). [429]

Archive A.A. Nijland. Folder 2.3. Eclipse-expeditions 1912-1914-1927-1929. Lecture Notes. Natura Dux Nobis. Box 1569. "Notebook VI", 102.

[429] UMU. Archief Nijland. Box 1569. Folder 2.4. College aantekeningen. "Notitieboek VII" (1920) 31.

Apart from the lecture hall, Nijland's notebooks also reflect his great reliance on the projection of images with the "lantaarn" for his lectures, as he noted down on some of these pages (see Fig. 70). Most of his notebooks, whether they were lectures presented at venues outside the university, such as *Diligentia* (Royal Association for Physics founded in 1793), or his university courses, contain lists of slides as well as the wallcharts that he used during these lectures (Fig. 71). This last notebook reflects a course that he taught between 5 October and 7 December 1920, weekly (the day is not specified) from 8am until 9:30am before a group of 130 students. This ten-lecture-course, titled *De Bouw van het Heelal* (The Construction of the Universe) was part of the broader introductory course for first year students "Populaire Sterrenkunde" (Popular Astronomy).[430] Although the content of the topics changed over the years, *De Bouw van het Heelal* (starting from the academic year 1914-15) was a returning topic.[431] As noted by Nijland, the intention of this course was "to give an idea of the schematic structure and dimensions of the visible universe, which not only includes the fixed stars and the Milky Way clouds, but also nebulae and star clusters."[432] Apart from explaining these phenomena, Nijland reflected on the discipline's history. How did astronomers in the past register the stars they could see? To what extent is this different from the present day and how can this be explained? What were the concepts about the ensemble of constellations, etc.? The content of the notebook can be combined with the lists of slides in the margins of the pages or on the left pages that list the names of historical astronomers, such as Nicolaus Copernicus, Galileo Galilei, Tycho Brahe, etc., that corresponded to the portraits found in the astronomical slide collection at Utrecht University (see Fig. 72-75).

However, what these portraits were (exactly or possible) meant to inform students about remains unclear when solely studying the notebook. The notes do not disclose the significance of these men, or the ideas that these men are known for. Rather their names are only featured in the lists of slides but not in the 'running' text. Yet, Copernicus is one exception, because Nijland connects him to the "History of the parallax question Copernicus (1543) to Bessel (1838)".[433] (The parallax question, which revolves around the issue of "the angular difference between an object's direction as seen from two points of observation, such as opposite sides of the Earth's orbit").[434] However, because the notes made by Nijland showcase his thought process, expressed in brief

[430] UMU. Archief Nijland. Box 1569. 2.4. "Notitieboek VII" (1920) 14.
[431] Utrechtsche studenten almanak voor ... Geraadpleegd op Delpher op 12-05-2023, https://resolver.kb.nl/resolve?urn=MMUTRA01:001395001:00011; Verslag van den staat der hooge-, middelbare en lagere scholen in het Koninkrijk der Nederlanden over ..., 1916 [volgno 1]. Geraadpleegd op Delpher op 12-05-2023, https://resolver.kb.nl/resolve?urn=dts:1487001:mpeg21:0043; Utrechtsche studenten almanak voor ... Geraadpleegd op Delpher op 12-05-2023, https://resolver.kb.nl/resolve?urn=MMUTRA01:001403001:00039.
[432] UMU. Archief Nijland. Box 1569. 2.4. "Notitieboek VII" (1920) 14.
[433] Ibid., 18.
[434] Definition of parallax obtained from: Ian Ridpath, *A Dictionary of Astronomy* (Oxford University Press, 2012). Accessible online: https://www.oxfordreference.com/display/10.1093/acref/9780199609055.001.0001/acref-9780199609055-e-2732?rskey=Lldm6Y&result=2898.

sentences, keywords, and enumerations, the exact function of these historical portraits remains hard to reconstruct.

Figure 72. Portrait of Copernicus. Slide number 242. (Lucerna website) [435]

Figure 73. Portrait of Tycho Brahe. Slide number 653. [436]

[435] UMU. Slide collection Sonnenborgh. Box 6. Image extracted from the website: https://lucerna.exeter.ac.uk/slide/index.php?language=EN&id=5113541. In his notebook, Nijland refers to slide number 785 as containing the portrait of Copernicus. However, on the lucerne website where the digitized slides of the Sonnenborgh collection are accessible the portrait of Copernicus does not have a number on the framework. And according to the website this slide is number 242 of box 6. Therefore, of this particular slide we cannot be sure if it is this image that he showed.

[436] UMU. Slide collection Sonnenborgh. Utrecht University. Box 06. Image extracted from the website: https://lucerna.exeter.ac.uk/slide/index.php?language=EN&id=5116378.

Figure 74. Portrait Johannes Kepler. Slide number 243. [437]

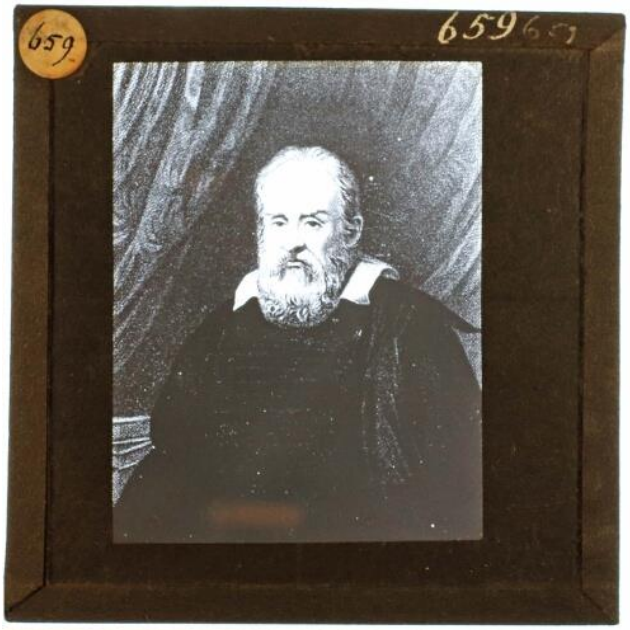

Figure 75. Portrait of Galileo Galilei. Slide number 659. [438]

[437] UMU. Slide collection Sonnenborgh. Box. 6. Image retrieved from the website: https://lucerna.exeter.ac.uk/slide/index.php?language=EN&id=5113542.
[438] UMU. Slide collection Sonnenborgh. Box 16. Image extracted from the website: https://lucerna.exeter.ac.uk/slide/index.php?language=EN&id=5116384.

So, despite the presence of both the slides and the hints of their use in a particular lecture to further grasp what he wanted to teach his students with these portraits requires additional 'circumstantial evidence'. This led me to a publication by Nijland in 1924, which had the same title as the lecture course under discussion here.[439] In part, this booklet seems to underscore Baggen's argument of the direct connection between *hoorcollege* and textbook. But, at the same time, it is important to remain cautious in treating this booklet as a reliable representation of the lectures, because this particular book was published by an association called "Volksuniversiteit Bibliotheek" (after the British example "Home University Library" and the German "Aus Natur und Geisteswelt"; hereafter V.U.B.).[440] The V.U.B. was founded in 1917, in a time when a growing need was felt for "scientific textbooks" for students, as well as for participants in the courses of the "Volksuniversiteit", the first of which was founded in 1913, in Amsterdam.[441] The book series published by the V.U.B. were mostly written by scholars, but had to be accessible to readers who had completed a secondary education.[442]

This type of publications was often based on lectures held at the "Volksuniversiteiten". As one of the founders, professor of sociology S.R. Steinmetz, stated in 1930, these lectures were "enlivened with lantern slides, demonstrations, excursions, museum visits and what not."[443] In some of the books we do find illustrations, mostly drawings. However, it is too simple a conclusion to say that they matched the slides shown. *De Bouw van het Heelal* by Nijland, for example, contained 40 images, but none of them resemble the lantern slides of the Sonnenborgh collection.[444] Strikingly, despite naming many historical figures, including those of Brahe, Kepler, Copernicus and other, none of their portraits feature in the publication.[445] Still, its content does shed light on their relevance for understanding the development of the discipline of astronomy and thus for inducting students and readers into the astronomical thought collective by means of the lantern lecture.

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[439] A.A. Nijland, *De Bouw van het Heelal* (Utrecht: Volksuniversiteit Bibliotheek, 1924).
[440] Steven Claeyssens, *'De menschen koopen alleen boeken, welke ze nodig hebben'. Uitgeverij De Erven F. Bohn, 1900-1940* (PhD thesis, Leiden University, 2014), 236-237.
[441] Volksuniversiteiten were voluntary nights schools for adults. Contrary to the university extension programs in England or the United States, Dutch "Volksuniversiteiten" were not connected to universities. Nevertheless, a lot of professors were involved in its organization or gave courses there. See Dulce da Rocha Goncalvez, (fortcoming, 2024).
[442] Claeyssens, *'De menschen koopen alleen boeken, welke ze nodig hebben',* 241.
[443] S.R. Steinmetz as cited in: Claeyssens, *'De menschen koopen alleen boeken, welke ze nodig hebben'* (Leiden, 2014) 232.
[444] Digitized lantern slide collection of Sonnenborgh can be found on the website: https://lucerna.exeter.ac.uk/result.php.
[445] Interestingly, portraits like the ones that will be discussed are also not found in textbooks of history of the same time period, even though these might seem books where these types of illustrations would be very suitable. See for example, G. van der Leeuw, *Inleiding tot de Godsdienstgeschiedenis* (Haarlem: De Erven F. Bohn, 1924).

Nijland opens his book with: "The problem of the 'Construction of the Universe' is the biggest issue, at least in the field of exact sciences, that the human mind is capable of posing."[446] Further on in his introduction he states:

> If we could determine the place of the stars, we could make a model of the visible Universe on an arbitrarily condensed scale, and our problem was solved. Moreover, the apparent brightness of the stars observed can lead to a knowledge of the true luminosity [...] and the apparent motion to a knowledge of the veritable motion in kilometers per second.[447]

Compared to how Nijland opened his lecture series, we can conclude that the approach in both contexts is almost identical, especially in terms on the focus on fixed and variable stars in better understanding the scale of the visible universe.[448] Taken together, these reflections offer a compact summary of what a course on *De Bouw van het Heelal* includes and thus also on *how* students needed to be trained in this respect. More specifically, what skills they should be taught in order to continue working on the project of mapping and better understanding the universe.

Chapter 4 in *De Bouw van het Heelal* is devoted to "Afstandsbepalingen" (Calculating distance), and it is here that we find the historical context—the geocentric versus the heliocentric worldview—that was being discussed by providing the names of historical figures, such as Copernicus, Brahe, Kepler and Galilei, who all played an important role in the change of worldview. It was Copernicus, who was the first to cautiously recognize that the heliocentric model was the right way to view the order of the universe. Based on observations and calculations, Galilei and Kepler subsequently demonstrated the correctness of Copernicus' ideas; Tycho Brahe, on the other hand, remained skeptical of this new worldview.[449]

The book tells us more about the historical discussion of worldviews, that could be enlivened through showing the portraits in a lecture. Their value lies mostly in their value for historical reflection. Often, both then and know, astronomy is claimed to be the "oldest science", as it has always fascinated human beings. However, as has been argued by David Baneke: "The statement 'astronomy is the oldest science' says more about what we understand to be science, than that it says about astronomy."[450] Still, for an aspiring astronomer, wanting to be trained to become part of the astronomical thought collective, having a sense of the discipline's history is indispensable. In my view, the reflections on history operate on two levels: first, they strengthen the idea and teaches students that they themselves are part of a longer tradition that they can build upon. But secondly, a more interestingly instructive use of these portraits can be found in

[446] Nijland, *De Bouw van het Heelal*, 1.
[447] Ibid., 3.
[448] UMU. Archief Nijland. Box 1569. "Notitieboek VII" (1920) 14.
[449] Nijland, *De Bouw van het Heelal*. 97-98.
[450] David Baneke, "Sterrenkunde, de oudste wetenschap?", in: *Nederlands Tijdschrift voor Natuurkunde* (2015): 252.

showing the historical context of astronomical observations. By highlighting how astronomers in the past have made observations, for what purpose, and with the help of which instruments, its history sheds light on the formation of the past thought collective. Mainly by recognizing the available equipment, ideas about the world and how this was situated within the larger universe, etc., it offered a reflection on the journey that they too were about to start. Accordingly, this historical reflection also paves the way for further understanding and sketching the contours of the current thought collective, based on its evolved 'seeing style' that guided the then-current astronomical observation.

The introductory course as was taught by Nijland over several years, revolved around getting acquainted with what the study of astronomy includes, and its formation around making observations to map the sky. Even though the historical portraits as such do not teach students anything about how to make observations themselves, they showcase which astronomers in the past have made important contributions to the field based on their own observations and calculations. In other words, these images function as a way of preparing astronomy students "to study a variety of individual topics in depth, and to maintain (and ideally strengthen) their grasp on how different topics relate to one another."[451]

Despite this rough reconstruction based on a small section of the large slide collection, the contextual information does provide insights into one way that these images most probably were used for within the discipline of astronomy. However, this case also highlights the speculative nature of this endeavor because it entails filling in the blanks in connection to the sparse material that is there. Furthermore, despite the seemingly straightforward connection of these figures for the history of the discipline of astronomy, it is still important to recognize that this is not the only way that this kind of portraits could have been used. This will be highlighted in the next example.

The advanced level: Heymans' classification of characters

With the appointment of Gerard Heymans in 1890 as professor of philosophy a new era dawned on the study of philosophy in the Netherlands. Heymans's conviction regarding philosophy was that everything mankind perceives in the external world is merely a mirror of the "perceiving mind".[452] Therefore, man's relationship to the external world is partly subjective, i.e., dependent on the conditions of the subject itself. With the importance he attributes to the sensations (Dutch: *gewaarwordingen*) experienced by human beings and to the perceiving mind, Heymans sees the

[451] Laura Perini, "Form and Function. A Semiotic Analysis of Figures in Biology Textbooks", in: Nancy Anderson and Michael R. Dietrich (eds.), *The Educated Eye. Visual Culture and Pedagogy in the Life Sciences* (Hanover: Dartmouth College Press, 2012): 235.
[452] Gerard Heymans, *Het Experiment in de Philosophie. Redevoering bij de aanvaarding van het Hoogleeraarsambt aan de Rijksuniversiteit te Groningen* (Leiden: S.C. van Doesburgh, 1890) 4.

"psychology of thinking" as the fundamental way forward in philosophical science.[453] Following his German colleagues, the most famous being Wilhelm Wundt (who's psychological laboratory Heymans visited in the 1890s), he established experimental psychology as a new scientific discipline, which focused on acquiring a better understanding of human consciousness (*bewustzijnsleven*).[454]

As Heymans explained, psychology should be divided in "general and special psychology", the former focusing on extracting general laws about how sensory stimuli are perceived within the consciousness of every individual, whereas special psychology studies the differences in those perceptions among different individuals. Heymans notes that in formulating these laws interhuman differences have been observed, but hardly studied. Yet precisely the knowledge about specific predispositions, temperaments, and character traits of people are fundamental in validating such laws. Indeed, according to Heymans, these personal qualities can provide explanations for their different manifestations. This then, was the task of special psychology, the field that Heymans committed himself to for a large part of his career. One of the things that he devoted his time to was the creation of a "typology of characters", which would account for the different intellectual types and their specific ways of thinking and help better understand the relationship between the general and the specific and, ultimately, the "structure of the human mind".[455]

His pursuit of creating a typology of human characters coincided with his teaching at the University of Groningen. Starting in the academic year 1903-1904, Heymans lectured every other year on 'Special Psychology', which mostly revolved around the topic of character classification.[456] And it was especially this topic that led to a growing interest in his lectures. Therefore, Heymans seized on this opportunity to make his lectures accessible, not just for students of philosophy, but also for wider audiences, predominantly teachers and professors of other disciplines.[457] Furthermore, like almost all professors at that time, Heymans, too, appealed to the Curators of the university for a bigger lecture hall to accommodate his growing audience. And eventually after a

[453] Heymans, *Het Experiment in de Philosophie*, 8.
[454] P.J. van Strien, *Nederlandse psychologen en hun publiek. Een contextuele geschiedenis* (Assen: Van Gorcum, 1993) 7; P.J. van Strien, "Gerard Heymans", in: Vittorio Busato, Mineke van Essen and Willem Koops (eds.), *Vier Grondleggers van de Psychologie. Pioniers van de Nederlandse Gedragswetenschappen. G. Heymans, F. Roels, G. Révész, J. Waterink* (Amsterdam: Bert Bakker, 2013): 27.
[455] Gerard Heymans, *De Classificatie der Karakters* (Amsterdam: Vereeniging Secties voor Wetenschappelijken Arbeid, 1907), 24.
[456] Even though the relationship between 'general' and 'special' psychology is clear, and we should note that in order to understand special psychology knowledge about the laws and concepts taken from general psychology were necessary, thus requiring a more advanced status of the student, it remains unclear why these courses alternated within the academic curriculum. Verslag van den staat der hooge-, middelbare en lagere scholen in het Koningrijk der Nederlanden over …, 1905 [volgno 1]. Consulted on Delpher 06-05-2023, https://resolver.kb.nl/resolve?urn=dts:1476001:mpeg21:0003; Van Strien, "Gerard Heymans", in: *Vier grondleggers van de psychologie*, 60.
[457] Jan Bank and Maarten van Buuren, *1900. Hoogtij van burgerlijke cultuur* (2000) 304.

destructive fire of the Academy Building of the University of Groningen, and the rebuilding of it, Heymans acquired his desired hall in 1909 (it may have helped that he was the university's rector at that time). This lecture hall (see Fig. 76) met modern requirements, such as a designated space for the use of the optical lantern (back of the room); it is in the same state as it was upon its completion in 1909 (Fig. 77 and 78).[458]

Figure 76. Postcard of the "Heymanszaal" at the Academy Building of the University of Groningen (1920-1940). Notice the window, near the upper edge, of the projection booth for the lantern. (Beeldbank Groningen).[459]

[458] Bank and Van Buuren, *1900*, 304; Van Strien, *Nederlandse psychologen en hun publiek*, 15.
[459] Image extracted from the website of the *Beeldbank Groningen:* Id-nr: NL-GnGRA_1986_521. https://www.beeldbankgroningen.nl/beelden/detail/6306d7d1-3651-2bbd-c393-309b5503847e.

Figure 77. Current state of the “Heymanszaal” at the University of Groningen. View on the exterior of the projection booth where the lantern used to be housed. (Photographed by the author in 2022).

Figure 78. Current state of the “Heymanszaal”. (Photographed by the author).

The importance of his teaching for the creation of his typology is affirmed by one of his former pupils, H.J.F.W. Brugmans, who considered one of Heymans's lectures performed for medical and natural philosophy students at the University of Amsterdam as the blueprint for his classification of characters.[460] In this lecture Heymans not only explained the peculiarities and importance of special psychology, but outlined the methods that led him to his classification system. And it is in the explanation of his method that we realize the significance of the historical figures whose portraits were most probably projected during his lecturing on this topic.

When creating a classification, Heymans says, one needs to substantiate it with a large amount of "factual material" (Dutch: "feitenmateriaal"), which should consist of "character descriptions" that were "as reliable and complete as possible".[461] In accordance with this guideline Heymans chose two methods that would enable him to collect this factual material. The first was the method of the survey, questionnaires that he sent out to a great number of people, which contained questions that were expected to lay bare "expressions of character".[462] The second important method was biographical research: "[...] one reads as many biographies of historical figures as possible, and notes down everything that seems to be important for the psychological characteristics of the person involved."[463] The method of the survey mainly served to supplement and check the results against the biographical studies. As Heymans explains, in reading biographies he abstracted the subjects' main characteristics, such as peculiar traits, "preference of certain food and beverages", from their personal living conditions, since "these factors do not shed light on the[ir] character."[464] So, in contrast to Nijland's use of historical figures and the portraits in his lectures, the historical situatedness of these figures did not add anything for Heymans.

Eventually, Heymans constructed eight "types" of character, based on the hundred biographies that he had collected. In classifying these people, Heymans based himself on three principles that define one's character: emotionality (susceptibility to disorder), activity (ability to act), and secondary function (degree of after-effects of conscious content).[465] By examining the degree of susceptibility to all of these principles, his subjects were classified accordingly in one of

[460] Mensch en maatschappij; Tweemaandelijksch tijdschrift jrg 6, 1930 [volgno 4]. Consulted on Delpher op 06-05-2023, https://resolver.kb.nl/resolve?urn=dts:2310004:mpeg21:0002.
[461] Heymans, *De Classificatie der Karakters*, 6.
[462] Ibid., 6. Examples of question that he asked are not included in this text.
[463] Ibid., 6.
[464] Ibid., 6.
[465] Ibid., 9. These principles were taken from existing ideas: emotionality was a pillar of the classical humora theory; the principle of activity was important for Kant's thinking about human cognition; secondary function was taken from Wundt's research into human introspection.

the eight categories: the melancholic with its subdivision in sentimentalists and nervous, the sanguine, the phlegmatic, the passionate, the choleric, the amorph, and the apathetic.[466]

In his lectures Heymans reviewed these categories one by one, accounting for their specific character traits. In this discussion he chose certain individuals as the archetype of a particular class. For example, in the case of the sentimentalists, where he spoke at length about Charlotte Brontë (Fig. 79), the nineteenth-century British writer of the famous novel *Jane Eyre*.

> […] she is quiet and modest, timid to the point of shyness, prone to self-consciousness and self-reproach, a person of lifelong friendships and of resentments that are difficult to overcome, attached to her country and her circle, and difficult to adapt herself elsewhere, conscientious and full of an anxious sense of duty; reserved with her closest friends, and yet incapable of the slightest untruth in speech or action.[467]

Heymans does not talk about Brontë's contribution to British literature, or the fact that she wrote under a pseudonym to avoid being dismissed as a writer, but rather, the psychological interest in her lay in her character, in her attachment to the important people in her life, whether she had long-term friendships, etc.[468]

After discussing Brontë, Heymans explains the difference between the sentimentalists and the nervous by adding other persons that fall into these different categories:

> […] by sentimentalists, then, are meant the emotional non-actives with a predominantly primary function [acute absorption of impressions]; to this category belong such persons as Ch. Brontë, Maine de Biran, Thackery, Ellen Key and (in his later years) Rousseau; among the nervous [persons] such as Byron, Multatuli, Dostojewsky, Alfred de Musset, Edgar Poe, etc.[469]

[466] Ibid., 9-11, 16-17,-18, 20, 22. For the last two categories, the amorphs and the apathics, Heymans did not have any material. According to him this had to do with their lack of activity and emotionality, which obstructed them from active involvement and participate in public activities.
[467] Ibid., 13.
[468] Elizabeth Gaskell, *The Life of Charlotte Brontë* (Edited with an Introduction and Notes by Angus Easson) (Oxford: Oxford University Press, 2009) 3-4; Information retrieved from the website: https://nl.wikipedia.org/wiki/Charlotte_Brontë.
[469] Heymans, *De Classificatie der Karakters*, 14.

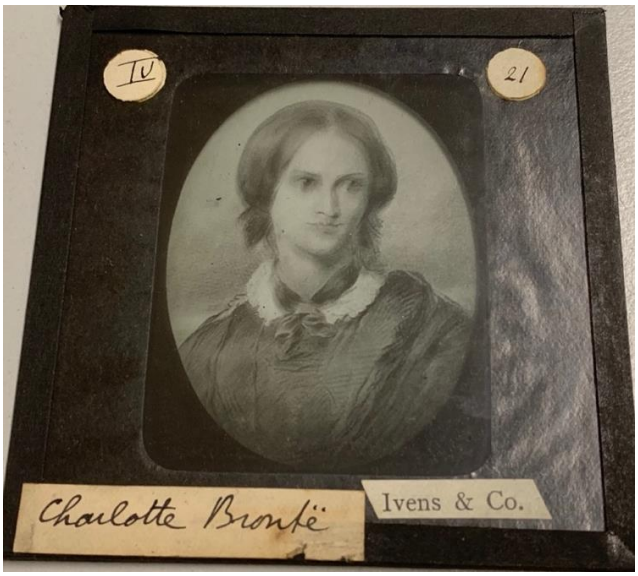

Figure 79. Lantern slide of a portrait of Charlotte Brontë. (Universiteitsmuseum Groningen. Glasdia Collectie Heymans).[470]

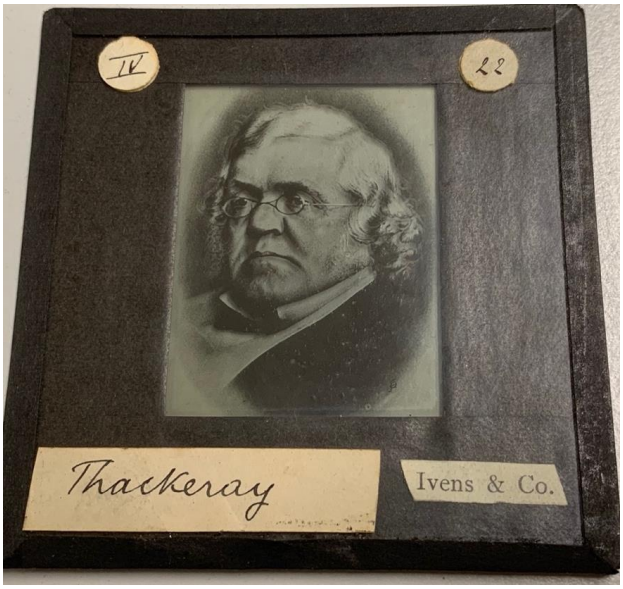

Figure 80. Lantern slide of a portrait of William Makepeace Thackeray. (Universiteitsmuseum Groningen. Glasdia Collectie Heymans).

[470] UMU. Psychologie Collection. Glasdia collectie Gerard Heymans. Uninventoried. Box "Algemene Psychologie". (UMU. Psychology Collection. Lantern slide collection Gerard Heymans. Uninventoried. Box "General Psychology"). All the following images are from the same box of slides.

Figure 81. Lantern slide of portrait of Ellen Key. (severe damage to the image). (Universiteitsmuseum Groningen. Glasdia Collectie Heymans).

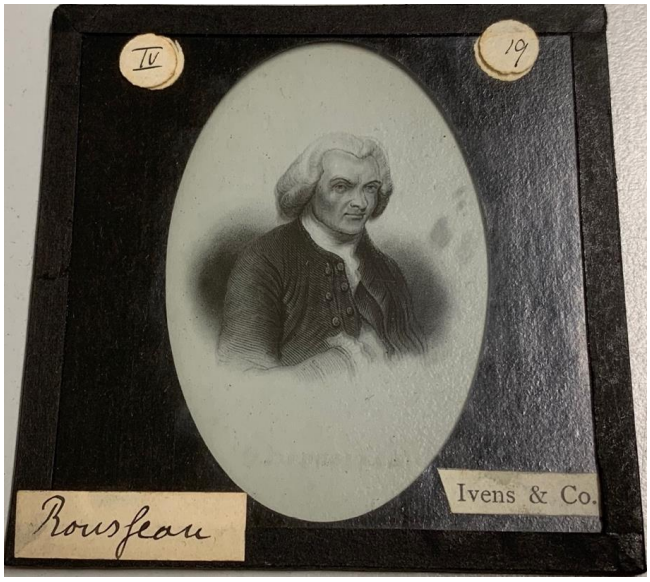

Figure 82. Lantern slide of portrait of Jean-Jacques Rousseau. (Universiteitsmuseum Groningen. Glasdia Collectie Heymans).

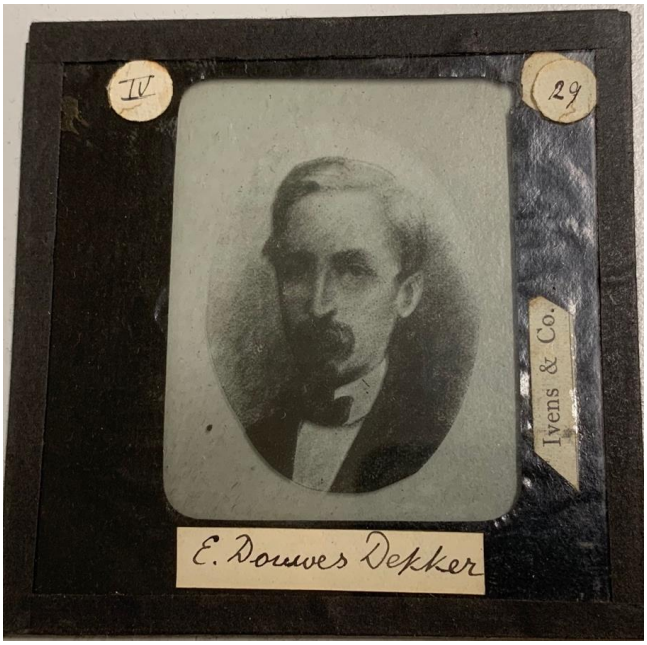

Figure 83. Lantern slide of portrait of E. Douwes Dekker (pseudonym Multatuli).(Universiteitsmuseum Groningen. Glasdia Collectie Heymans).

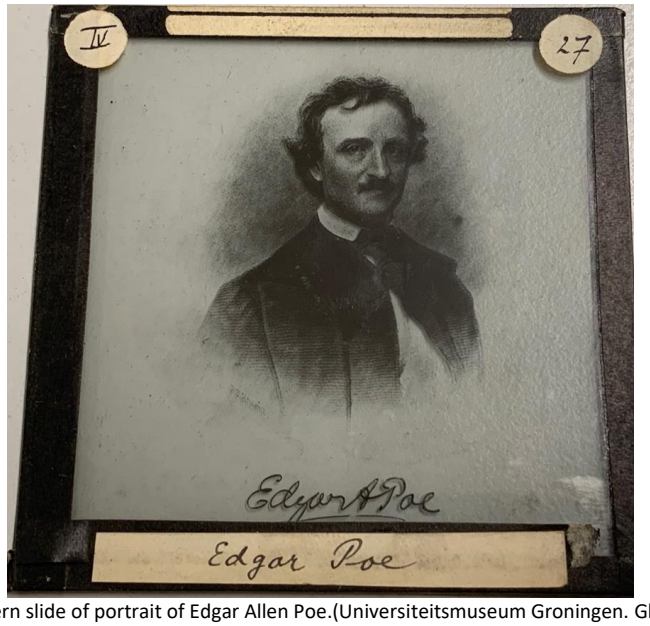

Figure 84. Lantern slide of portrait of Edgar Allen Poe.(Universiteitsmuseum Groningen. Glasdia Collectie Heymans).

In his discussion of historical figures one can easily imagine that he projected their portraits as concrete examples, specific persons that stood for a whole category, that served the didactical aim of recognition. They may also have been meant to function as aide-mémoires of the specific traits that belonged to the different categories Heymans distinguished.

On a final note, it is interesting to demonstrate another unexpected parallel between astronomy and psychology: the figure of Tycho Brahe. Although I have not found a lantern slide of Tycho Brahe in the psychology collection of Heymans, Brahe does play a role in his account of the category of the "passionate", on which he elaborated in one of his lectures at the University of Groningen.[471] Brahe's treatment in both educational contexts—astronomy and psychology—serving two different rhetorical strategies, also reinforces our need for a more thorough understanding of the particular use of these projected images. Tycho Brahe, in the booklet written by Nijland, is discussed for his astronomical contributions, specifically in the example given, his resistance to the idea of a heliocentric worldview and his planetary observations.[472] Heymans, in his discussion of Brahe, mainly focuses on his personal life. For the purpose of his classification system, he tries to find clear signs of his character based on the complicated relationship he had with his family, which did not support his astronomical work.[473]

It is often said that images "spay more than a thousand words". However, they hardly ever tell the same story. In astronomy the historical figures' portraits support the long tradition of the discipline's efforts in better understanding how the universe and its construction was conceived through the ages. In psychology, on the other hand, the portraits are not praised for their historical significance, the times in which they lived or what makes them interesting as people *per se*. They are rather presented as archetypes of certain characterological categories that Heymans distilled from reading their biographies. Both Nijland and Heymans used these portraits as illustrative, enlivening materials of their lectures as part of different rhetorical strategies. Moreover, these different strategies also underscore the different formative stages in inducting students into their respective thought collectives. For Nijland, the portraits were part of introducing his students to astronomical concepts and methods, whereas for Heymans the portraits were shown to more advanced students, allowing them to make connections between laws, concepts, and empirical evidence.

With the final example, I will further develop the idea about visual strategies employed, by focusing on two lectures that were given before a professional audience. I do this by discussing two lectures by botany professor F.A.F.C. Went, delivered in 1926 at two different scientific

[471] Groninger Archieven. Collectie Gerard Heymans. 50.8. College aantekeningen van P.W. Pannenborg. "Speciale Pyschologie college van Prof. Heymans" (n.d.).
[472] Nijland, *De bouw van het heelal*, 98.
[473] GA. CGH. 50.8. College aantekeningen P.W. Pannenborg, "Speciale Psychologie" (n.d.).

conferences. In contrast to the other examples, this case allows a full reconstruction, as both the fully written out lecture texts, as well as the lantern slides that he used within his performances have survived. What needs to be stressed here, is that the lectures that will be discussed are in part research results from what historians have referred to as the "Utrecht school" of plant physiology, which conducted "pioneering research" into tropism and growth regulators.[474] In contrast to the previous examples, the next case will discuss the intrinsic connection between this research conducted by (former) students and researchers under Went's supervision in the Botanical Laboratory in Utrecht, and the way in which he shared these new insights with an international audience as well as to his students via the *lantern* lecture.

The Professional Level: F.A.F.C. Went's teaching on plant movement

> The *text-book* corresponds to the instruction of the cause: it must be simple and objective being destined for reference in the study and must give facts and theories in a kind of crystallized, pure and well ordered condition. The task of the lecturer however is one of a more subjective character, he must button-hole his auditors and tell them what according to his present conviction is the kernel of the matter; he may use strong expressions because he can immediately afterwards soften them, but doing so he can say good things, which his audience will never forget.[475]

Botanical education in the Netherlands fundamentally changed around the turn of the twentieth century. This was mainly because most of the professors appointed at that time were trained in the 'new' subfield of plant physiology: Jan Willem Moll in Groningen, Hugo de Vries in Amsterdam, Friedrich August Ferdinand Christian Went in Utrecht, and Jacobus Marinus Janse in Leiden.[476] Most of them had for a longer or shorter period of time studied in Germany, where plant physiology had been a regular research field for some time, and they took their experiences and skills back with them. As a subfield, plant physiology studies the internal functioning of plants by using experimental methods. This experimental emphasis amplified the need for constructing new and modern botanical laboratories, to accommodate microscopy lessons, research on a larger scale, as well as lectures to instruct and train students for future research.[477] The importance of

[474] Patricia Faasse, *Experiments in Growth* (PhD thesis, Universiteit van Amsterdam, 1994) 21; Wim van der Schoor, *Zuivere en toegepaste wetenschap in de tropen* (PhD thesis, Utrecht University, 2012) 195. In both studies, the authors refer to the "Utrecht school" for plant physiology. This school, led by Went received international acclaim for its research through its growth experiments. Consequently, the lectures that Went presented at the various congresses indeed stresses his investment into this research topic as well as his effort in disseminating the knowledge that resulted from it.

[475] J.W. Moll, *Phytography as a fine art: comprising linnean description, micrography and penportraits* (Leiden: E.J. Brill, 1934), 512.

[476] Sirks, *Botany in the Netherlands*, 6-7, 14, 17-18, 27, 35; C. Kalkman, "The Rijksherbarium, in Past and Present", in: *Blumea,* vol. 25 (1979), 15.

[477] An argument that was simultaneously prompted by the constitutional provision of article 1 of the Higher Education Act of 1876, which stated that the main task of the university was: "training and preparing students to become independent practitioners of science" Higher Education Act 1876. Wet op het Hooger Onderwijs van 28

education and training, as discussed in chapter 1, is shown in the construction of the model botanical laboratory in Groningen at the end of the nineteenth century, under the supervision of Moll.[478] Together with the state architect, Jacobus van Lokhorst, Moll went to great lengths to fully accommodate the setup of the lecture hall to the use of the optical lantern.[479] This illustrates that not only the *content* of botanical education changed, but also its *pedagogical practices*.

As far as Went's teaching practices are concerned, fortunately much material has been preserved, albeit in different archives in the Netherlands. Whereas the collection of lantern slides that was part of his teaching practices is at the University Museum of Utrecht, most of the written documents relating to Went's use of them are at the Archive of Museum Boerhaave in Leiden.[480] Based on my archival research, only two of the lectures I retrieved were 'complete'—in the sense that they allow full reconstruction—and this was a lecture on plant movement, including 39 lantern slides. Strikingly, but then again not too surprisingly, the (photographic) images used for this lecture are also found in a textbook that Went published in 1922. Accordingly, what follows will be an in-depth discussion of this lecture aiming at understanding the role of the images therein. But before proceeding to this part, it is necessary to consider the context of the lecture as well as the textbook in order to gain a full understanding of the visual strategies employed in both these educational forms.

The Textbook

In 1922, Went received a request from the publishing house J.B. Wolters, in Groningen, to write a textbook on general botany. After some 'thorough contemplation' Went accepted this invitation and wrote his *Leerboek*. As he states in his preface, his most important reason to take up this task was to provide his students with a general overview of the state of the art of botanical science. Moreover, he adds, it was about time that a botanical textbook was written in Dutch. Despite the availability of high-quality textbooks in foreign languages (mostly German), the new generation of students needed to be trained in their own language in order to prevent the misuse of botanical terminology. In his view, besides language, the Dutch territorial context, particularly the characteristics of plants growing in the Dutch East Indies or Surinam, should receive more

April 1876 (1876): 3, article 1; Jamilla Notebaard, "De glazen erfenis van de Groningse botanische onderwijspraktijk rond 1900" (2023), https://www.rug.nl/museum/collections/columns/de-glazen-erfenis-van-de-groningse-botanische-onderwijspraktijk-rond-1900.

[478] Sirks, *Botany in the Netherlands*, 15; J.M. Janse, *Rede gehouden bij de opening van het Botanisch Laboratorium der Rijks-Universiteit te Leiden* (Leiden: E.J. Brill, 1908), 33.

[479] Jamilla Notebaard, forthcoming 2024.

[480] The scatteredness of this archival material has probably to do with Went's appointment in 1933 at the Univeristy of Leiden after holding a chair in Utrecht for 37 years.
https://resolver.kb.nl/resolve?urn=MMRANM02:000032841:mpeg21:a0070

attention, too.[481] Fundamentally, Went used this opportunity to write a textbook that fitted his own educational agenda. He states:

> The contents of the book cover general botany on a scope that approximates what is considered to belong to propaedeutic botany, i.e. the essentials that are covered in my general lectures in the course of two years.[482]

Hence, the audience that he envisions will initially be first- and second-year Biology students, who need to learn and internalize the basic principles, methods, and terminology of botany.[483]

Went's textbook is divided into two parts; the first part covers the subfield of morphology, the second part deals with physiology. Plant movement is discussed in the second part and covers about sixty pages. Divided over these pages, Went included 22 photographic images and three diagrams/graphs.

The lecture series

In contrast to the wide availability of historical scientific textbooks, very few lecture notes (whether by professors or students) in the form of fully written-out texts have survived. This case study then, is particularly rich because both the texts and accompanying lantern slides have come down to us.

The Third Pan-Pacific Science Congress in Tokyo in 1926, where Went performed his first lecture series, brought together a large community of international scientists "to study the scientific problems of the Pacific by cooperative effort, and these problems do not concern one or two only, but many if not all branches of science."[484] Went's lecture series on plant movement can thus be seen as a way of sharing knowledge and new insights about this topic. His series consisted of three lectures of roughly one hour that together included 39 projected images. And while the setup remained the same as his university lectures, the difference in target audience had consequences for both the content and the complexity of the lecture. Indeed, compared to the

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[481] F.A.F.C. Went, *Leerboek der algemeene plantkunde* (Groningen, 1923), v. As M.J. Sirks wrote about Went in his overview of botany's history and development at Dutch universities: "He inspired his students by his conviction that the development of the Dutch colonies should be attended by a thorough knowledge of nature in the tropics, i.e., by an adequate development of natural sciences." Sirks, *Botany in the Netherlands*, 18.
[482] Went, *Leerboek der algemeene plantkunde*, vi. Original text in Dutch: 'De inhoud van het boek omvat de algemeene botanie in een omvang, zooals men die ongeveer rekent te behooren tot de propaedeutische plantkunde, dus de hoofdzaken, van hetgeen door mij op het algemeene college in twee jaren behandeld wordt.'
[483] Ibid., vi. However, self-evidently, Went also includes other than students of Botany, who come from different scientific disciplines that use botany as an auxiliary science.
[484] Part of the opening speech of the Third Pan-Pacific Science Congress by Joji Sakurai quoted in: Masanori Wada, "The Two International Congresses Held in Tokyo in the 1920s: The Rise of the First Generation of Japanese Scientists", *International Workshop on the History of Chemistry, 2015, Tokio*, 38: http://kagakushi.org/iwhc2015/papers/06.WadaMasanori.pdf. According to one of Sakurai's contemporaries, F.G. Donnan, he was a "great promotor of scientific research in Japan", at the Pan-Pacific Congress in Japan in 1926 he gave the opening speech, see: F.G. Duggan, "Obituaries. Baron Joji Sakurai", in: *Nature*, vol. 144 (August 1939), 234.

textbook, one could say that the lecture text provides a more complex discussion of plant movement, as Went addressed current theories as well as experimental research in 'his' botanical laboratory in Utrecht that elaborated upon those theories.

Despite these substantive differences as well as the higher number of illustrations used, the textbook and the lecture did share fourteen images. The use of the same images for knowledge transmission to different target audiences reveals the varied strategies adopted in the process of the formation of a botanical thought collective. Instead of analyzing images based on what they depict or represent, the study of images based on how they were made instructive in different phases of that formation underscores the synergy between the different levels of expertise. In the words of Daston, it is part of the process of the 'calibration of observers'.[485] For example, as Victor Jacob Koningsberger recalled in his commemorative lecture devoted to Went in 1935, one of Went's "capita selecta" (classes where literature, specifically certain chapters were read and discussed) on phototropic movement was the main incentive for one of his pupils, Anton Hendrik Blaauw, to conduct research into this topic. In its turn, interestingly, part of that research shaped the content of the lecture series given in Tokyo.[486] This also leads to the assumption that the content of his lecture series eventually found its way into the curriculum of botanical students at Utrecht.[487] Yet another aspect of this synergy is that Went's lecture series in Tokyo was attended by a mixed audience, i.e., not just specialists in plant physiology.[488]

Contexts of display

In what follows, I present four examples that show how Went used visual strategies in his knowledge transmission. In the first case, I demonstrate the differences in target audience and their instrumentality for the type of knowledge transmission that can be achieved. In the second case, the concept of showing movement by means of still images is central, particularly in relation to time-lapse films. The third one will showcase the different material supports that trained students to 'see with the eyes of the collective', while the fourth one addresses the use of drawings and of photographs for different purposes. Together, these examples demonstrate the value of studying scientific pedagogy through the close study of images, to see in what ways they

[485] Daston, "On Scientific Observation", 102.
[486] V.J. Koningsberger, *Prof. Dr. F.A.F.C. Went. Herdenkingscollege, gehouden in het Botanisch Laboratorium te Utrecht op Woensdag, 9 October 1935* (s.l., 1935), 10.
[487] This was in line with the then current Act of Higher Education from 1876 which prescribed: "Higher education includes the education and preparation for the independent practice of science and for occupying social positions, which require scientific training." *Wet tot regeling van het Hooger Onderwijs*, Art. 1, 3.
[488] B.M. Duggar, "International Botanical Congress of Plant Sciences", in: *Proceedings of the International congress of plant sciences, Ithaca, New York, August 16-23, 1926* (Menasha, WI: George Banta1929), 61.

contributed to learning and allowed students to become members of the botanical thought collective.

Example 1 – (Formative) stages of the though collective

The first example concerns the visual strategy that Went employs in his first, introductory lecture on the topic of plant movement. As he explains, the time frame of three lectures does not allow him to fully dwell on everything that is known about plant movements. Therefore, he has come up with a way to deal with this matter more effectively. He starts by pointing out that for a long time it was thought that the 'principal difference between animals and plants' was their 'sensitivity', which Went translates with the botanical term 'irritability', by which he means the 'response by a living organism to external stimuli'.[489] However, as was already known 'long ago', there was one obvious example that refuted this idea of irritability as being exclusive to animals, namely the *mimosa pudica* (*kruidje-roer-me-niet* in Dutch). As soon as Went mentions this species, he shows two projected images in quick succession (see Fig. 85 and 86).

Shown in immediate succession, they corroborate Went's statement that this species showed movement. He continues: 'After touching the ventral side of the pulvinus, very strong movements are carried out, which I will not describe in detail since they probably are *very well known to the majority of my hearers*.'[490] In showing these images, Went presupposes that his audience must have seen this species' movements already *before*. Its role in botanical science, captured here by means of the photographic image, could be seen as 'iconic', (meaning here offering a sense of recognition). Capitalizing on his audience as a thought collective, these images not only appeal to its knowledge and memory, they also function as a way of introducing the subject under discussion.

Iconicity points to another function of teaching this visual strategy: that of a mnemonic device. As a course on plant physiology was spread over an entire academic year, student's memories had to be refreshed every now and then with regard to the specific topic under discussion.[491] This 'lantern lecture' practice, then, has partly taken over the function of the *responsiecollege*—a practice also adopted by professor of art history Willem Vogelsang, who

[489] Bibliotheek Rijksmuseum Boerhaave. Archief 14. F.A.F.C. Went. Arch. VIII. Folder 79-4. "Drie lezingen over plantbewegingen" (1926) 1. (Library National Museum Boerhaave. Archive 14. F.A.F.C. Went. Arch. VIII. Folder 79-4. "Three lectures on plant movement). The term "irritability" was coined by plant physiologist Julius Sachs, who is seen as the "founding father" of plant physiology. Following Sachs, Went's topic followed Sach's line of study, in trying to understand the connection between animals and plants, and thus also the unity of life. For more on Sachs, cf. Ulrich Kutschera and Frantisek Baluska, "Julius Sachs (1832-1897) and the Unity of Life", in: *Plant Signaling & Behavior*, vol. 10, 9 (2015). The modern definition of 'irritability' can be found in the "Dictionary of Botany": http://www.botanydictionary.org/irritability.html.
[490] BRB. Archief 14. F.A.F.C. Went. VIII. 79-4. "Drie lezingen over plantbewegingen" (1926) 1. [my emphasis].
[491] Verslag van den staat van het onderwijs in het Koninkrijk der Nederlanden over ..., 1924 [volgno 1]. Consulted on Delpher op 10-02-2023, https://resolver.kb.nl/resolve?urn=dts:1504001:mpeg21:0003, 24.

wrote in his lecture notes of 1909: 'repetition of [slides already] addressed'.[492] The repetition of projected images served the purpose of outlining the course, while it simultaneously ensured that the information was remembered.

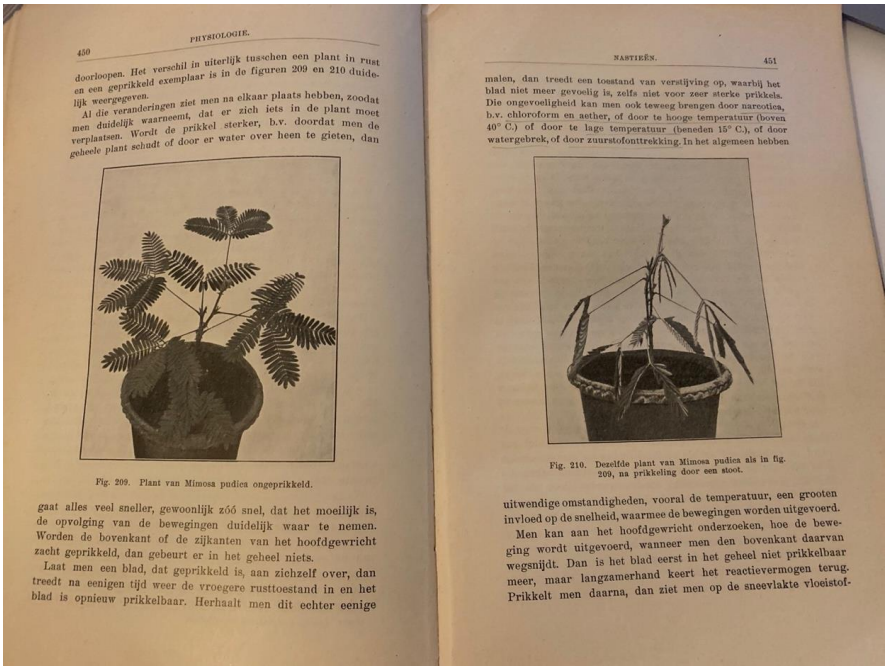
In Tokyo, Went showed the same set of images that appeared in the textbook (Fig. 87), albeit at the end rather than at the beginning of the section dealing with plant movements. Here, they are used to discuss the so-called 'seismonastic movement', movement caused by a shock (shaking for example).[493] Went explains:

> Now, if one carefully touches the bristles at the bottom of the main joint, one sees [...] the following happen. The general leaf stalk drops down, then the leaves of the first order move towards each other and finally all the leaves of the second order fold over around their joints in such a way that their top sides lie against each other, while they form an upward, acute angle.[494]

Figure 85. Slide number 1527, the unstimulated mimosa pudica (Universiteitsmuseum Utrecht, Botanische collectie glasdia's). (Photographed by the author).

[492] Vogelsang commonly began a new series of lectures by briefly summarizing what he had shown and discussed previously. AKHI. UU. AWV. 1.3. "Jaarverslag 1908-1909", 2.
[493] Went, *Leerboek der algemeene plantkunde*, 449.
[494] Ibid., 449-451. Original text in Dutch: 'Wanner men nu zeer voorzichtig de borstels aan de onderzijde van het hoofdgewricht aanraakt, ziet men (…) het volgende gebeuren. De algemeene bladsteel zakt naar beneden, de blaadjes van de eerste orde gaan daarna naar elkaar toe en ten slotte klappen al de blaadjes van de tweede orde om hun gewrichten zoodanig om, dat zij met hun bovenkanten tegen elkaar aan komen te liggen, terwijl zij tegelijkertijd een kleinen hoek naar boven doorloopen.'

Figure 86. Slide number 1528 of the 'irritable' mimosa pudica.(Universiteitsmuseum Utrecht, Botanische collectie glasdia's). (Photographed by the author).



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doorloopen. Het verschil in uiterlijk tusschen een plant in rust en een geprikkeld exemplaar is in de figuren 209 en 210 duidelijk weergegeven.

Al die veranderingen ziet men na elkaar plaats hebben, zoodat men duidelijk waarneemt, dat er zich iets in de plant moet verplaatsen. Wordt de prikkel sterker, b.v. doordat men de geheele plant schudt of door er water over heen te gieten, dan

Fig. 209. Plant van Mimosa pudica ongeprikkeld.

gaat alles veel sneller, gewoonlijk zóó snel, dat het moeilijk is, de opvolging van de bewegingen duidelijk waar te nemen. Worden de bovenkant of de zijkanten van het hoofdgewricht zacht geprikkeld, dan gebeurt er in het geheel niets.

Laat men een blad, dat geprikkeld is, aan zichzelf over, dan treedt na eenigen tijd weer de vroegere rusttoestand in en het blad is opnieuw prikkelbaar. Herhaalt men dit echter eenige

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malen, dan treedt een toestand van verstijving op, waarbij het blad niet meer gevoelig is, zelfs niet voor zeer sterke prikkels. Die ongevoeligheid kan men ook teweeg brengen door narcotica, b.v. chloroform en aether, of door te hooge temperatuur (boven 40° C.) of door te lage temperatuur (beneden 15° C.), of door watergebrek, of door zuurstofonttrekking. In het algemeen hebben

Fig. 210. Derzelfde plant van Mimosa pudica als in fig. 209, na prikkeling door een stoot.

uitwendige omstandigheden, vooral de temperatuur, een grooten invloed op de snelheid, waarmee de bewegingen worden uitgevoerd.

Men kan aan het hoofdgewricht onderzoeken, hoe de beweging wordt uitgevoerd, wanneer men den bovenkant daarvan wegsnijdt. Dan is het blad eerst in het geheel niet prikkelbaar meer, maar langzamerhand keert het reactievermogen terug. Prikkelt men daarna, dan ziet men op de sneevlakte vloeistof-

Figure 87. Textbook images of the mimosa pudica, similar to the lantern slides projected in the lecture series by Went.[495]

[495] Went, *Leerboek der algemeene plantkunde*, 450-451.

Compared to the textbook, the lecture demands a pedagogical approach adapted to its target audience. In encountering this phenomenon for the 'first' time, the student studying the textbook needs to learn what these images depict. They are not self-explanatory (as is the case when Went showed these images during his lecture in Tokyo) and they require additional information provided by the captions. The textbook leads students through the causal explanations of the most instructive examples of plant movement by both word and image. The images enable students to grasp which movement they represent and recognize that later, in doing their own research, for example. Still, we need to bear in mind that there is also a cooperative relation between the images displayed in the *lantern* lecture and in the textbook. Their recurrence in both contexts enables memorization, which is necessary in building a collective body of knowledge. Put differently, the process of recognizing, of learning how to 'read' these images, is reinforced by encountering these images in these different 'contexts of display'.

Example 2 – 'Single glance-ness'

Instead of showing movement of plants by means of the (rapid) succession of two (projected) images, Went also used the strategy of what I call here 'single glance-ness'. With this term I mean the amalgamation of multiple images in one single frame with the aim of merging (scientific) information for didactical purposes.

In discussing the so-called contact stimuli Went displays a full-page image containing three separate photographs of the Sicyos angulata in his *Leerboek* (Fig. 88). The composite image immediately makes clear what it demonstrates, i.e., the several stages of one single movement of this species. This constructed image allows students to take this phenomenon in by simply looking at the image, *at a glance*. It is important to stress that this practice in textbooks was already common. In the words of historian Henning Schmidgen, 'The printed world of 19th century physiology could only offer flat and immobile images', their display in series offered a way to fix 'single phases or stages of a process that were represented in a row'.[496] Thus, by sequencing images in this way, Went and others were able to find a solution to the problem of representing movement in a textbook.

Interestingly however, Went also used the image of 'single glance-ness' in his lantern lecture, even though the performative context of the lecture easily allowed for other ways of displaying this phenomenon (as for example by using double projection[497]). In fact, the discussion of plant movement by means of projected, photographic still images seems highly paradoxical.

[496] Schmidgen, "Pictures, Preparations, and Living Processes", 480.
[497] Double projection is the lantern practice that is often attributed to the German art history professor Heinrich Wölfflin, see for example: Hamber, "The Use of Photography by Nineteenth-Century Art Historians", 113-114; Dan Karlholm, "Developing the Picture: Wölfflin's Performance Art", *Photography & Culture*, vol. 3, 2 (2010), 20.

After all, cinematic time-lapse devices were already being used to illustrate movements and were able to provide evidence of the movement of plants in general.[498] And, as is known, when attending congresses at that time, showing film was also one of the options in presenting research or ideas before the though collective.[499] So, the question is why did Went refrain from this option and rather showed lantern slides to his audience?

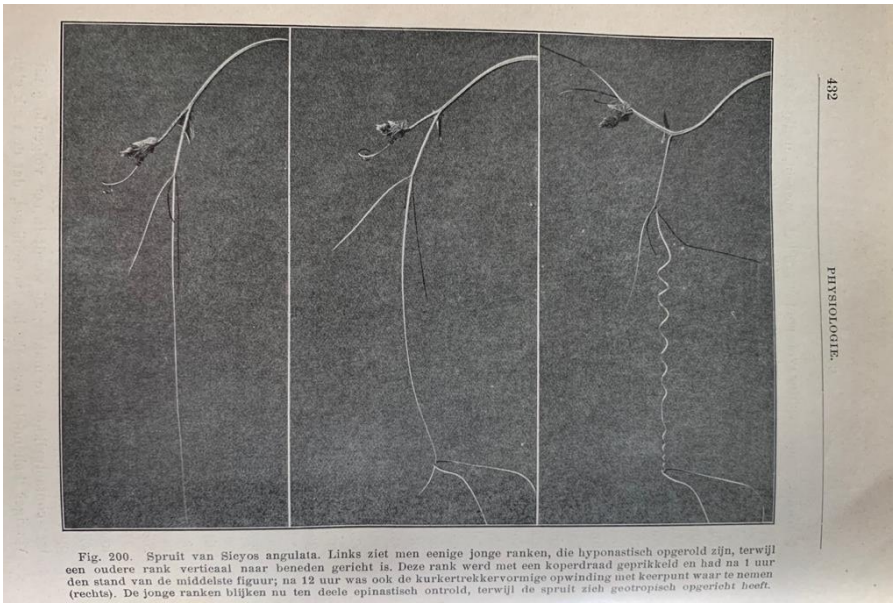


Figure 88. The published image of the movement of Sicyos angulate. [500]

According to film historian Oliver Gaycken it was German botanist Wilhelm Pfeffer, who was among the first to fully appreciate the use of time-lapse films for his botanical teaching practice. For Pfeffer the main pedagogical affordance of this medium was that it offered students 'visual evidence that in seemingly static plants lively activity was present.'[501] By accelerating the phases of movement through time-lapse films they become visible to the naked eye. In other words, through the time-lapse film time is diluted.[502] Thus, as pedagogical devices these films were mainly used to highlight and introduce the general phenomenon of plant movement. In the introduction of his textbook, Went also reflects on film, as he states: 'Anyone who has ever seen the unfolding

[498] Oliver Gaycken, "The secret life of plants: Visualizing vegetative movement, 1880-1903", in: *Journal of Early Popular Visual Culture*, vol. 10, 1 (2012), 56.
[499] Frank Thone, "Plant Physiology at the Ithaca congress", *Plant Physiology*, vol I, 4 (1926), 303.
[500] Went, *Leerboek der algemeene plantkunde*, 432. Notice the position of the image on the textbook page, in order to *see* it 'correctly, the reader has to turn the book in order to see it properly.
[501] Wilhelm Pfeffer quoted in: Gaycken, "The secret life of plants", *EPVC*, vol. 10, 1 (2012), 58.
[502] Cocchi, E., (2018) *Wilhelm Pfeffer Pflanzenbewegungen* [Video] Youtube. Retrieved on March 2, 2023 from the website: https://www.youtube.com/watch?v=FtCFCkQsBtg.

of a plant bud before their eyes in a cinema has been cured of the notion that plants do not move.'[503]

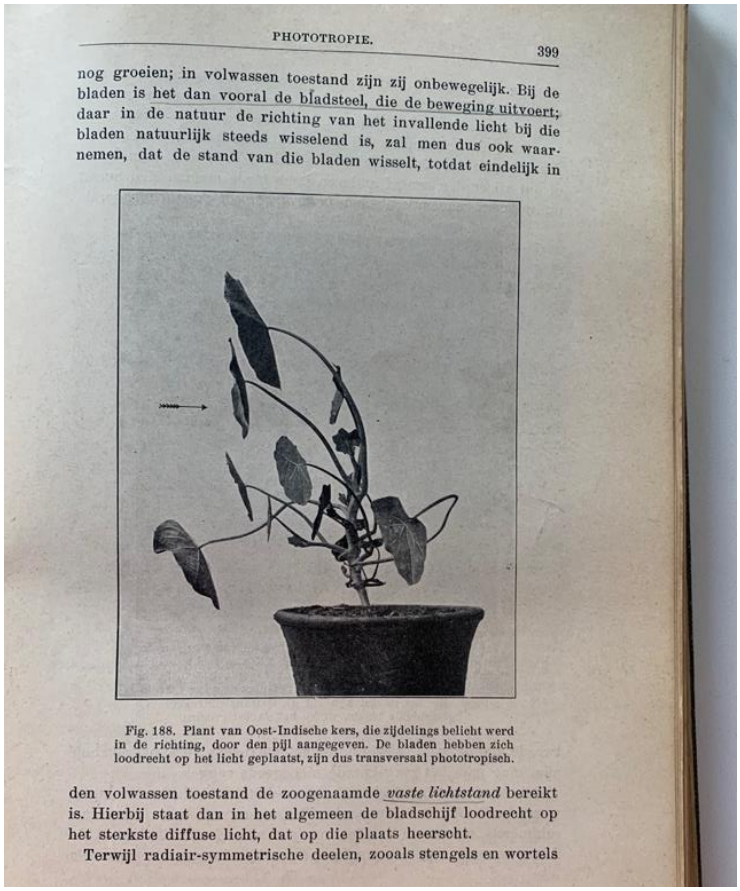
Simultaneously, however, Went warned that the medium of film was less helpful than it appeared at first sight. In 1931, in a chapter on *Bewegungen* in S. Kostytschew's *Lehrbuch der Pflanzenbewegungen*, he reflected more thoroughly on the problematic nature of film, especially regarding research practices. First, film requires natural light. But as light is one of the causes of plant movement, film recording, at least according to Went, threatens to interfere with another force of plant movement; geotropic movement, or movement caused by gravity. Secondly, for a thorough and detailed analysis of the different phases of movement, the ability to capture them by means of photographic still images enhanced insights into its causes and effects.[504] Instead of accelerating the phases of movement, as in time-lapse film, these images (Fig. 88 and 89) were rather meant to represent frozen moments in time. As Went explains in his lecture: 'The curvature is carried out in such a short time, that here again one is unminded [sic] of the movement [...].'[505] Put differently, he needed to show the different phases in the process of movement to indicate what preceded the stance of the tendril, i.e., to show the cause.

Figure 89. Lantern slide 1525, used by Went in his lecture series. (Universiteitsmuseum Utrecht, Botanische collectie glasdia's). (Photographed by the author).

[503] Went, *Leerboek der algemeene plantkunde*, 393.
[504] F.A.F.C. Went, "Bewegungen" in: S. Kostytschew, *Lehrbuch der Pflanzenphysiologie. Band II* (1931), 324-325. https://archive.org/details/in.ernet.dli.2015.377401/page/n409/mode/2up
[505] BRB. Archief F.A.F.C. Went. VIII. 79.4 "Drie lezingen over plantbewegingen" (1926) 3. 'Unminded' is Went his own term, which is a bit unclear. But what he most probably hints at is that the observer was not able to observe the plant movement, because of the slowness of the movement and therefore tends to be 'unminded' of it *per se*. Most likely, the 'unmindedness' refers to being unconscious of the movement taking place.

Example 3 – Visual adaptation

As noted, the formation of a thought collective also means being exposed to the same images, i.e., the same information, more than once. This final example deals with this visual strategy, more particularly with the affordances of different teaching aids in academic knowledge transmission. Central here is an image of the nasturtium (or Indian cress) reproduced on three material supports: a photographic textbook illustration (Fig. 90), a drawing of said photograph on a wallchart (Fig. 91), and a photographic lantern slide (Fig. 92). Even though Went did not use the wallchart for his lecture series, it was part of his teaching aids and teaching practice. By comparing these three material supports it becomes possible to delineate the interplay between the materiality of an image and the way in which it is constructed and used for instructive purposes.



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nog groeien; in volwassen toestand zijn zij onbewegelijk. Bij de bladen is het dan vooral de bladsteel, die de beweging uitvoert; daar in de natuur de richting van het invallende licht bij die bladen natuurlijk steeds wisselend is, zal men dus ook waarnemen, dat de stand van die bladen wisselt, totdat eindelijk in

Fig. 188. Plant van Oost-Indische kers, die zijdelings belicht werd in de richting, door den pijl aangegeven. De bladen hebben zich loodrecht op het licht geplaatst, zijn dus transversaal phototropisch.

den volwassen toestand de zoogenaamde *vaste lichtstand* bereikt is. Hierbij staat dan in het algemeen de bladschijf loodrecht op het sterkste diffuse licht, dat op die plaats heerscht.

Terwijl radiair-symmetrische deelen, zooals stengels en wortels

Figure 90. Image of the nasturtium (Indian cress) in Leerboek.[506]

[506] Went, *Leerboek der algemeene plantkunde*, 399.

Figure 91. Wallchart drawn after the photograph of the nasturtium (Indian cress). (Collectie Universiteitsmuseum Utrecht).

Figure 92. Lantern slide of the nasturtium (Indian cress) used by Went in his lecture series on plant movement in 1926.(Universiteitsmuseum Utrecht, Botanische collectie glasdia's). (Photographed by the author).

These images show the so-called *transversal phototropic* movement, i.e., the reaction of plants to unilateral light—here coming from the left—that causes the perpendicular position of the blades. This immediately raises the question of why this image was incorporated in three different 'contexts of display'. The first thing that stands out in both the wallchart and the image in the textbook is the addition of the arrow on the left side. In both, this arrow functions as an 'indicator of movement', a stand-in for the light source that the blades react to.[507] So, we might say that it has a guiding function: the arrow makes the cause of the position of the blades immediately perceptible.

However, the performance of the lantern lecture did not require additional visual information in the slide, as the projected image functioned in conjunction with the explanation of the lecturer. This we can see in the transcript of Went's lecture: "transverse phototropic movements of the leaves [can be detected] when the blade places itself perpendicular to the rays of light by means of a curvature executed by the leafstalk."[508] Furthermore, the performative

[507] The functioning of the arrow in textbooks has been discussed (among others) by Schmidgen in "Pictures, Preparations, and Living Processes", 480.
[508] BRB. Archief Went. "Drie lezingen over plantbewegingen" (1926) 7.

situation of the lecture allowed the use of a pointer, the equivalent of the arrow in the wallchart and the textbook illustration. One of the main affordances of the lantern lecture, then, was the interaction between the lecturer and his audience. By pointing out in word and/or gesture the key aspects of the knowledge he wanted to convey, the lecturer was able to guide its gaze and create mutual understanding about the movements' specific qualities for example.

The wallchart performs yet another function within the lecture hall and teaching practices in general. Like the academic lantern lecture, wallcharts were used within the confinements of the university building, in contrast to the use of the textbook which also functioned within the walls of students' study rooms. Moreover, whereas the academic lantern lecture makes use of a series of projected images that appear and disappear over the course of roughly an hour, the presence of the wallchart is permanent, as they were hung up for the duration of an entire course, often accompanied by other ones.[509] This implies that they were not always discussed. Wallcharts, then, took on the role of a referential aid: discussed in one lecture, referred to in the next or possibly not at all for the rest of the course. This explanation not only concerns the arrow, but also the wallchart's description at the bottom: together they make the wallchart immediately legible. In that sense, it is very similar to the published version of this image and its caption in the textbook.

Example 4 – Travelling strategies

The year 1926 was dominated by a longer journey for Went. Before travelling to Tokyo Went visited the International Botanical Congress in Ithaca, NY. After visiting Tokyo, he left for the Netherlands East Indies. In all these places he gave lantern lectures on plant movement. But, depending on the occasion, the time slots at his disposal or the audience he addressed, these lantern lectures differed in content. The main difference between Tokyo and Ithaca was the amount of time to give a lecture. While he gave three lectures in Tokyo, which allowed him plenty of time for an extensive account of his latest research. In Ithaca, he presented a single lecture about the topic of the bending of stems. In the Netherlands East Indies he gave a lantern lecture before the "Koninklijke Natuurkundige Vereeniging" (Royal Physics Association) during one of their meetings.[510] Interestingly, given these different occasions and audiences for the context here, is that, despite addressing different audiences, Went most probably brought a limited number of slides (a limit he set on his luggage while traveling, but also perhaps because he was invited or wanted to discuss this particular topic only).

[509] Noé, "The Use of Charts in the Natural Sciences", 572.
[510] Lezing Prof. Went.. "Bataviaasch Nieuwsblad". Batavia, 28-12-1926, p. 2. Consulted on Delpher 14-03-2023, https://resolver.kb.nl/resolve?urn=ddd:011037060:mpeg21:p002; Bewegingen van Planten. "Het Nieuws van den Dag voor Nederlandsch-Indië". Batavia, 29-12-1926, p. 2. Consulted on Delpher 14-03-2023, https://resolver.kb.nl/resolve?urn=ddd:010220770:mpeg21:a0014.

According to a report in a local newspaper Went showed "several lantern slides" that "illustrated" his presentation. And just as with his with the first lecture at Tokyo, Went projected the images of the mimosa-pudica (a species that was very common in the Netherlands East-Indies and thus appeal to the local context as well), i.e., first the untouched plant, followed by the irritated plant (see Fig. 85 and 86). Judging from this brief news report the discussion of the mimosa-pudica here was mainly aimed at making his audience aware of the presence of movements in plants, like he did in the Tokyo-lecture. However, the difference lies in the way he presented the images. "Next, speaker provides some examples of plant movement by using several lantern slides."[511] Most probably, the projected images were presented one after another while Went briefly stated the different types of movements they depicted, such as the nastic, hydrotropic, and geotropic movements. His aim must have been to 'simply' show the different types of movements known up to then.

In contrast, the single lecture presented in Ithaca was again one of a more specialized nature. In order to stress this point, I want to end this chapter with one final example of Went's use of lantern slides. The main aim of this lecture was to "give you a short account of the more modern ideas in this matter [the idea that light acts as a stimulus for curvatures in stems], as far as possible based on facts, though I sometimes may give some suggestions, which you can take for what they are worth."[512] The lecture deals largely with contemporary research to build a model that reflects the amount of light that is necessary to cause curvature. This involves the length of time that the seedling needs to be exposed to that light and the point at which the curvature keeps increasing or when no difference is observable anymore. An initial setup of this research was done by one Went's former pupils, Willem Hendrik Arisz, which he discussed in this lecture.[513]

> The next lantern slide [fig. 93] shows you a small zinc box with oat seedlings [Avena] that have have been illuminated from the righthand side during two seconds with light of a power of 20 M.C.; the photograph was made after having stood for three hours in complete darkness, the photograph was made; they show a very appreciable curvature. This slide already gives in a faint impression of the curvature's slow progress from the apex to the base of the seedlings.[514]

In showing this lantern slide Went provides 'evidence' of what happened to the stems of these oat seedlings during this experiment, effectively transforming his audience into witnesses of a process that has already taken place. Partly then, this strategy efficiently circumvents the physical demonstration of this experiment, which would normally last three hours. The photographic

[511] Bewegingen van Planten. "Het Nieuws van den Dag voor Nederlandsch-Indië". Batavia, 29-12-1926, p. 2. Consulted on Delpher 14-03-2023, https://resolver.kb.nl/resolve?urn=ddd:010220770:mpeg21:a0014.
[512] BRB. Archief 14. F.A.F.C. Went. 79.4. Int. Bot. Congress Ithaca. "Enkele lezing" (1926) 2.
[513] Information about Willem Hendrik Arisz retrieved from the website: https://resources.huygens.knaw.nl/bwn1880-2000/lemmata/bwn5/arisz.
[514] BRB. Archive 14. Went. 79.4. "Enkele lezing" (1926) 4.

image combined with Went's words is a condensed recreation of the experiment itself, a strategy that lends itself particularly well to a lecture of roughly an hour.

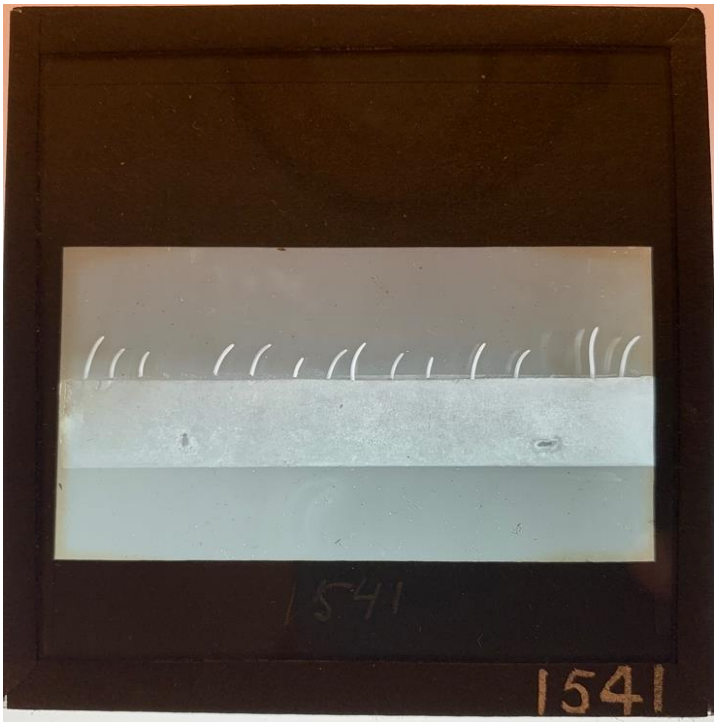

Figure 93. Lantern slide 1541. "Phototropic curvature of Avena".(Universiteitsmuseum Utrecht, Botanische collectie glasdia's). (Photographed by the author).[515]

While showing this image, Went continues by saying:

> But this [the slow progress of the curvature from the apex to the base] is demonstrated in a much better way when successive stages of the same seedlings are drawn during the process of curving, by using a red photographic lamp for these observations. [...] The next lantern slide [Fig. 94] shows a series of such drawings [...] It will be seen that the curvature begins at the tip and gradually stretches over the basal parts of the seedlings, while at the same time the apical parts begin to straighten.[516]

[515] Topic of the slide originates from the catalogues attributed to this collection: "Lantaarnplaatjes 1-1999", preserved at the Utrecht University Museum. Archive F.A.F.C. Went.
[516] RB. Archive 14. Went. 79.4. "Enkele lezing" (1926) 4.

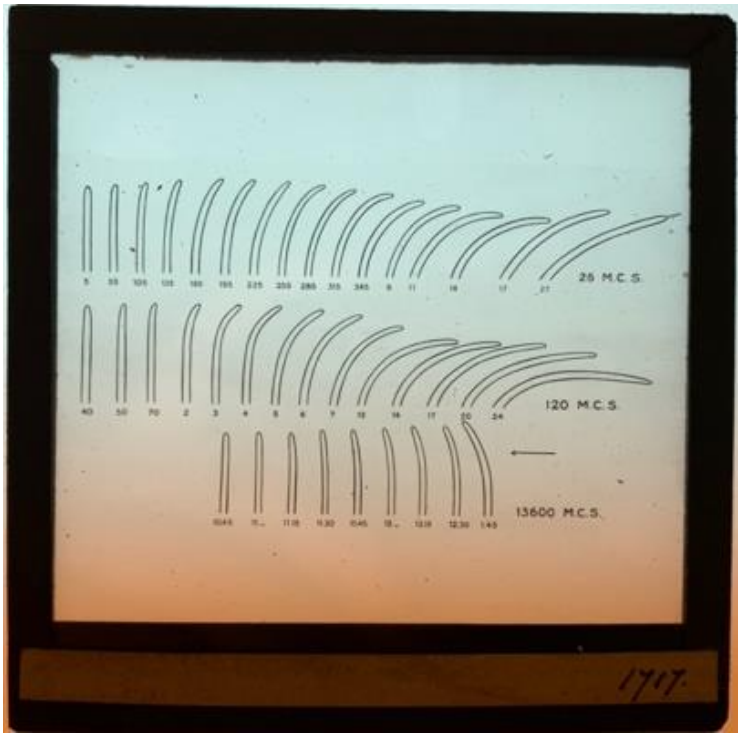

Figure 94. Lantern slide number 1717. "Verloop phototr. kromming in Avena".(Universiteitsmuseum Utrecht, Botanische collectie glasdia's). (Photographed by the author). [517]

Besides testifying to the actual process of the experiment, the treatment of these images that contain the experiments' data, Went reflects upon both the precision *and* the limitations of the photograph compared to the drawing. The photographic image Fig. 93 'simply' is one snapshot of the experiment. A such[!], it merely offers proof that the experiment actually took place. The drawing, however, in offering a more complete representation of the experiment's use of different light intensities—25 M.C.S. versus 120 M.C.S and 13,600 M.C.S.— as well as the recorded times of the process are more efficient. This way of recording allows one to combine all the retrieved data in one single image and observe at a glance the differences in the response of the oat seedlings to the light exposures. The information is combined in such a way that it becomes immediately understandable to the audience, similar to the earlier discussed 'single-glanceness image'. Given that he could only take a limited number of slides on his trip around the world, the cropping of data via these drawings also helped him in limiting the number of slides that he had to bring along for this lecture.

[517] UMU. Botanical Collection. Catalogue: "Lantaarnplaatjes 1-1999". Description of slide 1717.

Conclusion

"It is thus that a teacher prolongs his life and usefulness", wrote G.J. Peirce in his obituary of Went, recalling the many scientists that Went had trained at 'his' botanical laboratory in Utrecht.[518] His legacy, in other words, lived on through the scientific work of his students, the "Utrecht school" of plant physiology. This brings us full circle to the meaning and importance of thought collectives in the construction and transmission of scientific knowledge. Taken together, the examples from different disciplines regarding their use of slides in lectures, show the importance of accounting for the different phases of the academic study in which they are presented. Especially because the level of education largely influences how and to what end these projected images might have been used.

The academic curriculum is structured along the lines of the inducting process into the thought collective. Starting with general lectures focused on the history of a discipline or the main objects of study, lay the groundwork to build upon through more specialized and new angles of study. One of the interesting insights offered by the presented cases is that as one moves through the more advanced stages in the curriculum the character of the lantern lectures reflect the personal slant of lecturing by these professors: increasingly they discuss the state of the art: their own research questions as well as the research that they or their students conducted in answering new questions. Accordingly, the lantern lectures run parallel to the trajectory of moving from the thought collective's status quo towards new, uncharted territory that paves the way for the students to become specialists themselves. It is this awareness of the various formative stages that underpin every academic study and informs our understanding of the versatile use and the meaning of these projected images.

[518] G.J. Peirce, "F.A.F.C. Went (1863-1935)", *Plant Physiology*, vol. 11, 2 (1935), 222.

Conclusion

The academic lantern lecture, the 'seeing style' that trained students to see with the eyes of the collective.

The film about the Botanical Laboratory in Utrecht from 1932 provides an evocative picture of the (local) botanical thought collective at work. As an institute for both education and research, the film showcases the laboratory as a physical space where professional members—assistants, professors, researchers—as well as aspiring members are brought together to carry out their work or to receive education. The confluence of these activities indicates the formative nature of the collective at large, here particularly reinforced by ideas arising from research at the laboratory. Although the film was commissioned by a number of biology students as a gift to Went, it shows the curriculum of the botanical study, the various forms of education in inducting new members into this thought collective.[519] After the general lecture presented by Went (without projection), the audience is guided through other rooms at the laboratory. First, we see a "microscopy lesson" during a "first year practical": aided by professor Went, the students are taught to handle the microscope, e.g., focusing its objective in such a way that the specimen is 'properly' seen. In the afternoon, the *refereercollege* is filmed in which two students take center stage behind the lectern in presenting their literature review most probably accompanied by the projection of lantern slides. In other words, this film stresses the range of educational forms that together make up the different phases within the scientific curriculum that underpins botanical university education in this case. Generally speaking, the thought collective shaped by academic education can be considered a self-supporting system in which students are trained to "see with the eyes of the collective".

Even though the educational format of the lecture is featured in the film—one as performed by the professor and one by a student in the *refereercollege*—, the practicals and the research conducted are most prominent. A similar trend can be traced in the scholarly attention to the pedagogical form of the lantern lecture. Based on my research of academic teaching practices around the turn of the twentieth century, I conclude that this was one of the most important forms by which professors were "instilling and honing a shared way of seeing things", as Daston stated in her discussion of the "institutionalization of higher education".[520] Still, as an object of study the (lantern) lecture has remained under-researched in the historiography, expressions of the value professors attached to the lantern as a teaching aid notwithstanding. One

[519] Information retrieved from the Filmcatalogue of Eye: "Filmwerken Een dag in het laboratorium van Prof. Went (NL, Max de Haas, 1932). Accessible via the online catalogue: http://catalogus.eyefilm.nl/ce/.
[520] Daston, "On Scientific Observation", 106.

telling example are the opening sentences of the "public lesson" by Elisabeth Neurdenburg as she assumed the position of *privaatdocent* in art history at the University of Groningen:

> In starting my lessons in modern Art History I would have preferred to show you a series of artworks by means of projected lantern slides, in order to draw your attention to what I hope to offer with my teaching. However, there are objections to this and so I am now faced with, what I hope, the rare occasion that I will have to hold the attention of my audience for forty-five minutes without showing a single artwork, something that is actually not in keeping with a discipline devoted to visual, that is, visible art.[521]

Based on my own research, it is justified to state that she was far from alone in that respect. As a result, the question arises, why the pedagogical form of academic lantern lecture has been under-researched?

The negligence in studying the academic lantern lecture as a formative, academic practice probably has much to do with geographer Gillian Rose's reflections on her long, professional experience with slides: "the use of slides seems overwhelmingly uniform: the speaker stands in front of their audience, the slides are projected in a darkened room on a wall or screen also facing the audience, and the speaker speaks about them."[522] This format is indeed largely the same as it was more than 130 years ago. This long tradition (which for lecturing in general even goes as far back as the Renaissance) has received increasing criticism by modern-day lecturers. The most frequently heard argument against lecturing as a teaching practice is that it is "mere information transmission"[523] and creates a passive attitude in students.[524] Still, one wonders why the use of technologies like PowerPoint is hardly the subject of any type of reflection when it comes to the knowledge transmission that it facilitates. Rose suggests that it has to do with the "formal qualities" of slides in the setting of a lecture, where they support the words presented by the lecturer.[525] According to Erica Robles-Anderson and Patrik Svensson, the lack of scrutiny has perhaps to do with the "larger failure to enact an everyday turn".[526] Meaning here, looking critically at mundane practices such as knowledge communication. Indeed, thinking of the slide lecture as a specific unchangeable format will not lead to productive questions regarding its pedagogical affordances. Obviously, it is true that the lecture has a few stable features, such as a

[521] Elisabeth Neurdenburg, *Nog eenige opmerkinge n over het onderwijs in de kunstgeschiedenis. Openbare les, gehouden bij den aanvang harer lessen als lector in de modern kunstgeschiedenis aan de rijksuniversiteit te Groningen op zaterdag 19 October 1918* (Groningen, Den Haag: J.B. Wolters' U.M., 1918) 1.
[522] Gillian Rose, "On the Need to Ask How, Exactly, Is Geography "Visual"?", in: *Antipode* (2003): 214.
[523] Friesen, "The Lecture as a Transmedial Pedagogical Form", in: *Educational Researcher*, vol. 40, 3 (2011), 95.
[524] See for example Eric Mazur's own reflections on his lecturing in physics: Eric Mazur, "Farewell, Lecture?", in: *Science*, vol. 323, 5910 (2009), 50.
[525] Rose, "On the Need to Ask How, Exactly, Is Geography "Visual"?", 215.
[526] Erica Robles-Anderson and Patrik Svensson, ""One damn slide after another": PowerPoint at Every Occasion for Speech", in: *Computational Culture*, vol. 5 (2016). http://computationalculture.net/one-damn-slide-after-another-powerpoint-at-every-occasion-for-speech/

lecturer conveying information to an audience for a specified length of time. However, their specific interplay always varies. As Valerija Malavska argues:

> […] each lecture is an example of the individual style of a lecturer, each new lecture is unique and cannot be reproduced word for word by any other lecturer, even by the same author, because the cognitive and communicative processes are dynamic, ever-changing, and situative [sic] (occurring in relation to a specific situation) that may be dependent on such circumstances as target audience (e.g. students), setting (lecture room), time of lecture, et cetera.[527]

It is exactly this perspective of recognizing the (historical) situatedness of its performance, with or without slide projection, at particular phases in various scientific disciplines, that points up the versatility and adaptability of the academic lantern lecture as a pedagogical form.

As one of the few scholars Rose reflects in similar terms on the 'construction' of the slide lecture in making scientific knowledge claims before academic audiences. In discussing the "visual discipline of geography" she states that images are used on multiple levels in constructing specific knowledge claims as a way of "producing, interpreting and disseminating".[528] The performances display images that "focuses the audience's gaze", through the ensemble of the lecturer, the image and the audience (what in this research has been conceived of as the *pedagogical dispositif*), while "[t]the geographer mediates between the audience and the image by explaining it to them".[529] Consequently, she urges geographers—and teachers in general—to look more critically at their use of images in their slide lectures and reflect on what they want to convey and why a particular selection of images suits their purpose; after all, it is the arrangement of them that affects an audience's interpretation. Furthermore, in following Rose, it is the authority of the lecturer in making the decisions regarding what images to show and what is explained about them that guides and thus affects the interpretation of the audience.

Consequently, dismissing the cliché of the 'seemingly uniform' academic lantern lecture, my research aimed to disentangle the elements of its performance through the analytical framework of the *pedagogical dispositif*. This allowed me to analyze various performative situations for the interplay of its three poles and its implications for knowledge transmission. This approach also elucidates what needed to be taken care of in advance, that is, before a lantern lecture could actually be performed. The mere fact that J.W. Moll and Willem Vogelsang have spared neither expense nor effort in creating the right setup of the lecture hall—whether successful or not—indicates the importance attached to the optical lantern within these two disciplines around the turn of the twentieth century. The optical lantern should not simply be seen

[527] Valerija Malavska, "Genre of an Academic Lecture", in: *International Journal on Language Literature and Culture in Education*, vol. 3, 2 (2016): 66.
[528] Rose, "On the Need to Ask How, Exactly, is Geography "Visual"?", 213.
[529] Ibid., 216.

as a teaching tool, but as a device that kept pace with the institutional changes, while serving the specific requirements of various disciplines.

In further studying the academic lantern practices the combination of the concepts of the thought collective and the *pedagogical dispositif* has proven to be very fruitful in unravelling the impact of the lantern lecture in academic teaching practices around the turn of the twentieth century. It offers a model to study the historical practice itself; how the lantern lecture was performed in the lecture hall (by whom, as part of a course, with x number of slides, etc.), while simultaneously sketching the broader embeddedness of its performance within the overall curriculum of the scientific discipline and, by extension, as part of the process of maintaining and shaping the thought collective. The main advantage of this approach lies in the possibility to productively deal with 'incomplete' source material. One of the conclusions of this research is indeed that full reconstruction of historical performances of the lantern lecture is difficult to achieve because of lack of source material that elucidates its exact performance. Yet, one should not be deterred by this, since the availability of 'circumstantial evidence' can still greatly inform us about the possible ways in which the lantern lecture and the composition of large collections of lantern slides were an intrinsic part of pedagogical (visual) strategies pursued by various professors teaching at Dutch universities.

Furthermore, this research calls upon scholars of laboratory studies, university history, and historians of science to broaden their scope by focusing more on educational practices. Although this seems like a paradox (broadening the scope by focusing on the pedagogical form of the lecture, for example), this research has shown that it is the integration of various scientific parameters within the pedagogical form of the lantern lecture that can help us grasp the mechanism of knowledge transmission within various scientific disciplines. By expanding the scholarly horizon, one is able to connect various practices that all strive towards the same goal of facilitating, shaping, and maintaining their thought collective in order to advance the discipline and thus the knowledge that is obtained over generations of scientists.

The common idea expressed by all professors in the case studies presented here is the importance of the pedagogical affordance of simultaneous viewing. The arrangements that we have seen in the cases of Moll and Heymans for example, guided the gaze of the students towards the projected image on the screen, enabling them all to see the same object at the same time. The effect of the darkened room automatically imposed a way of disciplining the students—an element that contributed to the formation of a collective in itself. Furthermore, the disciplining quality of the space allowed the professor to coordinate his use of words and images. However, although the setup was 'seemingly uniform', the topics that were taught, the number of slides that were used

and for wat purpose varies among both the professors that make use of the lantern lecture as well as the scientific discipline that this pedagogical form is part of.

In order to fully appreciate the different "seeing styles" that were taught to students the in-depth study of institutional slide collections has proven to be very fruitful. Although there is one caveat. First, by its very nature, a slide collection is an unsteady entity in that it can be extended, supplemented, trimmed down or deaccessioned over time. This makes it difficult to ascertain what exactly was available to the professors and lecturers. Nonetheless, it is possible to roughly establish when the collections were initially created. In the case of the botanical slide collection of the University of Utrecht specifically, we can even identify when it was last systematically changed and reordered. Additionally, knowing the fields of knowledge that professors were specialized in allows one to connect slides to their teaching practices. Secondly, changes of the slide collections as a result of newly developed ideas and areas of interest reflect its institutional character, further underscored, thirdly, by the close cooperation between various specialists in the creation of these collections.

I think that practices linked to the lantern, such as the composition of slide collections, also offer important insights in our understanding of how scientific departments functioned from 1900 onwards. For instance, the use of the optical lantern sheds light on the division of labor within laboratories or other university buildings, uncovering the practice of what was at stake. Furthermore, it also emphasizes that the pedagogical form of the academic lantern lecture could not be performed without the effort of multiple people. First, of course, the fact that the lantern was operated from the back of the room by a projectionist (or other technician), as the professor was standing next to the wall or screen to lead his students through the projected images. Secondly, the production of photographic material that went into framing the lantern slides was left a lab assistant or in-house photographer. And lastly, as we have seen in the case of the botanical collection, assistants indexed the collection, wrote the labels, etc., and made it ready for use.

On a deeper level, the cases of botany, art history, and dentistry have also shown the investment of the thought collective itself in compiling and updating slide collections. Although, this not always happened in the most professional way (as Von Bissing would have argued), the involvement of specialists both in the exchange of slide material (Claude Martin in the case of Grevers) as well as its production (Salomonson producing X-ray photographs) is unmistakable. These slide collections, then, reveal the necessity of having a collection that represented the state-of-the-art of the scientific field. Therefore, I would argue that the slide collection can be seen as the materialized form of the "seeing style". As art historian Anke Napp has argued, it can be seen as a "time capsule" that allows one to trace the history of teaching objects that a thought collective

considered relevant at one point.[530] It is, in other words, the materialization of standard ideas and methods as well as of innovations that were responsible for new developments, such as photomicrography within the fields of botany and dentistry, that contributed to the knowledge transmission within the lecture hall. Intriguingly, the slide collections, more specifically the investments that were put in their creation, reveal the stakes within and the developments of the emerging disciplines discussed here. This aspect is invaluable, and its recognition will help further develop our notion of the particularities of "visual disciplines" in their creation of collections that underpin knowledge transmission to academic audiences.

The importance of the academic lantern lecture as a formative pedagogical form around the turn of the twentieth century can no longer be ignored. The instructive role of the lantern is intimately connected to and brings into sharp relief "shared ways of seeing things".[531] Still, in order to fully understand its role several layers have to be peeled off to pinpoint its general and (discipline-)specific implications for visual instruction. First, on a general note, the object of the slide itself, its very materiality indicates its use within a particular performance, i.e., communicative situation (they were meant to be shared with an audience). Secondly, more specifically, the composition of institutional slide collections was largely prompted by the larger (even international) thought collective. As traces of past teaching practices, therefore, these objects are great 'new' sources for research of their significance how they shared their output with their public.

One of the most important contributions of this research, in my view, has been the reconstruction of the various partnerships that were involved in performing this type of education. The various case studies have shown the well thought out considerations in obtaining proper material that was used for instruction (Grevers and Salomonson), the level of exchanging information between scientists (Grevers and Martin), but also the struggles about the academic value that was attached to these objects (Vogelsang and Von Bissing). In all cases, no matter how different, this research has shown how the slides and what they depicted were not neutral; rather they raised the academic standard of the person and, by extension, the institute, since everyone could make use of them.

By emphasizing that knowledge transmission is never straightforward, but rather depends on both the materiality of the teaching aid its context of display, and the strategies of its presentation, the *pedagogical dispositif*, we learn to appreciate the didactical value of this type of images. Instead of perceiving images in academic lectures as 'mere' illustrations, as entities that vivify the lecture hall, this research has demonstrated that they play a fundamental role in

[530] Anke Napp, "Time Capsules: Lantern slides in their media-archaeological environment at the Seminar of Art History at the University of Hamburg", in: Kessler, de Klerk, Notebaard, da Rocha Gonçalves, forthcoming, 2024.
[531] Daston, "On Scientific Observation", 106.

inducting a new generation of scientists into a thought collective. By using the heuristic tool of the *pedagogical dispositif*, we can a) discern the scientific embedding of the lecturer and the topic discussed; b) the images used and how they functioned in the lecture text; and c) reconstruct the specific pictorial aim of the lecture's performance (whether focused on distinguishing painting style or recognizing geotropical movement in plants). The way projected images were put together represent specific 'seeing styles'. When taking a closer look at lantern slides and the images that they contain, it is not (always) self-evident as to what knowledge they were meant to convey.

It is here, then, that we find the possibility of finding answers to the question posed by Gillian Rose in her call to reflect upon the images that are used within the "visual discipline of geography", but also other "visual disciplines" for that matter, albeit here from an historical perspective. Although the choice in disciplines was largely driven by the available source material, my approach, in focusing on the academic lantern lecture, has shown how fruitful it is to look at the specific ways in which students are trained to eventually work within science. The fact that various disciplines around the turn of the twentieth century were focused on the creation of an "educated eye" by the development of various 'seeing styles' shows that this didactic aim transcended disciplines. Training the eye was not only reserved for the exact sciences, which traditionally focus on empiricism or scientific observation as a particular practice, but was also necessary for art historians who needed to learn how to "see" works of art, e.g., how to make comparisons based on painting styles. The approach followed in this research, integrating educational practices while keeping an eye on the larger thought collective, reveals the significance of the 'good practice' of the lantern lecture for almost all disciplines, while simultaneously it enables us to discern the specificities in *how* the projected images facilitated the creation of "educated eyes". It is the combination between the seeing style and the *pedagogical dispositif* that allows us to look for both similarities and differences in the usage of projected images in lecture halls by different lecturers.

Suggestions for further research

In this research I have laid the groundwork for the exploration of the ways in which projected images—their provenance, their compilation in a series, their use in knowledge transmission—have been introduced into the academic teaching practices around 1900. Still, I encourage academic specialists, i.e., botanists, astronomers, medical specialists, chemists, geographers, (art) historians, etc., to take up this type of research to reflect upon the way in which knowledge was constructed before academic audiences in the past. Such a project can elucidate the status quo of the discipline some 130 years ago and trace the developments that have been made since, e.g.,

how the thought collective has changed its outlook on the object or method of study. The use of visualizations, therefore, does not only provide insights into the exact role that images played in lecturing practices, but also into the broader knowledge claims that were largely prompted by the thought collective. The 'lens' through which teaching practices can be studied is one way to understand the connection between knowledge in the making and the necessity of sharing it among academic audiences.

Even though a start has been made with the puzzle of educational (visual) practices and their specific role in training students to become future scientists, the complexity of academic teaching deserves more attention. One important aspect will be to further investigate the structure of academic curricula to enhance our understanding of the interlocking of lecturing practices and practical education. How do these pedagogical forms operate together in shaping a specific thought collective? But also, how are they structured over time, are there any significant changes in the dealing with the object of study or its method? How does this affect the use of visual teaching aids? Broadening the scope of studying scientific pedagogy also has the advantage of including the workforce involved in teaching practices, i.e., assistants, technicians, researchers, but also the thought collective at large. In laboratory studies, the workforce involved in research has already been important in understanding the different roles within research practices. A similar approach might also be fruitful in studying educational practices within academia, especially because they might be closely connected to research practices. As we saw in the case of Went and his "Utrecht school" of plant physiology, their joint research efforts trickled down into Went's education which strengthened and prolonged this specific research angle at Utrecht university. Taken together, it will further allow to discern the various specializations in curricula between the Dutch universities.

On a final note, the study of projected images, more specifically, the object of the lantern slide, is a valuable source in reconstructing Dutch universities' colonial ties. The (re-)discovery (or revaluation) of large university collections, such as lantern slide collections, offer new material ways to study the academic past. The botany slide collection, for instance, offers evidence of colonial networks and interests, which were actively maintained by professors as well as scientists working overseas. Further research needs to disclose to what extent there was cooperation with the local planters and authorities. In a recently published report by *Stichting Academisch Erfgoed* (SAE – Foundation for Academic Heritage) various Dutch academic institutions—including Museum Vrolik for example—report on their dealings with their own collections and their close connections to the colonial project.[532] In the various cases presented,

[532] Esther Boeles, Linn Borghuis, Frank Meijer, and Abel Streefland (eds.), *Verzameld in naam van de wetenschap. Omgang met universitaire collecties uit een koloniale context* (Amsterdam: Stichting Academisch Erfgoed, 2023). https://www.academischerfgoed.nl/wp-content/uploads/2016/11/Rapport_SAE_2023_Verzameld_Wetenschap.pdf.

the authors pose important, new questions, which largely deal with matters of provenance and its consequences. Is it possible to reconstruct where Dutch scientists working in the colonies took their objects from? If so, how do we deal with returning them to their rightful owners? And who would that be: individuals (such as former owners, heirs), institutes, governments at various levels? But also, what does this say about the knowledge that was obtained through those objects? One could argue that the complexity of university history and its colonial material is enclosed within the botanical cupboard discussed above. Slide collections may lead to new insights into the broader function of this photographic material outside the lecture hall.

The object of the lantern slide, in other words, deserves to become an important element in our quest in uncovering the material outlook of academia and its teaching practices. Its versatile use, its adaptability, its status as remnant of past lecturing practices, but also its encapsulation of historical practices, professional networks, and even colonial ties, makes it a valuable and illuminating object in further understanding past academic practices that left their traces in Dutch, national archives, as well as their foreign counterparts.

Samenvatting

Eén van de voornaamste plekken van wetenschappelijke kennisoverdracht is de universiteit. De verzamelplek van kennis en kunde waar studenten via verschillende pedagogische vormen kennis

maken met wetenschappelijke disciplines met als doel hen op te leiden tot volwaardige wetenschappers. In dit proefschrift wordt één van deze historisch pedagogische vormen nader onder de loep genomen: het hoorcollege met geprojecteerde lichtbeelden. Rond 1900 werd de projectielantaarn met de bijbehorende (fotografische) lichtbeelden voor het eerst geïmplementeerd aan verschillende Nederlandse universiteiten. De centrale vraag die dit proefschrift stelt betreft de verschillende rollen die de projectielantaarn speelde in wetenschappelijke kennisoverdracht. Wat waren exact de pedagogische voordelen van dit nieuwe onderwijsinstrument? Op welke manier werden geprojecteerde beelden ingezet om studenten te introduceren in hun nieuwe vakgebied? Daarbij onderstreept dit proefschrift de belangrijke implicaties van het combineren van gesproken woord en geprojecteerde beelden (gelijktijdigheid), vooral met betrekking tot het begrijpen van disciplinaire "ways of knowing" die tot uiting komen in de verschillende vormende stadia van de wetenschappelijke studie.

Het doel van dit proefschrift is om wetenschappelijk onderwijs een prominentere rol te geven in ons denken over de geschiedenis van de vorming en ontwikkeling van wetenschappelijke disciplines. De wetenschappelijke pedagogiek als categorie voor historisch onderzoek heeft de laatste jaren steeds meer aandacht gekregen. In plaats van dat historici zich binnen de wetenschapsgeschiedenis richten op het analyseren van wetenschappelijke methoden, de totstandkoming van nieuwe theorieën etc., is er steeds meer ruimte voor het bestuderen van het wetenschappelijk onderwijs en hoe deze bijdroeg aan bepaalde wetenschappelijke ontwikkelingen of juist het in stand houden van bepaalde overtuigingen ten aanzien van diverse onderzoeksobjecten. Dit perspectief is grotendeels voortgekomen uit hernieuwde aandacht voor het werk van de Poolse wetenschapsfilosoof en bacterioloog Ludwik Fleck. In een publicatie uit 1935 presenteerde hij het concept "thought collective", dat vrij vertaald 'een gemeenschap van personen die zich intellectueel tot elkaar verhouden en onderling ideeën uitwisselen' betreft. Het is door middel van onderwijs, aldus Fleck, dat een nieuwe generatie studenten, die zich wil bekwamen tot wetenschappers, inzicht verkrijgen in de fundamentele kennisaanspraken van een discipline. Door onderwijs te beschouwen als essentieel onderdeel in de vorming van "thought collectives" ontstaat de mogelijkheid om ook de verschillende stadia daarbinnen te duiden en te ontrafelen die zorgen voor de totstandkoming en instandhouding daarvan.

In het bestuderen van het hoorcollege met geprojecteerde beelden is het concept van het "thought collective" uiterst productief. Het biedt een belangrijke lens om deze onderwijsvorm diepgaand te bestuderen. In plaats van het onderwijsinstrument *an sich* te bestuderen, als generiek onderwijsmiddel, ontstaat de mogelijkheid om het gebruik van de projectielantaarn te koppelen aan het karakter van de wetenschappelijke discipline. Tevens kan er nader worden gekeken naar de beelden die werden geprojecteerd, in welk stadia van de studie deze (mogelijkerwijs) werden vertoond, op welke manier het een specifieke, disciplinaire manier van

kijken bewerkstelligt, maar ook hoe de glasdia's zelf werden verkregen en hoe deze bij elkaar werden gebracht in gerichte onderwijscollecties. Vandaar dat dit onderzoek tevens een brug probeert te slaan tussen verschillende onderzoeksgebieden, waaronder universiteitsgeschiedenis, wetenschapsgeschiedenis en mediageschiedenis.

Voor de systematische analyse van het hoorcollege met geprojecteerde beelden wordt in dit onderzoek een ander belangrijk mediahistorisch concept gebezigd dat in staat is om het belang van deze onderwijsvorm te doorgronden, namelijk het "pedagogische *dispositif*". Dit concept fungeert als een heuristisch model dat de wijzen van uitvoering van deze onderwijsvorm bestudeert. Het *pedagogisch dispositif* bestaat uit drie bepalende polen: a) performance (institutionele inbedding) b) toeschouwers (studenten die iets willen leren), c) tekstuele (onderwijsmiddelen en gesproken tekst). In de woorden van mediahistoricus Frank Kessler biedt dit model de mogelijkheid om licht te werpen op het "complexe samenspel tussen verschillende dwingende elementen die onderdeel zijn van een onderwijs of instructieve projectie-situatie." Niet alleen is elk hoorcollege met geprojecteerde beelden anders vanwege de tijd- en plaatsgebondenheid ervan, ook verschilt zijn toepassing per wetenschappelijke discipline, per professor, de beschikbaarheid van fotografische lichtbeelden etc. In plaats van het hoorcollege met geprojecteerde beelden te zien als een uniforme, statische onderwijsvorm wordt in dit onderzoek juist gekeken naar de verschillende strategieën die werden gehanteerd in het gebruik van de projectielantaarn in het opleiden van studenten en hen te "leren zien met de ogen van het collectief".

Het *pedagogisch dispositif* leidt ook direct tot een inzicht in de historische bronnen die nodig zijn voor een reconstructie van hoe een hoorcollege met lichtbeelden tussen 1890 en 1940 in Nederland werd gegeven. De institutionele inbedding van het hoorcollege met lichtbeelden vergt inzicht in de academische structuur, maar ook van de gebouwen die speciaal ingericht werden voor projectie. Tevens richt een reconstructie zich op de positionering van professoren binnen hun respectievelijke "thought collective". In hoeverre was hun onderzoek gekoppeld aan de hoorcolleges die zij gaven – en in hoeverre verschilde dat naarmate studenten in hun vakgebied vorderde?

De bronnen die nodig zijn om deze reconstructies te kunnen maken, zoals collegeaantekeningen, aantekeningen van studenten, zijn echter zeer schaars. Alhoewel er genoeg aantekeningen zijn overgeleverd van professoren verwijzen zij maar zelden naar de toepassing van geprojecteerde beelden. Het is echter nog lastiger om zicht te krijgen op de ervaringen van studenten. Alhoewel er wel degelijk studentenalmanakken en -aantekeningen zijn overgeleverd, zijn dit haast nooit weergaven van de complete onderwijssituatie. Veelal zijn het samenvattingen van wat er tijdens een college werd verteld met soms een tekening in de marge. Alleen is hieruit

vaak niet af te leiden wat er nu precies werd nagetekend; was dit een tekening van de professor op het bord, een wandplaat of een geprojecteerd beeld? Ten slotte, zijn daar de tekstuele en visuele bronnen oftewel de lichtbeelden zelf. Deze vertonen ver- en gebruikssporen die weer verbonden zijn aan een bepaalde discipline en zelfs aan professoren en leraren die in een bepaalde periode werkzaam waren aan de universiteit. Op deze manier probeer ik in dit proefschrift aan de hand van voorbeelden uit drie disciplines de puzzel te leggen die uiteindelijk het begrip vergroot ten aanzien van het gebruik van geprojecteerde beeld in academische onderwijssituaties.

Om te kunnen duiden wat de voornaamste pedagogische voordelen waren van het gebruik van geprojecteerde beeld staan er in dit proefschrift drie thema's centraal: a) de randvoorwaarden voor projectie, b) de intentie in de samenstelling van institutionele collecties glasdia's en c) de pedagogische strategieën die werden ingezet in de hoorcolleges binnen verschillende disciplines in het gebruik van de projectielantaarn.

In de eerste twee hoofdstukken worden de disciplines botanie en kunstgeschiedenis bestudeerd in het scheppen van de randvoorwaarden van de toepassing van projectie. In de jaren 1890 ontwierp de Groningse professor in de botanie J.W. Moll samen met de rijksarchitect Van Lokhorst een nieuw Botanisch Laboratorium. Binnen het nieuwe laboratorium was een moderne collegezaal waar beelden konden worden geprojecteerd een belangrijke vernieuwing. Volgens Moll was dit vooral noodzakelijk vanwege het toegenomen aantal studenten dat zijn colleges bezocht. Het gebruik van geprojecteerde beelden stelde hem in staat om aan een grote groep hetzelfde visuele materiaal te laten zien, terwijl hij erover sprak. Echter, om überhaupt te kunnen projecteren moest de collegezaal verduisterd kunnen worden. Maar dit zou als groot nadeel hebben dat zijn studenten vervolgens geen aantekeningen konden maken van de colleges. Om dit te voorkomen bedacht Moll samen met Van Lokhorst een ingenieus elektrisch lichtsysteem dat boven de collegebanken hing, maar niet intervenieerde met de lichtstraal van de projectielantaarn. Het belang van een collegezaal met projectie was ook nog om andere redenen van belang voor professoren. Uit hoofdstuk twee, waarin de casus van kunstgeschiedenis centraal staat, blijkt dat het ook belangrijk was om de onderwijsmiddelen, waaronder de collectie glasdia's, binnen handbereik te hebben. Willem Vogelsang, de eerste hoogleraar kunstgeschiedenis in Nederland, maakt in brieven aan het College van Curatoren van de Universiteit van Utrecht in zijn beginjaren (jaren 1910) veelvuldig duidelijk hoe ondoenlijk het is om gebruik te maken van collegezalen van zijn collega's, niet in de laatste plaats vanwege het gewicht van de glasdia's die hij telkens moet meedragen alvorens hij zijn college kan beginnen.

Aan de hand van de eerste twee hoofdstukken wordt duidelijk dat voor het welslagen van deze onderwijsvorm zowel een daartoe ingerichte collegezaal as de samenstelling en catalogisering van institutionele collecties glasdia's van essentieel belang zijn. Maar ook dat dit binnen verschillende disciplines een ander verloop kende. Waar het bij de botanische collecties

die zijn geraadpleegd voor dit onderzoek van belang was om de glasdia's context te geven via catalogi en indexboeken, daar was het voor de kunsthistorische collecties veelal gebruikelijk om de informatie op de glasdia's zelf toe te voegen via beschreven of gedrukte labels of in de boxen waarin zij bewaard werden. Naast het feit dat beide invloed hebben op de manier waarop professoren en docenten deze collectie gebruikten, biedt deze samenstelling ook informatie over de herkomst van de verschillende, veelal fotografische afbeeldingen. Binnen de botanie komt een patroon naar voren van onderlinge uitwisseling van foto's tussen botanici die zowel nationaal als internationaal opereerden. Bijvoorbeeld in de indexboeken van de Utrechtse collectie, samengesteld onder leiding van professor F.A.F.C. Went, staat vaak achter de beschrijving de herkomst van een foto: overgenomen uit belangrijke botanische standaardwerken of naar foto's van collega's en vrienden van Went uit zijn botanische netwerk. Deze informatie roept een beeld op van een wetenschappelijk bedrijf dat sterk gericht is op de allernieuwste inzichten die binnen het vakgebied zijn verkregen en via lichtbeelden over worden gebracht op de studenten. Daarnaast toont het ook het belang van een internationaal netwerk aan in de vergaring van wetenschappelijke kennis die vervolgens kan worden overgedragen binnen het onderwijs.

In tegenstelling tot de botanische collecties berust de basis van de hier onderzochte kunsthistorische collecties veel meer op gespecialiseerde, deels commerciële bedrijven. Het fotograferen van kunstwerken vraagt een andere expertise dan een bepaalde plant die groeit aan de andere kant van de wereld. De noodzaak van het tonen van kunstwerken ligt namelijk niet in waar het schilderij bezichtigd kan worden, maar veel meer in het object zelf: het kunstwerk. Hoe ziet het eruit? Wie heeft het geschilderd? En hoe verhoudt dit kunstwerk zich tot andere kunstwerken uit die tijd of door die specifieke schilder? Uit dit onderzoek blijkt dan ook dat het binnen de kunstgeschiedenis van cruciaal belang was om kwalitatief hoogstaande lichtbeelden of foto's te verkrijgen, waardoor er veelal werd aangekocht bij daartoe gespecialiseerde bedrijven in bijvoorbeeld Italië en Frankrijk. Alhoewel de glasdia's dezelfde uiterlijke kenmerken hebben (formaat, fotografisch materiaal) vond de aanschaf en uitwisseling van deze objecten op een totaal andere manier plaats, welke in lijn was met het wetenschappelijke doel dat beide disciplines nastreefde. Deze voorbeelden laten zien dat deze materiële geschiedenis een belangrijk licht kan werpen op de inrichting van het onderwijs en daarmee de vormgeving van een specifieke "thought collective".

Naast de randvoorwaarden belicht dit proefschrift de relatie tussen theorie en praktijk die met behulp van het gebruik van geprojecteerde beelden visueel kon worden vormgegeven. De projectielantaarn kon worden gebruikt om studenten in een vroeg stadium van hun studie voor te bereiden op de latere praktische uitvoering van hun vakgebied. Dit kon bijvoorbeeld op het gebied van onderzoek: laten zien hoe proeven of experimenten konden worden gedaan. Maar een ander interessant gegeven is het kunnen vertonen van veel patiënten en daarmee ziektebeelden

die anders de aanwezigheid van echte patiënten vergde. Om dit pedagogische effect verder te duiden, staat in het derde hoofdstuk tandheelkunde centraal. Aan het begin van de twintigste eeuw was dit eveneens een discipline die een nieuwe vorm kreeg aan de universiteit met name door een curriculum dat gestoeld was op praktische vakken, zoals het vervaardigen en inpassen van prothesen en orthodontie. Aan de hand van deze twee vakken toont dit hoofdstuk aan dat het gebruik van de projectielantaarn goed paste in deze nieuwe focus. Het stelde de professoren namelijk in staat om meerdere voorbeelden te laten zien in plaats van patiënten voor een groep studenten neer te zetten. Ook hier maakte projectie een groter aantal, simultaan getoonde afbeeldingen mogelijk. Maar daarbij had het ook belangrijke pedagogische implicaties voor het kunnen herkennen van bepaalde tandheelkundige ziektebeelden. Het leidde tot een gedegen voorbereiding waar de professor zijn studenten gericht kon meenemen in het proces van diagnose tot behandeling, zonder dat daar een patiënt onnodig voor belast werd. De relatie tussen theorie en praktijk is voor elke student tandheelkunde onontbeerlijk. Naast het kunnen herkennen van de bekende ziektebeelden worden zij tevens opgeleid tot praktiserende orthodontisten of tandartsen, daarvoor is het praktiseren van hun vak noodzakelijk. Echter, voor men hiertoe over kan gaan dienen zij eerst vertrouwd te worden gemaakt met een groot aantal aandoeningen en behandelingen zonder dat patiënten daar onnodig voor geraadpleegd worden.

In het laatste hoofdstuk wordt de stap naar de 'dagelijkse praktijk' van het onderwijs bekeken aan de hand van een aantal reconstructies van hoorcolleges met geprojecteerde beelden zoals deze aan het begin van de twintigste eeuw in zekere zin moeten hebben plaats gehad. Vanwege het, in veel gevallen, gebrekkige bronnenmateriaal is het eerste deel van dit hoofdstuk vooral bedoeld om te laten zien hoe dit type onderzoek naar de daadwerkelijke uitvoering van colleges met lichtbeelden kan worden vormgegeven. Daarbij wordt vooral benadrukt hoe belangrijk indirect bewijsmateriaal is in het kunnen begrijpen van de manier waarop en met welk doel beelden werden toegevoegd. Het tweede deel van dit hoofdstuk biedt een meer volledige reconstructie van een lezing van professor Went over plantbewegingen. Een reconstructie die alleen mogelijk is vanwege de aanwezigheid van uitgeschreven collegeaantekeningen waarin wordt aangegeven wanneer er welke dia's werden gebruikt. Vervolgens konden dit verder worden uitgewerkt door de aantekeningen te verbinden aan glasdia's uit de botanische collectie van de Universiteit van Utrecht. Dit deel toont niet alleen aan wat ervoor nodig om een reconstructie te kunnen maken, maar ook op welke manier de geprojecteerde beelden instrumenteel waren in het nader verklaren van bepaalde botanische fenomenen maar ook hoe men probeerde het onzichtbare zichtbaar te maken.

De projectielantaarn en de daarbij behorende glasdia's zijn materiële erfstukken van een vervlogen onderwijspraktijk. Alhoewel het onmogelijk is om de exacte toepassing ervan te kunnen achterhalen, vanwege het ontbreken van voldoende bronnenmateriaal, bieden de glazen objecten

inzicht in de rijke geschiedenis van het universitair onderwijs van rond de vorige eeuwwisseling. Wat deze objecten en de daarbij behorende context vooral interessant maakt is de mogelijkheid die het biedt om dichter bij de dagelijkse praktijk van het onderwijs te komen. Door middel van het achterhalen van de zwaartepunten van "thought collectives" aan het begin van de twintigste eeuw, wordt er middels de studie naar het hoorcollege met lichtbeelden inzichtelijk gemaakt op welke manier de toevoeging van beeld een nieuw élan gaf aan de vorming en de instandhouding van bijvoorbeeld de botanische, kunsthistorische en tandheelkundige disciplines zoals zij bestonden of werden vormgegeven aan Nederlandse universiteiten.

In het huidige tijdsgewricht is visueel onderwijsmateriaal niet meer weg te denken uit het onderwijssysteem, maar door dit te vergelijken met hoe dit ruim 130 jaar geleden begon ontstaat er zowel zicht op de waarde die beeld heeft in academische kennisoverdracht als op de mogelijkheid om te reflecteren op het gebruik van PowerPoint, YouTube-filmpjes en andere typen visuele hulpmiddelen die wij tegenwoordig voor lief nemen, maar die nog altijd een belangrijke pedagogische boodschap meegeven aan studenten die een bepaald vakgebied ambiëren.

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Abbreviations archives:

CMV	Collectie Museum Vrolik
GA	Groninger Archieven

HUA	Het Utrechts Archief
NA	Nationaal Archief
RB	Rijksmuseum Boerhaave
RKD	Nederlands Instituut voor Kunstgeschiedenis
BC RUG	Bijzondere Collecties Rijksuniversiteit Groningen
BC UA	Bijzondere Collecties Universiteit van Amsterdam
UMG	Universiteitsmuseum Groningen
UMU	Universiteitsmuseum Utrecht

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