Gorter and the Americanization of Dutch Science

To what extent was Dutch science Americanized and how did this process manifest in Gorter's career?

Suzette Obbink, 3360512
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Supervisors: David Baneke and Ad Maas

Abstract

After the Second World War, Dutch scientists had to cope with an enormous knowledge gap between them and American scientists; hence transformations in the Dutch science system were necessary to remain part of the international scientific community. In this thesis, I surveyed whether this process of transforming developed in such a way that it followed American standards: to what extent was Dutch science Americanized? For this purpose, I focused on several aspects of this process – such as the adoption of reorganizational structures in science and education, or the embracement of American norms and values – by examining the career of experimental physicist C.J. Gorter and the institute he worked for: Leiden University. Both appeared to orient immediately towards America: many proposals for transformations were based on the American model. However, the universities' preservation of their old dogma's, and the conservative attitude of Dutch professors determined whether suggestions were actually implemented or not. Recommendations regarding reorganizations, such as an increase in the number of professors, often opposed the old principles, and hence were ignored. On the other hand, suggestions that were in line with the existing principles were realized, such as an extraordinary focus on fundamental science and the creation of a students' community. Furthermore, American norms and values, such as the democratic attitude, were adopted only within the board of the prevailing conservatism. Consequently, the process of Americanization of Dutch science was most clearly visible in new organizations, in which new principles needed to be formulated. The existing institutes with a fixed regime, such as Dutch universities, got into a transitional phase in which new ideas were proposed – often in accordance with American examples – but were not implemented yet, due to the fact that its professors held on to the prevailing, and occasionally old-fashioned principles.

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Chapter 1

Introduction

In his speech on 7 April 1941, Johan Huizinga (1872-1945), head of the Humanities and Social Sciences Division in the 'Royal Netherlands Academy of Arts and Sciences' (*Koninklijke Nederlandse Academie voor Wetenschappen*, or 'KNAW') said:

> 'This is and remains one of the most valuable characteristics of Dutch intellect, that it is able to experience strange influences and to consider foreign thoughts, without even slightly losing the spirit of its own nationality.'[1]

He pointed out that the Netherlands had been sensitive to external influences, yet it kept its own identity. In this thesis, I will survey whether Dutch scientists were able to maintain this attitude after the Second World War, when Dutch science had to cope with new, strong external influences, mainly from America.

After the development and usage of nuclear weapons by the US military in 1945, Dutch scientists realized that the Netherlands were behind in scientific development. They started to fear that they would be left out of international scientific discussions. In order to 'catch up and keep up' with the American achievements and to recover its position in the international scientific world, transformations in the organization and coordination of Dutch science were deemed necessary.[2] One step in this process was the establishment of scientific organizations, such as the 'Foundation for Fundamental Research of Matter' (*Stichting voor Fundamenteel Onderzoek der Materie,* or 'FOM'). In their article on the foundation of FOM, historians of science Friso Hoeneveld and Jeroen van Dongen argue that the foundation of FOM 'effectively put Holland in a position that greatly enhanced the

[1] My translation; original text: 'Dit is en blijft een der kostbaarste eigenschappen van den Nederlandschen geest, dat hij in staat is velerlei vreemde invloeden te ondergaan en denkbeelden van andere volken op te nemen, zonder de pit van de eigen nationaliteit ook maar eenigszins te verliezen.' J. Huizinga, *Vijf maal vijfentwintig jaar wetenschap in Nederland*, (Amsterdam: Nederlandse Akademie van Wetenschappen, 1941), p. 17. See also, J.C.C. Rupp, *Van oude en nieuwe universiteiten: De verdringing van de Duitse door de Amerikaanse invloeden op de wetenschapsbeoefening en het hoger onderwijs in Nederland, 1945-1995,* (Den Haag: Sdu Uitgevers, 1997), p. 21.

[2] D. Baneke, 'The Absense of the East: International Influences on Science Policy in Western Europe during the Cold War,' in: J. van Dongen, F. Hoeneveld. and A. Streefland (eds.), *Cold War Science and the Transatlantic Circulation of Knowledge*, (Leiden: Koninklijke Brill NV, 2015), p. 173.

possibility to converse and coordinate with a (senior) partner.'[3] Especially, Dutch scientists aspired a partnership with the USA, because of its size, lead and their role in ending the German occupation.[4]

Similar thoughts reigned in other Western Europe countries, where scientific developments also suffered owing to ill-equipped laboratories, demoralized researchers, and governments with more pressing concerns than scientific recovery.[5] Interestingly, it was not solely in the interest of Western Europe to collaborate: the USA benefitted as well. To rebuild Europe's scientific and technological research system according to US values and to secure European economic growth was of highest concern, for this could 'push back the lure of domestic communism' in Europe.[6] Moreover, European science 'could also make an important contribution to the scientific capital, the stockpile of knowledge, of the US scientists.'[7] Consequently, historian of science and technology John Krige wrote about the 'coproduction of American hegemony' by Western Europe and the United States.[8] In fact, they were 'mutually dependent, albeit in a rather asymmetrical way,' as historian of science David Baneke convincingly argued.[9] The USA used its power in order to mold Europe according to its preferences. For example, their recovery aid was not solely about providing funds and material resources, but also about exporting the American model: 'about structures and changing attitudes and values among scientists in line with democratic values.'[10]

US intellectuals acted cleverly, by letting it seem as if they were the best partner, and by giving Europe an apparent freedom to develop. The US attitude of a 'ceaseless pursuit of scientific and technological pre-eminence coupled with an ideological commitment to openness and sharing (within limits)' made the USA a desirable partner for Europe. Yet, 'it also enabled the USA to draw creatively on what its partners had to offer so as to 'run faster' than they did, even as it attracted them into its orbit of influence.'[11] America gained this 'orbit of influence' by giving Europe some freedom, e.g. how to spend the American funds. Consequently, 'it allowed the US actions to seem less dominating and less constraining and thus probably made for a more broadly accepted policy.'[12] This not only points to an asymmetry in the relation between the USA and Europe, but it also reveals

[3] F. Hoeneveld and J. van Dongen, 'Out of a Clear Blue Sky? FOM, the Atomic Bomb, and The Boost in Dutch Physics Funding after World War II,' *Centaurus,* vol. 55, no. 3 (2013), p. 274.
[4] Ibid.
[5] J. Krige, *American Hegemony and the Postwar Reconstruction of Science in Europe*, (Cambridge: The MIT Press, 2006), p. 1.
[6] J. Krige, 'Building the Arsenal of Knowledge', *Centaurus,* vol. 52, no. 4 (2010), p. 280.
[7] Krige, *American Hegemony* (2006), p 11; and Krige, 'Building the Arsenal of Knowledge' (2010), p. 281.
[8] See Krige, *American Hegemony* (2006), pp. 4-9.
[9] Baneke, 'The Absense of the East' (2015), p. 168.
[10] Krige, *American Hegemony* (2006), p. 39.
[11] Krige, 'Building the Arsenal of Knowledge' (2010), p. 292.
[12] Officially quoted in Krige, *American Hegemony* (2006), p. 5; originally quoted from: C.S. Maier, 'Alliance and Autonomy: European Identity and U.S. Foreign Policy Objectives in the Truman Years,' in: M.J. Lacey (ed.), *The Truman Presidency* (Washington, D.C.: Woodrow Wilson International Center for Scholars and Cambridge University Press, 1989), p. 276.

the American aim to subtly Americanize Western Europe. As the Netherlands was one of the countries that desired to improve its capabilities, was Dutch science also influenced by the US policy?

Much research in recent years has focused on Americanization. For example, Krige rejects the concept of Americanization by arguing that the American model was neither passively accepted nor totally rejected, quoting Jonathan Zeitlin and Gary Herrigel, who suggest that Europe selectively adopted and modified American methods and practices. According to Krige, the concept is 'too cumbersome and analytically crude to be of much use.'[13] Yet, he acknowledges the fact that America exerted influence on European science.

More specifically, historical-sociologist Jan Rupp claims that Dutch science was not Americanized, since it was not predominated by American influences: 'in the past, the Netherlands was not incorporated in the German universities, nor did it become a province of the American practice of science after the Second World War.'[14] Instead, the Netherlands acted to remain independent, for example by 'rejecting attempts of American universities, among them New York University and the University of Oregon, to establish dependences and study centers on Dutch soil.'[15] Furthermore, the Netherlands solely became involved in projects that were mutually beneficial, such as the Fulbright Program – an educational exchange program between the United States and, among others, the Netherlands.[16]

Indeed, the Fulbright Program was beneficial for the Netherlands; yet, Giles Scott-Smith – holder of the Ernst van der Beugel Chair 'Diplomatic History of Transatlantic Relations since WW II' at Leiden University – shows that it also allowed the United States to influence the Dutch educational system. The program caused a transformation in the post-war Dutch academic landscape, and over time the Dutch educational culture adopted American norms and values. 'While other influences – primarily intra-European – were naturally also active, the consistent level of US patronage, the commitment of Dutch authorities to utilizing the same, and the enduring attraction of US higher education led the Fulbright Program to exert a special influence on post-war Dutch academia.'[17]

Together with the fact that America provided an apparent freedom to develop, the Fulbright program indicates that Americanization seemed to penetrate more deeply in Dutch science than

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[13] Krige, *American Hegemony* (2006), p. 269.

[14] My translation; original text: 'Nederland was in het verleden niet ingelijfd bij de Duitse universiteiten en is na de Tweede Wereldoorlog ook geen provincie geworden van de Amerikaanse wetenschapsbeoefening.' Rupp, *Van oude en nieuwe universiteiten* (1997), p. 341.

[15] My translation; original text: '[Men] weerde met alle kracht pogingen van Amerikaanse universiteiten, waaronder de New York University en de University of Oregon, af dependance en studiecentra in Nederland te vestigen.' Ibid.

[16] Ibid.: p. 342.

[17] G. Scott-Smith, 'The Fulbright Program in the Netherlands: An Example of Science Diplomacy', in: J. van Dongen, F. Hoeneveld, and A. Streefland (eds.), *Cold War Science and the Transatlantic Circulation of Knowledge*, (Leiden: Koninklijke Brill NV, 2015), p. 157.

Rupp suggested. Indeed, the Netherlands may not have become a province of American practice; yet, its education did adopt American norms and values, as Scott-Smith analyzed. Due to the relative freedom that the Netherlands received from the USA, Dutch intellectuals may not have noticed that they sometimes adopted to the American ideas and policies. This supports historians of science, such as Klaas van Berkel, who argue that Dutch science was Americanized. In particular, Van Berkel argues that the ideas regarding the American reformation within Dutch universities started during the interwar period, yet were implemented after the war when America was in the center of international science.[18]

1.1. My research question

Considering these conflicting opinions, I think Americanization is an important concept to survey, and hence, convenient to use. I shall define Americanization as the process of a country or region – in this case the Netherlands – developing in such a way that it follows American standards. This process covers a wide range of aspects, such as the adoption of American organizational structures in science or financing systems, the focus on particular research subjects, or the embracement of American norms and values. Throughout this thesis, these four aspects will be explored. Orientation to America, and thus contact with American scientists, can stimulate or lead to Americanization, but cannot be considered as an aspect of the process. Rather, orientation to America can be regarded as a catalyzer: it fastens the development, without being involved.

The contrasting views of Rupp and Van Berkel indicate that a re-examination is vital for the understanding of the Dutch scientific development after the war. Therefore, my research question is: to what extent was Dutch scientific system Americanized in the first decades after the Second World War and to what extent did America exert its influence to stimulate this process? Did Dutch scientists maintain their research style or were they indoctrinated by American norms and values? In order to answer these questions, I will survey the two major issues that Dutch science was confronted with in the early postwar years, namely the reorganization of science and the altered role of science in society.

After the development and usage of nuclear weapons by the US military in 1945, Dutch scientists realized that the Netherlands were behind in scientific development. Especially the US achievements in physics contrasted sharply with the stagnation of scientific developments in the Netherlands during the Second World War, hence the knowledge gap was especially large in the physics discipline. As a consequence, transformations in the organization and coordination of Dutch physics in

[18] K. van Berkel, 'Amerikanisering van de Nederlandse Universiteit? De chemicus H.R. Kruyt over Hogeschool en Maatschappij (1931),' *Tijdschrift voor de Geschiedenis der Geneeskunde, Natuurwetenschappen, Wiskunde en Techniek*, vol. 12, no. 4 (1989), pp. 223-4.

particular were necessary in order to recover. Furthermore, ethical questions were raised on the role of science and society as a consequence of the atomic bombs. Who was responsible: the scientists who developed the nuclear weapons, or the politicians who decided to drop them? In addition, the issue of the use of science in military research became subject of debate: to what extent should these be intertwined? Physicists in particular, stood up in order to avoid negative publicity on their discipline, and according to Hoeneveld, their entrance in the social debates endured.[19] Considering these developments, it is relevant to explore the developments of Dutch physics in order to answer my research question.

In their article on the foundation of FOM, Hoeneveld and Van Dongen have already addressed the issue of reorganization, arguing that Dutch scholars embraced American norms and values in order to court American partnership. They drew similar conclusions in their recent work on the development of Dutch military research, taking the establishment of the 'National Defense Organization' (*Rijksverdedigings-Organisatie*, or 'RVO') into account.[20] FOM and RVO were both new organizations. In this thesis, I will survey whether this courtship of American partnership is also apparent at the institutes that already existed – the universities – by examining the developments from a prominent physicist's perspective.

1.2. Prof. C.J. Gorter

The life and career of experimental physicist Cornelis Jacobus Gorter (1907-1980) is a relevant case study to analyze the issues of the reorganization of science and its changed role in society. Firstly, he was closely engaged in the process of restructuring of physics, as he was scientific director of the Kamerlingh Onnes Laboratory at Leiden University. Secondly, Gorter was the founder of 'Association of Scientists' (*Verbond voor Wetenschappelijke Onderzoekers*, or 'VWO'), an association that focused on the relation between science and the social relevance of its outcomes – illustrating his concerns about the issue of the altered role of science in society. Lastly, Gorter was actively involved in the 'Committee Development of Natural Scientific Research', or shorter the *Casimir Committee* – a committee that aimed at transforming the Dutch educational and science system towards the American model.

The institute Gorter worked for – Leiden University – is an interesting case study itself. In the prewar era, Leiden University was significantly oriented to US science, and this further extended

[19] F. Hoeneveld, 'De Niagara-watervallen in iemands achtertuintje: De eerste reacties in Nederland op het vallen van de atoombom,' in: T. Cocquyt and A. Maas, *Verborgen krachten: Nederlanders op zoek naar energie* (Hilversum: Verloren, 2011), p. 92.

[20] J. van Dongen and F. Hoeneveld, '*Quid Pro Quo:* Dutch Defense Research during the Early Cold War', in: J. van Dongen, F. Hoeneveld. and A. Streefland (eds.), *Cold War Science and the Transatlantic Circulation of Knowledge*, (Leiden: Koninklijke Brill NV, 2015), pp. 101-121.

soon after the war.[21] This indicates that American influences could soon reach the Netherlands via Leiden University. Therefore, I will survey Gorter's views in the context of the developments at Leiden University.

Gorter's case study is not only important with respect to the problems of reorganization and the role of science in society. In fact, he was a central figure in Dutch physics and could be the sole subject of a thesis. This is, for example, reflected in his position as head of one of the largest Dutch physics laboratories. Ever since Kamerlingh Onnes successfully attempted to reach the lowest temperature ever measured, the laboratory was known for its cryogenic research, and further improved its reputation on an international level. In his years as scientific director, Gorter extended this course in cryogenic research. Furthermore, Gorter was involved in several important scientific discoveries, of which his contributions to research on nuclear magnetic resonance (NMR) is the most well-known. Unfortunately, Gorter did not discover any phenomenon himself; yet, as his friend and contemporary scientist, Hendrik Casimir (1909-2000) mentioned: 'Certainly, [Gorter] has been close to results that would probably have earned him a Nobel Prize, but emphasizing that fact one does scant justice to what he *did* achieve.'[22] Indeed, the studies Gorter described in autobiographical article on his misses – 'Bad Luck in attempts to Make Scientific Discoveries' – are not at all representative for the work he has done. [23] For example, he did not explicitly mention his systematic pioneer work on paramagnetic relaxation. After the war, his book *Paramagnetic Relaxation* was published which was seen as an influential work, also in the United States.[24] Furthermore, Gorter carried out research on a wide scale of subjects, for example on thermodynamics of superconductivity together with Casimir, adiabatic demagnetism, optics, and liquid helium-II.

In addition, Gorter was an outspoken internationalist, as he contributed much to the international scientific community by traveling all over the world to be guest speaker, to visit laboratories, to go to conferences and committee meetings, et cetera.[25] The many distinctions and honorary doctorates that Gorter received from universities all over the world, such as France, Norway, Canada and Argentina, indicate that Gorter was a welcomed guest. Indeed, he also became a foreign member of the Swedish, Finnish, Flemish, and American Academy of Sciences.

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[21] Rupp, *Van oude en nieuwe universiteiten* (1997), p. 40.
[22] H.B.G. Casimir, *Haphazard Reality: half a century of science*, (New York: Harper and Row Publishers, 1983), pp. 175-6; emphasis in original.
[23] C.J. Gorter, 'Bad Luck in Attempts to Make Scientific Discoveries', *Physics Today*, vol. 20, no. 1 (1967), pp. 76-81.
[24] Nico Bloembergen said in an interview that Harvard students had to read Gorter's book in preparation for a course on paramagnetic relaxation; see interview of N. Bloembergen by J. Bromberg and P.L. Kelley, 27 June 1983, *Niels Bohr Library & Archives, American Institute of Physics* (hereafter AIP), College Park, MD, USA; accessible at: www.aip.org/history-programs/niels-bohr-library/oral-histories/4511 [accessed 19 January 2016]. See also: Casimir, *Haphazard Reality* (1983), p. 176.
[25] In 'Bad Luck' (1967), Gorter said he 'felt' like an internationalist, see p. 81; Casimir pointed his internationalism out as well, see: *Haphazard Reality* (1983), pp. 176-7.

Figuur 1, Prof. C.J. Gorter. (Officially published in *Nederlands Tijdschrift voor Natuurkunde*, vol. A46, no. 4 (1980), p. 135. Originally published in *Vrij Nederland* (1969))

Being an internationalist, Gorter also visited Harvard University in the summer of 1947, where he met with Nico Bloembergen (1920). Bloembergen left Utrecht University directly after the war to become a graduate student at Harvard University under supervision of Purcell, who had just discovered NMR in solids. For practical reasons, Bloembergen could not obtain his doctoral degree at Harvard; hence, he asked Gorter to be his supervisor, who agreed. After publishing his dissertation *Nuclear Magnetic Relaxation* in 1950, Bloembergen returned to Harvard, yet he remained in contact with Dutch scientists, giving them his opinion on the Dutch educational system and recommendations based on the American model. Considering Van Berkel's claim that

'Americanization of European science developed via returning emigrants', their correspondence provides a clear case study.[26]

Gorter's above mentioned activities in the international scientific community and in several scientific organizations illuminate the important role he played in the process of the Americanization of Dutch science. Moreover, I found several articles written by Gorter on, for example, differences between Harvard and Leiden University, which indicates that he concentrated on the American educational system. Therefore, I will survey his life and career in order to answer the research question to what extent Dutch science was Americanized, and to what extent this was forced by America. What was Gorter's standpoint and his contribution in the scientific organizations, such as VWO and the Casimir Committee? And how did Americanization manifest in his own career?

This thesis is organized as follows: the second chapter describes the situation before the war. What were the positions of Dutch and US science and how were these related to each other? Did Americanization already occur during the interwar years? I will use Gorter's study years and early career as illustration. The third chapter focusses on the reorganization of Dutch physics in the early postwar period. Firstly, the cases of FOM and ZWO are re-examined in order to investigate American involvement in the establishment of new scientific organizations. Secondly, the cases of Gorter and Leiden University are explored in order to see whether the facilitation of American partnership is also apparent in the reorganization of the already existing institutes. Chapter 4 sheds light on science and its altered role in society. The standpoints and activities of departments of VWO are used as starting point to describe the Dutch view on international processes, such as control on nuclear science and the intertwinement of military and scientific research. To what extent was America regarded as role model in these issues? National issues, such as the altered role of science in society, and proposals for a reorganization of the university board, are also taken into account. The fifth chapter examines the aftermath of the reorganization of science by considering the efforts of the Casimir Committee, of which Gorter was a member. To what extent was Dutch science reorganized and to what extent did Dutch scientists maintain their own way of working? The last chapter contains concluding remarks and provides an answer to the main research question to what extent Dutch science was Americanized in the first decades after the Second World War.

[26] K. van Berkel, 'De 'brain drain' en de Europese wetenschap', *Spiegel Historiael,* vol. 36, no. 2 (2001), p. 67.

Chapter 2

Dutch and American science before the Second World War: Did Americanization occur?

Before I turn to my case study, it is necessary to investigate the scientific situation before the end of the Second World War in both the Netherlands and America. What were the positions of Dutch and US science and how were these related to each other? Did Americanization of Dutch science already occur during the interwar years? In order to answer these questions, this chapter focusses on the Dutch situation regarding natural sciences, using the first decade of Gorter's career as illustration.

2.1. Dutch and US science during the interwar years

Just after the First World War, Europe could be seen as the center of knowledge: Germany, Denmark and England were important places for the developments of modern physics. The Netherlands also played a considerable role in the international scientific scene. The four Nobel Prize laureates exemplify the level of Dutch physics: Johannes van der Waals (1837-1923), Pieter Zeeman (1865-1943), Hendrik Lorentz (1853-1928), and Heike Kamerlingh Onnes (1853-1926). Leiden University in particular rose in international prestige, owing to the successes of the latter two. Kamerlingh Onnes achieved to measure the lowest temperature ever reached, making his laboratory became known as 'the coldest place on earth'.[27] Consequently, a considerable number of foreign scientists came to Leiden to carry out their research at low temperatures.[28] Lorentz was renowned for his work on the Lorentz transformations and his international activities – he was, for example, the chairman of the first five meetings of the Solvay-conference, a small international conference to which eminent scientists were invited.[29] Especially after the First World War, when German scientists were excluded from international scientific discussions, Lorentz put a lot of effort into including them in the scientific community again. Despite these activities, Lorentz held an ambivalent view on international science as necessity to enhance the development of physics. In his opinion, the physics

[27] By then, the name of Kamerlingh Onnes's physics laboratory was 'Physics Laboratory of Leiden University' (*Natuurkundig Laboratorium der Rijksuniversiteit Leiden*); in 1932, the laboratory was dedicated to physicist Heike Kamerlingh Onnes. To avoid ambiguity, I will use the name 'Kamerlingh Onnes Laboratory' throughout this thesis, regardless of the date.

[28] Museum Boerhaave Archive, Leiden (hereafter 'MB'), Gorter archive, inv. 479, folder 13, 'Het lijkt mij gepast om u thans in enkele woorden...'.

[29] For general overview of Dutch science during the interbellum, see: K. van Berkel, A. van Helden, L. Palm (eds.), *A History of Science in the Netherlands, Survey, Themes and Reference*, (Brill, 1999), pp. 170-209.

discipline would advance by contemplating and with individual efforts rather than discussions at conferences. This was in sharp contrast with his successor Paul Ehrenfest (1880-1933), who further enhanced Leiden's international prestige.[30]

Considering international science of paramount importance, Ehrenfest extended the course of international science. Whereas Lorentz held the opinion that scientific progress evolved from individual research, Ehrenfest thought intellectual enhancement could be catalyzed by cooperation and discussions with colleagues. Consequently, he frequently arranged a colloquium – the *Ehrenfest Colloquium* – which national as well as international scientists attended. With these developments, Ehrenfest got the attention of American scientists, among others.[31]

Compared to the European level, US science was at a minor position after the First World War; this started to change during the 1920s. Due to their participation in World War One, American intellectuals discovered the fruitfulness of natural science. Consequently, financial resources for scientific research at universities increased considerably. Furthermore, industry required more educated engineers; hence, the number of students as well as staff members raised.[32] Yet, the case of American physicist Robert Oppenheimer (1904-1967), later known as father of the atomic bomb, exemplifies that in the 1920s, the level of US science did not correspond with the scientific level in Europe. After graduating from Harvard in 1925, Oppenheimer went to Cambridge in England, where an advanced stage of the new theory of quantum mechanics was reached. Oppenheimer, together with many other senior physicists, however, had to learn about the theory and related phenomena from the start, illustrating a knowledge gap between America and Europe.[33]

In order to narrow this gap, American universities invited European scientists to be guest lecturers. As the Dutch astronomer Pannekoek (1873-1960) put it:

> 'Frequently, European scientists were invited to visit America either for a short series of lectures, for a year, or to work there permanently, being offered high salaries owing to many private foundations and funds. According to a Dutchman living in America, they were brought here to exchange all the knowledge they had; hence, to profit from them as much as possible.'[34]

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[30] M. Hollestelle, *Paul Ehrenfest. Worstelingen met de moderne wetenschap, 1912-1933*, (Leiden University Press, 2011), p. 238.
[31] Ibid.: pp. 238-9.
[32] Ibid.: p. 260.
[33] K. Bird, and M.J. Sherwin, *American Prometheus, The Triumph and Tragedy of J. Robert Oppenheimer*, (New York: Alfred A. Knopf, 2005), p. 42.
[34] My translation; original text: 'Steeds opnieuw zoekt men Europese geleerden naar Amerika te halen, hetzij voor een korte serie voordrachten, hetzij voor een jaar, hetzij voorgoed, en altijd door ze royaal te betalen, wat bij het Amerikaanse systeem van leven op tal van partikuliere stichtingen en fondsen ook het gemakkelijkst gaat. Ze worden hierheen gehaald, zei een in Amerika wonend Hollander, die dit alles goed kent, om ze uit te pompen; dus om alles aan lering uit hen te halen wat maar kan.' Officially quoted in Hollestelle, *Paul Ehrenfest*

Prominent European physicists, such as A.J. W. Sommerfeld (1868-1951), M. Born (1882-1970), W.K. Heisenberg (1901-1976) and some Dutch physicists Lorentz, H.A. Kramers (1894-1952), L.S. Ornstein (1880-1941) and P.J.W. Debye (1884-1966), all made one or several visits to the USA to give lectures.[35]

The fact that Dutch scientists traveled to America either to give lectures, or to stay there permanently indicates that they began to pay attention to America. In fact, Dutch intellectuals traveled to the United States even before the First World War. Astronomer J.C. Kapteyn (1851-1922), for example, yearly visited America from 1908 to work as research associate for four months. However, due to the U-boat war during World War One, contacts between US and Dutch scientists were interrupted; as a consequence, Kapteyn never returned to the observatory in California.[36] Shortly after the war, America proposed to initiate a foundation with a dual aim: firstly, to serve the common interests between the countries, and secondly, to re-establish contact. The Netherlands accepted, hence the *Netherland-America Foundation* (or 'NAF') was founded in 1921.[37] This foundation sponsored, for example, exchange programs; through notices in scientific newspapers, the availability of travel grants was announced to Dutch students who desired to continue their study in the United States (see figure 1). In addition, Leiden University organized Dutch study weeks for American students in 1924 and 1925.[38] Also American professors and students traveled to the Netherlands, albeit in a much smaller amount due to the language barrier.[39] Contacts between America and the Netherlands, thus, recovered. In fact, Dutch scientists were renowned for their visits to the United States, especially Leiden's astronomers, who were sent by Willem de Sitter (1872-1934). Astronomer Harlow Shapley (1885-1972) once uttered: 'Leiden is the city where they cultivate tulips and astronomers for export!'[40]

(2011), p. 262; originally quoted from: A. Pannekoek, *Herinneringen. Herinneringen aan de Arbeidsbeweging. Sterrenkundige herinneren*, (Amsterdam: Van Gennep, 1982), 270.

[35] Hollestelle, *Paul Ehrenfest* (2011), p. 262.

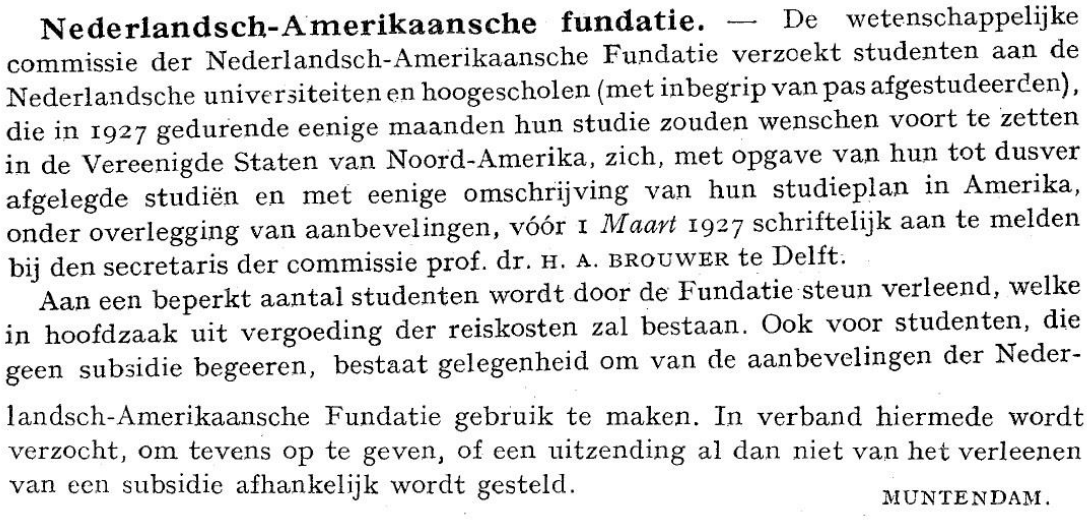
[36] Van Berkel et al., *A History of Science* (1999), p. 170; Berkel, 'Brain drain' (2001), p.63; see also: H. Edelman, *The Netherland-America Foundation, 1921-2011. A history,* (New York: The Netherland-America Foundation, 2012), p. 6.

[37] The Dutch branch was called 'Nederlandsch Amerikaansche Fundatie.' Edelman, *The Nederland-America Foundation* (2012), p. 10. See also: Van Berkel, 'Amerikanisering van de Nederlandse universiteit?' (1989), p. 206.

[38] Edelman, *The Nederland-America Foundation* (2012), p. 18

[39] Ibid.: p. 21.

[40] Officially quoted in: Van Berkel, 'Brain drain' (2001), p. 64; original source unknown.



Nederlandsch-Amerikaansche fundatie. — De wetenschappelijke commissie der Nederlandsch-Amerikaansche Fundatie verzoekt studenten aan de Nederlandsche universiteiten en hoogescholen (met inbegrip van pas afgestudeerden), die in 1927 gedurende eenige maanden hun studie zouden wenschen voort te zetten in de Vereenigde Staten van Noord-Amerika, zich, met opgave van hun tot dusver afgelegde studiën en met eenige omschrijving van hun studieplan in Amerika, onder overlegging van aanbevelingen, vóór 1 *Maart* 1927 schriftelijk aan te melden bij den secretaris der commissie prof. dr. H. A. BROUWER te Delft.

Aan een beperkt aantal studenten wordt door de Fundatie steun verleend, welke in hoofdzaak uit vergoeding der reiskosten zal bestaan. Ook voor studenten, die geen subsidie begeeren, bestaat gelegenheid om van de aanbevelingen der Nederlandsch-Amerikaansche Fundatie gebruik te maken. In verband hiermede wordt verzocht, om tevens op te geven, of een uitzending al dan niet van het verleenen van een subsidie afhankelijk wordt gesteld.

MUNTENDAM.

Figuur 2, A note published in the Dutch Journal for Medicine (Nederlands Tijdschrift voor Geneeskunde, 1927, vol. 71, pp. 526-7).

Apart from De Sitter, Ehrenfest contributed to the 'brain drain' as well. He stimulated his physics students to study or begin their career abroad. Lorentz once wrote to him: 'Owing to your interferences, many young Dutchmen make their way.'[41] Indeed, when Walter Colby (1880-1980), Professor of Physics at the University of Michigan, visited Leiden to search for a theoretical physicist, Ehrenfest insisted the American director appointed at least two. Consequently, the promising students George Uhlenbeck (1900-1988) and Samuel Goudsmit (1902-1978) emigrated to Ann Arbor.[42] Yet, Ehrenfest also attracted American scientists to work in the Netherlands; physicist Ralph Kronig (1904-1995) is an exemplar of this. Furthermore, it is important to notice that when Ehrenfest sent his students abroad, he often stimulated them to go to Germany or Denmark – the centers of theoretical physics – instead of to America.[43] Thus, regarding Dutch physicists, it was not necessarily the case that a brain drain to America occurred in the 1920s.

The European situation changed considerably in the 1930s, when Adolf Hitler (1889-1945) came to power in Germany. Due to the upcoming Nazism and the economic and political crisis, a significant European brain drain occurred. Particularly from Germany, many prominent (Jewish) natural scientists departed for America. The turbulent situation in Europe also affected Dutch scientists. For example, Uhlenbeck, who had returned to the Netherlands in 1935, now left Holland permanently.

[41] My translation; original text: 'Dank zij Uwe bemoeiingen vinden langzamerhand heel wat jonge Nederlanders hun weg.' Officially quoted in Hollestelle, *Paul Ehrenfest* (2011), p. 293. Originally quoted from: Lorentz to Ehrenfest, 18 January 1927, in: *Archive Paul Ehrenfest*, Ehrenfest Scientific Correspondence 7, section 8.
[42] Ibid.: p. 293
[43] Ibid.: p. 239

The fact that a considerable part of the European scientists emigrated to the USA, indicates that a new knowledge center was constituted.[44]

Indeed, Rupp observed similar developments examining other indicators. Considering the natural sciences, the origin of study books, for example, showed a transition from German to English literature, since the 1930s.[45] Yet, this was presumably due to Germany acquiring a bad reputation, rather than to America's rising prominence. Moreover, Rupp emphasized that the origin of study books provides a rather conservative view. Instead, he argued that educational backgrounds most clearly indicate the center of science, for young, promising students will go to the place where new discoveries are developed.[46] After evaluating where a random sample of postwar KNAW-members had studied – implying that most of them studied during the late interwar period – Rupp observed that studying abroad was a 'sine qua non' and that the most were oriented to America:

> 'From the seventeen members of the Science Division, who became a member during 1945-1959 and died in the period of 1985-1995, twelve studied abroad (before the Second World War), of which two in Germany (physics and mathematics), one in Paris (physics), and nine in the USA (brain research, crystallography, astronomy, botany, chemistry, and informatics).'[47]

Adding that American philanthropic funds, such as the Rockefeller Foundation, played an important role in these developments, Rupp concluded that the Dutch natural sciences were already oriented towards America before the Second World War.[48] Considering the efforts of the NAF, it is indeed likely that more Dutch natural science students studied in the USA due to these funds.

Interestingly, this study also reveals that the physics students remained in Europe – suggesting that the orientation to the USA did not occur regarding the physics discipline in particular. Thus, following Rupp's argument that students indicate the center of science, it can be argued that America did not become a center of *physics*, even in the thirties. Indeed, important discoveries in this discipline were still made in Europe. In Paris, for example, the first nuclear splitting experiment succeeded. However, the fact that the eminent physicists Goudsmit, and later also Ulhenbeck, maintained their position at the University of Michigan, clearly illustrate that the level of American

[44] Van Berkel, 'Brain drain' (2001), p. 64-5; K. Schuyt, and E. Taverne, *1950: welvaart in zwart en wit*, (Den Haag: Sdu Uitgevers, 2000), p. 334.
[45] Rupp, *Van oude en nieuwe universiteiten* (1997), p. 32; in an oral interview, J. H. van der Waals said that this change in language was especially noticeable after the Second World War (Amsterdam, 20 January 2016).
[46] Rupp *Van oude en nieuwe universiteiten* (1997), p. 30.
[47] My translation; original text: 'Van de zeventien in de periode 1985-1995 overleden leden van de Afdeling Natuurkunde, die in de periode 1945-1959 tot lid waren benoemd, hadden er twaalf (vóór de Tweede Wereldoorlog) in het buitenland gestudeerd; twee in Duitsland (natuurkunde en wiskunde); één in Parijs (natuurkunde) en negen in de Verenigde Staten, waarvan één mede in Engeland (hersenonderzoek, kristallografie, sterrenkunde, plantkunde, chemie en informatica).'; Ibid.: p. 47.
[48] Ibid.: pp. 47,49.

physics attained a European level. Thus, US science was certainly enhanced during the interwar years, even though it may not have become the center of physics yet.

In Gorter's study and early career, similar developments can be observed. During his study years, American science appeared to be at a lower level than Dutch; no special attention to American science was given. This altered during Gorter's early career.

2.2. Gorter's study and early career

Encouraged by his favorite schoolteacher, Gorter began to study physics at Leiden University in 1924. Gorter's years of education exemplify two characteristics of Dutch science education during the interwar years. Firstly, there were opportunities, especially in Leiden, to learn about the modern developments. Even though the official physics curriculum ignored modern achievements, Gorter and his contemporaries were taught, for example, quantum theory, via a special student society 'The Leiden Jar' (or *De Leidse Fles*), of which Gorter became a fellow in his second year. Exclusively for its members and under special protection of Ehrenfest, the society provided a one-hour class on Friday, during which the modern subjects of theoretical physics, such as the quantum theory, were taught.[49] As shown earlier, this was much more difficult for American students: they had to wait until prominent European scientists were invited to visit an American university or they had to travel to Europe themselves – securing their financing first.

Secondly, Gorter's years of education exemplify Dutch scientific internationalism during the interwar years. Even though Gorter never studied abroad, he got acquainted with scientific internationalism and was able to build a network of foreign scientists and students through Ehrenfest. In his third year, Gorter was personally invited to visit the *Ehrenfest Colloquium*, where he began to build his international network of physicists. As Ehrenfest invited many foreign students to Leiden, Gorter expanded his network with Paul Dirac (Great-Britain), Enrico Fermi (Italy), Robert Oppenheimer (USA) and Ralph Kronig (USA)[50]. Furthermore, Gorter once accompanied Ehrenfest to Göttingen (Germany), where he met more great theoretical physicists, such as James Franck and Max Born.[51] Gorter's internationalism was not solely owing to Ehrenfest, as he enjoyed to travel himself as well. During his study years, Gorter participated in two expeditions: at the age of twenty, he

[49] Interview of C. J. Gorter by J.L. Heilbron on 15 November 1962, *AIP*; accessible at: www.aip.org/history-programs/niels-bohr-library/oral-histories/4639 [assessed 19 January 2016].
[50] Kronig was born in Germany in 1904; after his primary and high school education, he emigrated to the United States. There, he started his study at Colombia University, New York City.
[51] Interview of Gorter by Heilbron, *AIP*, (1962).

traveled to Norway to investigate the color of the corona during a sun eclipse, and in 1929, he traveled with Utrecht professors and students to Sumatra to build an observatory.[52]

To conclude, there were ample opportunities to build an international scientific network. Interestingly, from Gorter's study years, a special interest to American science does not become apparent. In conjunction with the earlier stated fact that Ehrenfest dispatched his students to Europe, it is evident that Leiden's physicists were not particularly focused on their American colleagues in the 1920s. I shall show below that American science started to play a role in Gorter's early career simultaneously with the rise of American science in Europe in the thirties, using his dissertation as starting point.

2.2.1. Gorter's Nuclear Magnetic Resonance program

Gorter's first close cooperation with American physicists began during his work on his dissertation on 'Paramagnetic characteristics of salts' (*Paramagnetische eigenschaften von Salzen,* 1932), which was supervised by prof. W. J. de Haas (1878-1960).[53] The subject was inspired by work of American physicist John van Vleck (1988-1980) on magnetic susceptibility in quantum mechanics, of which the first papers were published in 1927. Their cooperation appeared to be the origin of a close friendship and further scientific collaboration in the field of paramagnetism.[54]

Even before finishing his dissertation, Gorter was appointed as conservator at the laboratory of the Teyler's Foundation under Dutch physicist Adriaan D. Fokker (1887-1972). Gorter carried out research in a diverse range of fields, yet I will focus on the research that followed from his dissertation: paramagnetic relaxation and nuclear magnetic resonance (NMR), as Gorter's contributions in these fields are most acknowledged. Furthermore, the latter will connect Gorter to Nico Bloembergen, as will be discussed in Chapter 3.

Gorter's work on paramagnetic relaxation followed from his dissertation, which pointed to the existence of nuclear magnetic spin, proposing that: 'Perhaps, it is possible to observe nuclear

[52] Interview of Gorter by Heilbron, *AIP*, (1962). See also: J. van den Handel, 'Afscheid van prof. C.J. Gorter', *Nederlands Tijdschrift voor Natuurkunde*, vol. 39, no. 16 (1973), p. 270; L. Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…': De geschiedenis van het Verbond van Wetenschappelijke Onderzoekers (VWO) 1946-1980*, (Delft: Uitgeverij Elmar, 1994), p. 75; *Archive of the Kamerlingh Onnes Laboratory* (hereafter KOL-archive), Institute-Lorentz, Oort building, Niels Bohrweg 2, room 261, University of Leiden, Leiden, folder 'Gorter's voordrachten'.

[53] C.J. Gorter, *Paramagnetische eigenschaften von Salzen*, (Haarlem: Loosjes, 1932).

[54] J. van den Handel, 'Preface', *Physica*, vol. 69, no. 1 (1973), pp. v-vi; Interview of J. H. Van Vleck by C. Weiner and G. Lubkin on 28 February 1966, *AIP*; accessible at: www.aip.org/history-programs/niels-bohr-library/oral-histories/4931-1 [assessed 1 June 2016]. See also: C.J. Gorter, and J.H. van Vleck, 'The Role and Exchange Interaction in Paramagnetic Absorption', *Physical Review*, vol. 72, no. 11 (1947), p. 1128.

magnetic spins using gyromagnetic measurements at very low temperatures.'[55] Thus, Gorter expected to observe an angular momentum in paramagnetic substances when subjected to a changing magnetic field at very low temperatures. His preliminary attempt to observe this – conducting experiments at room temperature with lithium-7 and hydrogen – yielded positive results. However, reliable values of the magnitude of the effects could not be obtained due to heat developing during the experiment. After discussing this with De Haas, Gorter was invited to carry out the experiment in Leiden with low temperatures. Indeed, paramagnetic relaxation was now easily observable and thus proved.[56]

Despite the freedom to conduct experiments in a variety of subjects, the Teyler Laboratory's quiet atmosphere, its modest facilities, and its technical assistance did not match Gorter's ambitions in the long run. As a consequence, Gorter left, and succeeded J.A. Prins (1899-1986) in 1936 as reader at the University of Groningen, where he got to work with D. Coster (1889-1950), F. Zernicke (1888-1966) and R. Kronig, and supervised his first students, F. Brons and P. Theunissen, with whom he worked on paramagnetic absorption and dispersion.[57] Additionally, Gorter initiated his research into NMR, publishing his first failed attempt to detect nuclear magnetic spins.[58] Still eager to succeed, Gorter spent the summer of 1937 in the USA with the plan to observe magnetic resonances in mind. There were two American universities where research groups were specialized in this experimental field:

> 'I had the choice between Columbia University – where I. I. Rabi had refined a molecular-beam technique that might make it possible to avoid the increase of spin temperatures and thus the compensation of absorption by stimulated emission that had been fatal for the Leiden nuclear-magnetic-resonance experiment – and the University of Michigan where C.E. Cleeton and N. H. Williams had opened the field of microwave absorption of ammonia gas, which might present a starting point for the detection of electron spin resonance.'[59]

Gorter choose to visit the latter, as the University of Michigan offered possibilities to conduct experiments himself. However, due to miscommunication, professor Williams (1870-1956) was not

[55] My translation; original text: 'Vielleicht wäre es möglich durch Ausführung von gyromagnetischen Messungen bei sehr tiefen Temperaturen Näheres über einen magnetischen Kernspin zu erfahren.' Gorter, *Paramagnetische eigenschaften von Salzen* (1932), p. 106. See also: Gorter, 'Bad Luck' (1967), p. 76.
[56] C.J. Gorter, 'Paramagnetic Relaxation', *Physica*, vol. 3, no. 6 (1936), pp. 504-5. See also: Gorter, 'Bad Luck' (1967), p. 76.
[57] See: Gorter, 'Bad Luck' (1967), p. 77; Interview of Gorter by Heilbron, *AIP*, (1962); C.J. Gorter, 'Departure: 19 October 1973' (s.l.: s.n., 1973), p. 1; Van den Handel, 'Afscheid van prof. C.J. Gorter' (1973), p. 270.
[58] C.J. Gorter, 'Negative result of an attempt to detect nuclear magnetic spins', *Physica,* vol. 3, no. 9 (1936), pp. 995-8.
[59] Gorter, 'Bad Luck' (1967), pp. 77-8.

prepared for Gorter's visit and departed on vacation after welcoming Gorter kindly. As no other professors or technicians were acquainted with the specific microwave techniques, Gorter did not learn the new skills. Fortunately, Gorter managed to visit Rabi (1898-1988) on his way home. When Gorter saw that the apparatus was not suited for carrying out quantitative magnetic resonance experiments, he proposed a possible solution, using high frequent magnetic fields.[60] Remarkably, he could not persuade Rabi to make the changes; his proposal was dismissed. However, a few months later, Rabi heralded the first successful nuclear magnetic resonance experiment in a Letter to the Editor in the *Physical Review*, for which he would receive the Nobel Prize in 1944.[61] Gorter said he 'felt some pride, mixed with the feeling that [his] contribution had been somewhat undervalued,' as his advice was acknowledged in a footnote. According to Dutch physicist J.H. van der Waals (1920), who scrutinized Gorter's contribution to the development of NMR, '[this] transpires that Gorter had provided a stimulus which was crucial for this success.'[62] Indeed, Gorter's effort in this research field are mentioned in general histories on NMR.[63]

After four years in Groningen, a few months before the start of the Second World War, Gorter was appointed to succeed Pieter Zeeman (1865-1943) at the University of Amsterdam. Unsurprisingly, Gorter's inaugural address – being held during war time – was on 'Magnetic characteristics of atoms and ions' (*De magnetische eigenschappen van atomen en ionen*), and indeed, Gorter pursued his research on paramagnetics and NMR to the extent in which this was possible due to the war.

At first, the German occupation was not very noticeable in the Dutch universities; this soon changed when Jewish professors and students were dismissed. After various protests, several Dutch universities, among them Leiden University, were closed by German authority, but their laboratories often remained open.[64] As a consequence, experimental research could proceed, albeit the appalling conditions. At the University of Amsterdam, the number of student protests remained low amid fears

[60] Gorter, 'Bad Luck' (1967), p. 78.
[61] I.I. Rabi, J.R. Zacharias, S. Millman, and P. Kusch, 'A New Method of Measuring Nuclear Magnetic Moment', *Physical Review*, vol. 53, no. 4 (1938), p. 318.
[62] J.H. van der Waals, 'Gorter's Footprints on the Trail That Led to Magnetic Resonance', in: D.M. Grant and R.K. Harris (eds.), *Encyclopedia of Nuclear Magnetic Resonance, vol. 1,* (Wiley, 1996), p. 667.
[63] See E.D. Becker, 'A brief history of Nuclear Magnetic Resonance', *Analytical Chemistry*, Vol. 65, no. 6 (1993), pp. 295-302; C.P. Slichter mentions Gorter's contributions in his book: *Principles of Magnetic Resonance, Third enlarged and update edition* (Berlin: Springer, 1990), pp. 9, 52, 151.
[64] P.J. Idenburg, *De Leidse Universiteit, 1928-1946. Vernieuwing en verzet.* ('s Gravenhage: Universitaire Pers Leiden, 1978), pp. 147-9. For information on the Kamerlingh Onnes Laboratory during the war years, see: D. van Delft, 'Tegen de Roof: het Kamerlingh Onnes Laboratorium in oorlogstijd', *Gewina*, vol. 30, no. 4 (2007), pp. 247-264.

that they would be accused of being anti-German.[65] Consequently, the university and its laboratory remained open, and Gorter could proceed his experimental work, even though he sometimes had to make use of Leiden's hospitality. After transporting the most stable of their paramagnetic dispersion apparatus, he was able to renew his research on NMR together with L.J.F. Broer (1916-1991) in 1942. Unfortunately, their attempt to observe NMR in solids resulted in negative outcomes again.[66]

In addition, Gorter continued lecturing; in 1942, he provided a discourse on magnetism at the University of Groningen.[67] However, when the German authority introduced a declaration of loyalty in 1943, that students had to sign in order to continue studying, many refused and stopped their study activities. The resources to conduct research also became scarcer and scarcer reaching its nadir during the last winter of the war – known as 'starvation winter'. Conducting research was reduced to theoretical activities due to the absence of electricity and gas. In the Zeeman Laboratory, enough fuel was left for one room to still be heated, hence this building remained one of the few centers where theoretical research was carried on. Gorter, as well, interrupted his experimental research and began to write his book on paramagnetic relaxation.[68] This monograph on the non-resonance precursor of NMR received wide publicity in the scientific community after the war. [69]

In general, the war devastated Dutch science – especially in the last year, when there were hardly any resources and several laboratories, among them the Kamerlingh Onnes Laboratory and the Physics Laboratory in Amsterdam, were plundered. Meanwhile in America, atomic bombs were produced, and Bloch and Purcell independently discovered NMR in solids.[70] According to physicist K.H. Chang (1945), this ended the monopoly of the Dutch school of physics in field of paramagnetism and NMR.[71]

In conclusion, America plays a role in Gorter's early career. During his study, activities with American students remained absent, yet with his dissertation, his first US cooperation began in the 1930s. Gorter's visit to Rabi at Colombia University exemplifies that American scientific improvement

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[65] P.J. Knegtmans, *Een kwetsbaar centrum van de geest, De Universiteit van Amsterdam tussen 1935 en 1950*, (Amsterdam: Amsterdam University Press, 1998), p. 103.

[66] C.J. Gorter, and L.J.F. Broer, 'Negative result of an attempt to observe nuclear magnetic resonance in solids', *Physica*, Vol. 9, no. 6 (1942), pp. 591-596.

[67] MB, Gorter archive, inv. 479, folder 5.1, 'Magnetisme, voordracht te Groningen, 17-3-´42'.

[68] See the preface of his book *Paramagnetic Relaxation*; C.J. Gorter, *Paramagnetic Relaxation*, (Elsevier Publishing Company, inc., 1947), pp. v-vi . Also published in Gorter, '*Departure: 19 October 1973'* (1973), pp. 8-9.

[69] For an extensive overview of the consequence of the war for specific Dutch universities or laboratories, see: Knegtmans, *Een kwetsbaar centrum van de geest* (1998) on the University of Amsterdam; and Van Delft, 'Tegen de Roof' (2007) on the Kamerlingh Onnes Laboratory.

[70] After the discovery, it appeared that Gorter and Broer used too pure chemicals and therefore obtained too long relaxation times: Gorter had bad luck in his attempt to discover NMR. Gorter, 'Bad Luck' (1967), p. 79.

[71] K.H. Chang, *Evaluation and survey of a subfield of physics, Magnetic resonance and relaxation studies in the Netherlands*, (Stichting F.O.M., 1975), p. 117.

was extended in the late thirties. Gorter acknowledged afterwards that he realized quite well that 'it would have cost [him and his Dutch colleagues] years to set up the adequate equipment in [their] small group at Groningen.'[72] This implies that American scientists had better equipment at their disposal compared to Dutch scientists.

Although cooperation with America entails a Dutch orientation on American science, no answers can be provided yet on the question whether Dutch science was Americanized before the ending of the Second World War. In order to deal with this question, it is important to scrutinize an article of Van Berkel, in which he addresses various opinions of Dutch intellectuals on the American educational system. Did a Dutch reorganization towards the American system arise?

2.3. Dutch views on the American educational system

From Amsterdam professor of botany Hugo de Vries (1848-1935), it becomes clear that Dutch scholars were in awe of the American educational system already before the First World War. In his travel books, De Vries discussed his admiration for the practical orientation of the American universities and the social importance of the subjects being studied.

> 'In America, valuable studies are being done full justice, as studies that are pointless for society are sidelined. (…) For example, botany is considered as primary discipline in university, for it is the principle of agriculture. Hence, an improvement in botany indicates an improvement in agriculture, which is the main source of national wealth.'[73]

Due to the American invitations and the rise of philanthropic foundations, more intellectuals traveled to America during the interwar years.[74] Johan Huizinga was a representative of such a fund for social sciences, the Laura Spelman Rockefeller Memorial Fund. In 1926, he traveled to America for the first time and afterwards he wrote his book 'America, thinking and living' (*Amerika, denkend en levend*, 1926), in which he commented positively on America and its universities. In earlier work, he had already praised the American university board and advocated a similar system in the Dutch universities, in which the university board was merged with the academic senate to form a decisive board.

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[72] Gorter, 'Bad Luck' (1967), p. 78.

[73] My translation; original text: 'De nuttige vakken en studiën komen daardoor steeds meer tot hun recht, terwijl wat voor de maatschappij waardeloos is op den achtergrond gebracht wordt. (…) Zoo wordt in Amerika b.v. de plantkunde, als grondslag voor den landbouw, als een der belangrijkste vakken der Universiteit beschouwd, want vooruitgang in de plantkunde beteekent vooruitgang in den landbouw, die de hoofdbron van den nationalen rijkdom is.' Officially quoted in Van Berkel, 'Amerikanisering van de Nederlandse Universiteit?' (1989), pp. 204-5; originally quoted from H. de Vries, *Naar Californië. Reisherinneringen*, (Haarlem: Tjeenk Willink, 1905), pp. 422-3.

[74] Van Berkel, 'Amerikanisering van de Nederlandse Universiteit?' (1989), p. 206.

The American model was not always praised. Utrecht physical chemist Ernst J. Cohen (1869-1944), for example, was one of the first who spoke critically of the American system in his travel book 'From the country of Benjamin Franklin' (*Uit het land van Benjamin Franklin*, 1928). Although he praised the country for its rapid progress in science, Cohen spoke out against the overregulated character of the universities.[75] This opinion was shared by American intellectuals as well: Abraham Flexner (1866-1959), one of the directors of the General Board of Education in New York, had written in *The Atlantic Monthly* that, owing to the close connection between college and graduate school, American professors were like teachers; they should become independent, just like in Europe. After a study trip to England and Germany, Flexner published a book, *Universities. American, English, German* (1930), in which he compared their universities at the expense of the American ones.[76]

This book was published in Dutch simultaneously with the publication of chemist Hugo Kruyt's pamphlet 'University and Society' (*Hooge School en Maatschappij*, 1931), which, according to Van Berkel, actually began the discussion on 'Americanization' of the Dutch universities. Basing its content on his experiences in the USA in 1927, Kruyt (1882-1959) 'deplored the isolationism of the Dutch universities towards the needs of modern society and advocated a reorientation of the Dutch universities more or less on the model of the American universities.'[77] Similarly to De Vries, Kruyt accentuated the fact that the advancement of the American university was parallel to the civilization and its current needs in contrast to Europe, and thus Dutch universities, that 'followed a medieval pattern'.[78]

In fact, these points were quite akin to those of his predecessors, yet, Van Berkel demonstrates that Kruyt's pamphlet was most influential – if only because it triggered many reactions.[79] At that time, discontent with the universities' position in society started to reign, especially among students. As Kruyt's booklet was addressed to them, their involvement may have caused a livelier debate on this issue. Lastly, contrary to other travel reports, the booklet directly listed the benefits of the US model; hence, its form may have triggered the discussion as well.[80]

Here, emphasis on the word 'discussion' is necessary, as consensus was never reached. Flexner's book was easily used by opponents, such as philosopher A. Vloemans (1898-1982). As he had never been in the USA himself, Vloemans entirely depended his arguments against the American model, and the idea that American universities were modern, on Flexner's book.[81]

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[75] Ibid.: p. 215.
[76] Ibid.: pp. 216, 220.
[77] Ibid.: p. 224 (in the summary).
[78] Ibid.: p. 200.
[79] Ibid.: pp. 218-9.
[80] Ibid.: pp. 223-4.
[81] Ibid.: p. 221. For Vloeman's article, see: A. Vloemans, 'Amerikaansche universiteiten: een voorbeeld of een schrikbeeld?', *Haagsch Maandblad*, vol. 16, no. 1 (1931), pp. 68-79.

2.4. Conclusion

The dual aim of this chapter was, firstly, to examine the position of Dutch and US science and how they were related to each other; and secondly, to analyze whether Dutch science was already Americanized before the Second World War.

In the 1920s, it appeared that Dutch science, especially in Leiden, was internationally oriented, but not specifically to America. Although astronomers were often sent to the USA, physicists more often had Europe as destination, where the centers of knowledge were located. The fact that American physicist Colby had to visit Europe for prominent students illustrates that physicists did not emigrate spontaneously to the USA. Furthermore, the fact that Oppenheimer and other American physics students traveled to Europe to learn about the current developments in physics, contrasts with the Dutch situation. Leiden University, specifically, offered ample opportunities to get acquainted with new achievements. Hence, in the Netherlands studying abroad was no necessity to remain updated and to gain an international scientific network; Gorter's study years exemplify this. As American students had to travel to Europe, it appears that the scientific level of the USA did not correspond to the European level yet.

The situation changed in the 1930s, when a European brain drain to the USA occurred, as a consequence of the upcoming Nazism. Gorter's early career is a perfect example of the raised interest in the upcoming American science among Dutch physicists. From the mid-thirties, Gorter was working a new field of physics: nuclear magnetic resonance; yet, his attempts to detect this phenomenon failed. In America, physicists were simultaneously working on this matter, developing new technologies. In 1937, Gorter traveled to the USA for the purpose of gaining more knowledge of new technologies in this research field. Although he did not acquire the skills he hoped for, due to a miscommunication, this clearly illustrates that, in the prewar years, American science was enhanced to a similar scientific level as in Europe – at least in some fields.

Gorter's orientation to America illuminates that Gorter developed into an internationalist. As Ehrenfest contributed considerably to the process of gaining international prestige for Leiden University, and given that he actively encouraged young students to study abroad, he was a great example to Gorter. Yet, even though Gorter adopted Ehrenfest's international orientation, Gorter was more reluctant to send his students abroad during his own career – they had to obtain their doctoral degree first.[82] The poor situation in the postwar period presumably affected this, as Dutch scientists had to cope with a lack of manpower, as will be shown in chapter 3.

Considering the relation between Dutch science and US science, it became apparent that both were orientated to each other. This already occurred before the First World War and afterwards

[82] Oral interview with R. de Bruijn-Ouboter, Leiden 29 March 2016.

when their relationship was restored via the *Netherland-America Foundation* (NAF). Furthermore, Van Berkel showed that (natural) scientists were interested in the American educational and science system. He concluded that due to other more urgent problems, which universities had to cope with, such as overpopulation in the thirties, reorganization was no priority. Consequently, Van Berkel's final conclusion is that the ideas regarding the American reformation within Dutch universities started during the interwar period; yet, were implemented after the war when America was the center of international science.[83]

However, this inappropriately implies that during wartime the Netherlands scrutinized the American system in order to make similar reformations in the Dutch system when the war had past. Firstly, the Dutch situation before and after the war differed, hence the motivations to transform differed as well. Secondly, as consensus was never reached, there were too many opponents of the American system to state that Holland aimed at a reformation according to the USA in the pre-war era. Lastly, concrete evidence is missing that the US system constituted as a model for the most important concerns put forward by Kruyt and Huizinga: the reorganization of the Board of Trustees and the isolation of the Dutch university from the needs of modern society, respectively. Chapter 4 shall reveal both issues were not indiscriminately based on the American model after the war.[84] Therefore, Van Berkel's final conclusion should be revised. It is too straightforward to state that transforming according to the American model was taken into consideration before the war and was executed afterwards. More investigation into developments after the war is necessary before sound conclusions can be drawn.

In the prewar period, the observations of, and pleas for the American science system remained a subject of discussion: consensus or actions to transform never ensued. Therefore, the conclusion can be drawn that Dutch science was not Americanized before the Second World War. Interestingly, Dutch physicists did not participate in debates on American science. This changed considerably after the war, as will be shown in the next chapter.

[83] Van Berkel, 'Amerikanisering van de Nederlandse Universiteit?' (1989), p. 224.

[84] For the development of the university board after World War Two, see: D. Baneke, 'Sterrenkunde na Oort, De veranderende bestuurscultuur in wetenschap en universiteit in de jaren zeventig en tachtig', *Bijdragen en Mededelingen betreffende de Geschiedenis der Nederlanden – Low Countries Historical Review*, vol. 129, no. 1 (2014), pp. 27-31. For the necessity for universities to relate their research to social needs, see: T. van Helvoort, *De chemie van de universitaire wetenschapsbeoefening: Een halve eeuw scheikunde in Groningen, 1945-1995*, (Hilversum: Verloren, 2008), pp. 255-258.

Chapter 3

Gorter, Bloembergen and the early postwar recovery

As mentioned in the second chapter, World War Two and the German occupation caused an immense stagnation in Dutch scientific progress. Although some research was conducted during this period, these studies were primarily theoretically oriented. At the same time, US scientific activity grew extensively owing to military research, with radar technology and the atomic bomb as examples of results.

Near the end of the war, Dutch scholars realized they had to work closely with a partner in order to encourage scientific interest and progress. In his book 'The New Netherlands' (*Nieuw Nederland*), Jan Romein discussed the difficulties that politicians would encounter after the war, listing two conditions that would guarantee success:

> 'Firstly, that the international situation develops profitably, i.e. that cooperation between the leading victors becomes closer and closer, using their unified power for the greater good; secondly, that the public opinion supports and encourages it.'[85]

Although Romein discussed political theory, the same conditions were valid for the field of science. Internationalism and public support became of great importance, especially after US scientific advancements and dropping of the atomic bombs in August 1945. This was a pivotal moment, as Dutch scientists realized they lagged behind. Rapidly, the 'Dutch Physical Society' (*Nederlandse Natuurkundige Vereniging*, or 'NNV') organized an international congress in September 1946, chaired by Gorter, which was praised by foreign invitees.[86] In addition, the scientific movement needed to regain public support for their scientific activities, as ethical questions were being raised as a consequence of the nuclear bombs. This development will be the focus of the next chapter. This chapter will analyze the reorganization of Dutch science after the war. How did Dutch physicists, Gorter in particular, resume their work and attempt to narrow the gap between them and America?

[85] My translation; original text: 'De eerste is, dat de internationale situatie zich gunstig ontwikkelt, d.w.z. dat de samenwerking tussen de groten onder overwinnaars hechter en hechter wordt en deze de ernstige wil hebben, die samengebalde macht te gebruiken ten bate van het geheel; de tweede, dat de publieke opinie haar steunt en voortstuwt.' J. Romein, *Nieuw Nederland: algemene beginselen ener hervorming in hoofd en leden*, (Amsterdam: Vrij Nederland, 1945), p. 98. See also: Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), p. 32.

[86] The KOL-archive, folder 'Zeeman Congres' contains several positive replies to the invitation of the NNV. Professor of physics Otto Laporte, for example, wrote from the University of Michigan (USA) that this would be 'an invaluable chance to re-establish scientific contacts in [the Netherlands].' (Laporte to Gorter, 24 June 1946). Physicist Julius .E. Mack from the University of Wisconsin replied that '[the NNV] is to be congratulated for taking this early step to help us resume the contacts we all need so much.' (Mack to Gorter, 15 June 1946).

To what extent were American organizational structures adopted, and what influences did America exert?

As mentioned in the introductory chapter, Hoeneveld and Van Dongen argued that the organization of FOM aligned American policies in order to court American intellectuals, so that US partnership could be facilitated.[87] I will scrutinize their study and the foundation of another scientific organization 'Dutch Foundation for Pure Scientific Research' (*Organisatie voor Zuiver-Wetenschappelijk Onderzoek*, or 'ZWO'), in order to assess possible American influences on these establishments. Next, I will analyze the cases of Gorter and Leiden University, to analyze whether the facilitation of American partnership is also apparent in the reorganization of this institute and Gorter's laboratory. For this purpose, I will analyze Gorter's viewpoint regarding the postwar reconstruction efforts: did Gorter advocate American ideas and were American examples implemented in the science system?

The case of Bloembergen strengthens Gorter's ideas. Moreover, his early correspondence with Gorter provides a vivid example of how the Dutch scientific community experienced the sense of lagging behind. Therefore, I will start with a short introduction of Bloembergen and how he came into contact with Gorter.

3.1. Bloembergen and Gorter – how did they come into contact?

Starting in 1938, Bloembergen studied at Utrecht University under prof. J.M.W. Milatz (1910-2000). He obtained his master's degree during the war in 1943, two weeks before the loyalty declaration and just before the Germans closed the university. Always harboring plans to obtain his Ph.D. abroad, Bloembergen seized the opportunity to transfer to the United States in January 1946, leaving devastated Europe behind. As American scientists were either in the army or still working at radiation labs, many positions were vacant. As a result, Bloembergen was warmly welcomed to join a research group at Harvard of his own choice. As Edward Purcell (1912-1997) – a physics lecturer at Harvard – had discovered nuclear magnetic resonance in solids (NMR) six weeks before Bloembergen's arrival, the decision was rapidly made.[88]

Even though Bloembergen's original plan was to obtain his Ph.D. at Harvard, he soon learnt this was impractical, for his Dutch certificates were not acknowledged in the USA Hence, Bloembergen had to find a Ph.D. position in the Netherlands, and Gorter was clearly the most suitable advisor

[87] Hoeneveld, and Van Dongen, 'Out of a clear blue sky' (2013), pp. 273-4.

[88] *Central archival storage* (in Dutch: *Centrale archiefbewaarplaats*) (hereafter UU-archive), Administration Building, Heidelberglaan 8, room 007, Utrecht University, Utrecht, Shelve 45-46, k11, 42-51, box 08047, Bloembergen to Milatz, 27 February 1946 – I am grateful to Rob Herber for pointing to me the relevance of this archive. See also: N. Bloembergen (ed.), *Encounters in Magnetic Resonances, Selected Papers of Nicolaas Bloembergen (with Commentary)*, (World Scientific Publishing Co. Pte. Ltd., 1996), p. 7.

given his experience in NMR research. Consequently, he received a letter from Bloembergen with the question whether he was amenable to be his supervisor.[89] Agreeing with this was no harmless task, because taking over another one's student, particularly when he was promising, was a delicate matter at that time. Gorter replied that he agreed solely when Milatz approved as well. [90] Subsequently, Gorter wrote to Milatz as well to be completely sure that he confirmed that Gorter could be Bloembergen's promotor:

> 'I do not wish to cooperate with [Bloembergen], if I am not completely sure this does not create hatred, or at least disappointment. I do not feel like taking another one's students, even though it unfortunately appears to be the course of events since the occupation, that former Leiden's students continue studying everywhere, except here!'[91]

This citation not only shows Gorter's kind request; it also implicitly reveals a national frustration at a lack of science students, that was peculiar about the early postwar period. Many students had had to break off their study during war, and those who were graduated often went to the USA, where the circumstances were considerably better – Bloembergen is an example of this. I will return to this issue below.

Milatz granted Gorter's and Bloembergen's request; accordingly, Bloembergen would obtain his degree in Leiden, after conducting the largest part of the experiments at Harvard first.[92] In the summer of 1947, Gorter traveled to Harvard as visiting professor to provide a series of lectures on his book *Paramagnetic Relaxation*, and additionally, Gorter got to meet Bloembergen in person for the first time.[93] By then, Bloembergen had obtained his research results, and moreover, he had finished his draft of his first two chapters, which were to be corrected by Purcell and Gorter.[94] In September, Bloembergen returned to the Netherlands to actually obtain his doctorate.

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[89] Bloembergen to Gorter, 29 June 1946. I am very grateful to Rob Herber, who provided me copies of the correspondence between Gorter and Bloembergen that he obtained at the KOL-archive in Leiden and at the Bloembergen archive at Pusey Library, Harvard University. Hereafter, I refer to Herber when I used his copies of the Gorter-Bloembergen correspondence.

[90] Herber, Gorter to Bloembergen, 10 July 1946.

[91] My translation; original text: 'Ik wil echter toch niet met hem in zee gaan, als ik niet zeker weet, dat dit bij jou geen kwaad bloed of althans teleurstelling wekt. Ik voel er niets voor, dat wij elkaar's mensen gaan inpikken, al is het door de gang van zaken in de bezettingstijd thans wel helaas zo, dat vroegere Leidse studenten vrijwel overal verder studeren, behalve hier!' UU-archive, box 08047, Gorter to Milatz, 8 March 1947.

[92] Bloembergen, *Encounters in Magnetic Resonance* (1996), p.10.

[93] Interview of Bloembergen by Bromberg and Kelley, *AIP*, (1983).

[94] UU-archive, box 08047, Bloembergen to Milatz, 1 July 1947. This draft served as the basis for a Bloembergen's first significant publication: a comprehensive paper, known as BPP (Bloembergen, Purcell and Pound), that was published in the *Physical Review*: N. Bloembergen, E.M. Purcell, and R.V. Pound, 'Relaxation Effects in Nuclear Magnetic Resonance Absorption', *Physical Review*, vol. 73, no. 7 (1948), pp. 679-712.

3.2. Opposite effect of the war on USA and the Netherlands

Bloembergen's early correspondence from Harvard to Milatz and Gorter clearly illustrates the opposite effects of the war. The American work pace, for example, was very high. In a letter to Milatz, Bloembergen stated that a particular cyclotron set-up was used for sixteen hours per day during war.

> 'During the war, American scientists worked tirelessly. In two years, a radiation laboratory was set up in Cambridge at M.I.T. for radar research. In the laboratory, 5000 scientific workers, of which 2000 were physicists, worked for 70 hours per week without any vacation for 5 years.'[95]

Apart from the high work pace, there were also ample scientific researchers to reinforce the American international scientific leadership. In Leiden, the situation was rather different. Even though the workers at the Kamerlingh Onnes Laboratory and its instrument building school could continue their work during the war years, continuing research at a pre-war pace was difficult due to the lack of resources and other problems caused by the war. Especially near the end, when resistance activities received more priority and some important instruments were requisitioned and taken away by German authorities, Leiden's scientific research languished.[96]

Fortunately, when the German occupation ended, several companies were willing to give financial support to rebuild Leiden's laboratory. For example, the *N.V. Bataafsche Petroleum Maatschappij* (or 'BPM') donated one million guilders for 'renovating and equipping the Physics Laboratory of the University of Leiden, in order to rejuvenate the famous Kamerlingh Onnes Laboratory.' The purpose of the BPM was to provide modern installations to obtain the lowest temperatures, so that the fundamental research on characteristics of matters could be resumed. Consequently, the Kamerlingh Onnes Laboratory was occupied with the recovery from April 1946 to 1952, when the laboratory was inaugurated. One month before the start of the renovations, Gorter had succeeded W.H. Keesom (1876-1956), and therefore he was immediately immersed in finding new apparatus.[97]

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[95] My translation; original text: 'Gedurende de oorlog is er fantastisch hard gewerkt. In Cambridge bij M.I.T. is in 2 jaar tijd een radiation laboratory opgezet voor radar onderzoek met 5000 man wetenschappelijk personeel, waaronder 2000 physici. Er waren weken van 70 werkuren, en vijf jaar zonder vacantie!' UU-archive, box 08047, Bloembergen to Milatz, 27 February 1946.

[96] KOL-archive, folder 'KOL in oorlogstijd', 'Het Kamerlingh Onnes Laboratorium gedurende den oorlog', and folder 'Geschiedschrijving', 'Het Kamerlingh Onnes Laboratorium tijdens de Tweede Wereldoorlog (12/14/01)'. The latter were presumably notes of Dirk van Delft, which he based on the correspondence between De Haas and Wiersma, and several other records. See also: Van Delft, 'Tegen de Roof' (2007).

[97] A.F.A. Reynhart, *De modernisering van het Kamerlingh Onnes Laboratorium der Rijksuniversiteit te Leiden: de realisatie van de schenkingen aan het Hoger Onderwijs in Nederland gedaan door de N.V. De Bataafsche*

Not solely the lack of resources differed in the early postwar years; it also became apparent that American scientists had more advanced instruments at their disposal. Six months before Bloembergen would work at the Kamerlingh Onnes Laboratory, he enumerated a list of equipment that was available in the United States and necessary to rebuild a replica of the NMR-apparatus at Leiden – the list was quite long. He wrote:

> 'For Holland, these luxuries are probably difficult to obtain. Philips is presumably the sole place where such instruments are produced. (…) Fortunately, you have a good reputation here, and I believe that with some of Purcell's help, we can take some equipment to Holland for a fair expense. Many components are available in war-surplus.'[98]

Bloembergen also brought a main component from America, and succeeded in building the replica in one month. Dutch dependency on American apparatus remained for at least five years after the war. In the 1950s, for example, Bloembergen brought a particular crystal to conduct an experiment in Leiden. This was made in America, and apparently it was not possible to obtain in the Netherlands, as Gorter put a lot of effort to get the crystal in the Netherlands again.[99]

In sum, the circumstances at American universities and Dutch universities were contrary to each other. In America, many scientific workers maintained the high working pace and were occupied with changing from war effort to peace time activities. In addition, American physicists profited enormously from five years of radar research and other achievements that were results of their war effort. [100] In the Netherlands, on the other hand, scientists were occupied with reconstructing their laboratories, and covering the deficit of resources in general. To illustrate, in 1946, Gorter was still clothed in a suit that Van Vleck had sent him.[101] Additionally, the lack of trained scientific workers was problematic, as I mentioned above. Keeping pace with America was also a matter of urgency in order to avoid being excluded from international scientific discussions. The next section will focus on the attempts of scientists and politicians to diminish the knowledge gap.

Petroleum Maatschappij (Koninklijke Shell groep), (Den Haag: Bataafsche Petroleum Maatschappij, 1952), p. 9. See also: KOL-archive, folder 'Geschiedschrijving', 'BPM-schenking'.

[98] My translation; original text: 'Dit is voor Holland waarschijnlijk een moeilijk te verkrijgen luxe. Philips is vermoedelijk de enige plaats, waar het daar te vinden is. (…) Gelukkig heeft U hier een grote mate van goodwill, en ik geloof wel dat we met medewerking van Prof. Purcell voor betrekkelijk geringe kosten een en ander naar Holland mee kunnen nemen. Veel zeker zijn namelijk in de war-surplus te krijgen.' Herber, Bloembergen to Gorter, 30 March 1947.

[99] Herber, Gorter to Stout (University of Chicago), 27 September 194_ (the year is unknown).

[100] Herber, Bloembergen to Gorter, 29 June 1946.

[101] Herber, Gorter to Bloembergen, 10 July 1946.

3.3. Diminishing the knowledge gap: scientists and politicians

Given these successes in America, Dutch scholars realized that scientific development and progress would be of vital importance for the postwar reconstruction efforts of the Netherlands. Large investments were necessary in order to do so. Consequently, the scientific community and political powers had to work together, but both parties were not accustomed to do so. During the pre-war era, the reputation of Dutch physicists was high, which is why this discipline received sufficient support to succeed properly.[102] The urgent need for an extensive growth in scientific level after the war demanded a cooperation, however. Fortunately, the new government was primarily constituted of scientifically trained ministers, with four professors, including the new Prime Minster Willem Schermerhorn (1894-1977), and the Minister of Education, Arts and Science Gerard van der Leeuw (1890-1950), who were respectively, professor in geodesy at the Delft University of Technology, and professor in the history of religions at Groningen University. Consequently, scientific activities were immediately advocated, and new scientific organizations were readily established.

At first, applied science was advocated by scientists as well as politicians: Schermerhorn advocated applied sciences 'to improve and renew production'. Furthermore, Gilles Holst (1886-1968), leader of the 'Philips Physics Laboratory' (*Philips Natuurkundig Labotorium*), also favored applied, industrial science, for this, according to him, would result in new, important techniques and products for progress, such as jet engines and radar.[103] However, as shown above, the war caused that the Dutch scientific level lagged behind the United States, and this was particularly realized by Dutch physicists after the explosion of the atomic bombs in August 1945. Too much knowledge was missing to create similar types of technology to what was developed in America. In the Netherlands, the possibility of creating an atomic bomb was inconceivable in the early war years. Prof. G.J. Sizoo (1900-1994), the first nuclear physicist in the Netherlands, wrote an article in 1941 in which he examined why it was practically impossible to create a nuclear weapon. He assessed that it would take years of lengthy research before this could be produced, and even though surprises are imaginable, 'it is unclear whether this would have consequences for the economy and especially what consequences it has on "human happiness".'[104] This thought reigned among the majority of international scientists at the start of the war, but it changed during it. In the Netherlands, however, scientists remained oblivious. Gorter claimed that he knew about the possibility of creating a bomb out of uranium via French physicists Halban and Joliot in Paris; yet, he completely forgot about this.

[102] MB, Gorter archive, inv. 479, folder 5.1, 'PT October'.
[103] Hoeneveld, and Van Dongen, 'Out of a clear blue sky' (2013), p. 270.
[104] G.J. Sizoo, 'De atoomkernen als mogelijke bron van energie', *Stemmen des tijds: maandschrift voor Christendom en cultuur*, vol. 30, no. 8-9 (1941), pp. 405-422.

Consequently, not until five years, when the news of the devastations in Hiroshima and Nagasaki was widely published, Gorter realized that the bomb had to be made of uranium.[105]

Together with the realization of lagging behind, the fear prevailed that Dutch scientists would be excluded from serious international scientific discussion. This was emphasized by Gerard Kuiper (1905-1973), an Dutch-American astronomer, who wrote a letter to Schermerhorn stating that the USA and Great Britain held a monopoly in the scientific world and that if Holland was not able to catch up with them immediately 'America would start to compare Holland with Portugal or Romania.'[106] This would have considerable consequences for Dutch prestige, the Dutch role in international politics and its national security and, therefore, it was a serious threat. Furthermore, Kramers assembled a 'petit comité', which Gorter joined, to ponder upon solutions to cope with the knowledge gap. Schermerhorn officially installed the 'Committee on Nuclear Physics' (*Commissie voor Atoomphysica*) on 16 August 1945.[107]

After the acknowledgement that Dutch knowledge in the field of science was in a precarious state, an appeal of fundamental sciences was launched to regain lost ground. Furthermore, a focus on 'pure' science would 'enable Holland to play a part in a 'possible international collaboration' towards nuclear technology.'[108] Scientists as well as politicians supported these ideas.

3.3.1. Efforts of Dutch scientists

Dutch scientists, including Sizoo, strongly based their arguments for the support of fundamental science on the ideas of Vannevar Bush – the chairman of the American Research and Development Board, the Rockefeller Foundation, and the establishment of the National Science Foundation.[109] Just before the atom bombs, Bush published his report *Science, the endless frontiers* in which he strongly advocated fundamental research for applied science in order to maintain the amount of government funding for science akin to the large investments provided during the war.[110] In the Netherlands, his report was used to advocate similar ideas. Sizoo, for example, defined fundamental research as 'the founding knowledge and insight into the principles behind the phenomena that are indispensable for

[105] Interview of Gorter by Heilbron, *AIP*, (1962). The fact that Dutch scientists knew that uranium was of importance can also be illustrated by the fact that De Haas secreted a large stock of uranium in Delft, see Van Delft, 'Tegen de Roof' (2007).
[106] Baneke, 'Absence of the East' (2015), p. 222; Hoeneveld, and Van Dongen, 'Out of a clear blue sky' (2013), p. 273.
[107] J.M. van Splunter, *Kernsplijting en diplomatie, De Nederlandse politiek ten aanzien van de vreedzame toepassing van kernenergie, 1939-1957,* (Amsterdam: Het Spinhuis, 1993), pp. 110-1.
[108] Hoeneveld and Van Dongen, 'Out of a clear blue sky' (2013), p. 273.
[109] M. van de Goor, 'De wederopbouw van Nederland en de organisatie van wetenschappelijk onderzoek (1945-1947)', *Scientiarum Historia,* vol. 26, no. 1 (2000), p. 202.
[110] V. Bush, 'Science – The Endless Frontier: A Report to the President by Vannevar Bush, Director of the Office of Scientific Research and Development, July 1945'; accessible at: https://www.nsf.gov/od/lpa/nsf50/vbush1945.htm [assessed on 23 June 2015].

any possible application.'[111] Thus, fundamental research on field of physics in particular could contribute to the revitalization of industrial output.

Gorter concurred with these statements. In his inaugural speech in Leiden on the 'progress of physics', he mentioned the close correlation between fundamental and applied science. He argued that it was often the case that an outcome of applied science became a separate, interdisciplinary branch, such as physical chemistry. Later, scientific developments, such as new instruments, can then return to the pure physics, and can be of great importance for further development. In short, fundamental and applied science stimulate each other.[112]

In his speech, Gorter did not call to stimulate fundamental science in Leiden, probably because Leiden was already known for its fundamental research on low temperature conditions. [113] In contrast, Sizoo did advocate the fundamental sciences. However, he also argued that improved organization and coordination of Dutch science were imperative for pure research to be implemented in the Dutch scientific field. His solution to this necessary transformation was a national research council for fundamental research in all fields of science.[114] Due to the political and social instability immediately following the war, many ideas could be implemented which would not succeed under normal conditions. Such period can be seen as a 'window of opportunity'.[115] Furthermore, the new government supported the development of scientific research and hence supported initiative to found new institutes.[116] As a consequence, such foundations could easily be established. Taking further into account that research in the field of physics became highly valued, and that many Dutch physicists were actively involved in the enhancement of science organization, it is not surprising that a foundation fully devoted to physics was rapidly set up, namely the 'Foundation for Fundamental Research of Matter' (*Stichting voor Fundamenteel Onderzoek der Materie*, or 'FOM'). Formally instated in April 1946, the foundation immediately received considerable government funding to invest into the development of pure science, of which the lion's share was allocated to fundamental physics.[117]

The establishment of FOM was a first result of the Committee on Nuclear Physics. As Gorter was a member, he also pondered upon means to make up the scientific arrears after the Second World

[111] Officially quoted in Hoeneveld, and Van Dongen, 'Out of a clear blue sky' (2013), p. 272; originally quoted from: G.J. Sizoo, 'Kernphysica en de Nederlandse wetenschap', *Atoom. Maandblad gewijd aan de atoomenergie en haar gevolgen voor mens en samenleving*, vol. 1, (1946), pp. 14-5.
[112] C.J. Gorter, *Vooruitgang der Natuurkunde*, (Groningen: J.B. Wolters' Uitgevers-Maatschappij, 1946), p. 7.
[113] Zie ook: MB, Gorter archive, inv. 479, folder 13, '40 jaar onderzoek bij zeer lage temperaturen', and folder 5(2), 'The Kamerlingh Onnes Laboratory has continually specialized on low temperatures'.
[114] Hoeneveld, and Van Dongen, 'Out of a clear blue sky' (2013), p. 272.
[115] K. van Berkel, *De stem van de wetenschap: de geschiedenis van de Koninklijke Nederlandse Akademie van Wetenschappen, deel II: 1914-2008*, (Amsterdam: Uitgeverij Bert Bakker, 2011), p. 223.
[116] Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), p. 30.
[117] Hoeneveld, and Van Dongen, 'Out of a clear blue sky' (2013), pp. 264-5 .

War. Additionally, Gorter also discussed the committee's plans confidentially with his Amsterdam colleague J. Clay (1882-1955), and proposed to involve Milatz from Utrecht as well, to include all Dutch prominent research centers. However, since Gorter was appointed in Leiden early 1946, his activity had lowered. Due to his recovery activities of the Kamerlingh Onnes Laboratory and his national organizational duties for the NNV, Gorter was urged to withdraw from the actual establishment.[118] Later, from 1954 to 1960, Gorter became FOM's head of the Board of Governors, which illustrates that he remained involved.

3.3.2. Efforts by Dutch politicians

In addition to these preparations proposed by scientists, the government had meetings on what was best for the development of scientific progress as well. The government soon focused its efforts on America. In the second meeting of the brand-new government, it was decided to send geophysicist prof. F.A. Vening Meinesz (1887-1966) to the United States in order to assess the damage to the Dutch state of science as compared to the American state of science. His report, released in December 1945, provided the advice to annually send a scholar to the United States in order to list the latest developments. Additionally, a permanent representative should be sent overseas for administrative tasks.[119] Eventually, it appears that this advice was ignored. Yet, he also brought a copy of Bush's *Science, the endless Frontier*, which became influential in the Netherlands as illustrated above. Apart from Vening-Meinesz' journey to America, Hugo Kruyt was sent to tour Europe in order to see how other European countries arranged their science policies. Using Vening Meinesz' report, he recommended to establish a new organization that would distribute financial resources for, among others, research projects or travel grants: the 'Central Organization for Fundamental Scientific Research' (*Centrale Organisatie voor Fundamenteel Onderzoek*). Kruyt proposed to organize this funding system following the example of the American Rockefeller Foundation.[120] In March 1946, Schermerhorn took up this idea and formed a commission to evaluate the Dutch scientific situation, under the direction of H.J. Reinink (1901-1979), secretary-general for the department of Education, Arts and Sciences. This committee was called Reinink-I, as one month later, a similar committee was appointed to evaluate the reorganization of Dutch higher education:

[118] MB, Gorter archive, inv. 494, Gorter to Boumans, 30 March 1966.
[119] KOL-archive, folder 'unknown', 'Rapport aangaande een wetenschappelijke vertegenwoordiging van Nederland in de Vereenigde Staten, door Prof.Dr.Ir. F.A. Vening Meinesz'. According to Friso Hoeneveld, this is a 'subsection' of the original report. The report to the minister can be found in the *National Archive*, 2.25.36, 195, in Den Haag. I am grateful to him for providing me this report and the further information.
[120] A.E. Kersten, *Een organisatie van en voor onderzoekers: De Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (Z.W.O.) 1947–1988*, (Assen: Van Gorcum, 1996), p. 16. Van Berkel, *De stem van de wetenschap* (2011), p. 224.

Reinink-II. This report was published in 1949, and its content will partly be discussed in Chapter 4.[121] The outcomes of Reinink-I were published in August 1946; yet, owing to a new government, the report was not taken into consideration until physicist J.H. Bannier (1909-1995) took notice of it in January 1947. Consequently, the new foundation was finally established, albeit with a different name: 'Dutch Foundation for Pure Scientific Research' (*Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek*, or 'ZWO').[122]

Recapitulating, FOM was originated by physicists, and hence was primarily devoted to that branch of science, whereas ZWO originated from political initiative and covered all sciences. The fact that these two quite similar agencies were founded in a short period of time caused a constant power struggle between the organizations: ZWO wanted to be responsible for all scientific disciplines, whereas FOM wanted to operate independently.[123] Despite the scientifically orientated government and the ready establishments of new scientific organizations, the cooperation between politicians and scientists was not always smooth. This can be illustrated with the KNAW and the politicians: both parties were oblivious of each other's projects. Moreover, the function of the KNAW was not quite clear among the politicians, as they attributed very similar duties to the ZWO, such as encouraging the development of scientific research.[124] Conversely, the scientific members of the KNAW were unfamiliar with what the government did, as the following quote illustrates:

> 'Meanwhile, the memorandum ['Natural science and society and the duty of the Dutch Royal Academy of Science' from December 1945] clarifies that a KNAW-member like Pannekoek hardly knew about the political and administrative movements with which the Department of Education, Arts and Sciences were occupied simultaneously. Knowledge and perceptions, insight and comprehension were unequally divided during the post-war situation.'[125]

[121] *Rapport van de Staatscommissie tot reorganisatie van hoger onderwijs, ingesteld bij Koninklijk besluit van 11 april 1946, Nr 1*, (Den Haag: Staatsdrukkerij- en Uitgeverijbedrijf, 1949). See also Van de Goor, 'De wederopbouw van Nederland' (2000), p. 202.
[122] Kersten, *Een organisatie van en voor onderzoekers* (1996), pp. 10-20; Van Berkel, *De stem van de wetenschap* (2011), pp. 225-6.
[123] See Hoeneveld, and Van Dongen, 'Out of a clear blue sky' (2013), p. 285, referring to Kersten, *Een organisatie van en voor onderzoekers'* (1996), pp. 39-43.
[124] Van Berkel, *De stem van de wetenschap* (2011), p. 227.
[125] My translation; original text: 'Tegelijk maakt de Nota [Natuurwetenschap en maatschappij en de taak van de Koninklijke Nederlandse Academie van Wetenschappen van december 1945] duidelijk dat een Akademielid als Pannekoek nauwelijks op de hoogte was van de politieke en bestuurlijke bewegingen die zich op datzelfde moment in dezelfde geest afspeelden in Den Haag, in de regering en op het departement van Onderwijs, Kunsten en Wetenschappen. Kennis en visie, zicht en inzicht waren ongelijk verdeeld in de naoorlogse situatie.' G. Alberts, 'Niet 'het huis der wetenschap'', in: G. Alberts, and H.J. Zuidervaart (eds.), *De KNAW en de Nederlandse wetenschap tussen 1930 en 1960,* (Amsterdam: Amsterdam University Press, 2009), p. 39.

Yet, there were also similarities in the approach of Dutch scientists and politicians to enhance the Dutch scientific level. The preceding section showed that the Dutch scientific community as well as the Dutch government compared the Dutch scientific environment to that of America, and based their proposed policies on those in the USA. Furthermore, Vening Meinesz's journey brought Bush's report and the information on the Rockefeller Foundation, which were both used as inspiration for Dutch scientific policies and organizations. In fact, by promoting pure science, it appears that Dutch scholars reinforced Americanization, because they argued that basic research would contribute to international science.[126] This was also one of the purposes of the Marshall Plan in April 1948 – a large financial support from America to stimulate European economic recovery. Interestingly, Bush introduced the 'rehabilitation of European Science' during the formation of the Marshall Plan, and argued that it should be considered part of the program. The *Office of Naval Research* further addressed this issue and agreed to support basic research as it was beneficial for both America and Europe. Given the fact that Bush's report on fundamental science was so highly influential in the Netherlands, it may be presumed that Bush's report was a first step in the process of Americanization. However, *Science and the Endless Frontier* was fully devoted to America, which indicates that Bush was not concerned about the European situation in the early postwar years. Consequently, the fact that Dutch scholars focused on fundamental science cannot be seen as a result of American influence, but rather as a courtship of American intellectuals, like Hoeneveld and Van Dongen observed.

> 'Both the USA and the Netherlands chose their policies out of an observed self-interest; what becomes clear is that the Dutch chose a policy that turned out aligned with future US plans for European science, even if until 1954 these still largely left out nuclear science as a field to be supported. After December 1953, when Eisenhower gave his 'Atoms for Peace' lecture, the US attitude regarding sharing sensitive aspects of nuclear physics changed. Already well before, as well as at that point, Dutch institutions were in effect lined up and willing to co-construct US hegemony in physics.'[127]

As a result, this co-constructing of US hegemony can be seen as Dutch facilitation of Americanization and was emanated from the strong Dutch orientation towards America directly after the war. Even negative aspects of America, such as its nuclear secrecy policy, appeared to be diminished and downplayed. These conclusions are drawn from newly established institutes. By further exploring the case of Gorter, in conjunction with Bloembergen, and Leiden University, I will attempt to analyze whether similar conclusions can be drawn based on the existing institutes: the

[126] Hoeneveld, and Van Dongen, 'Out of a clear blue sky' (2013). pp. 265-6, 273.
[127] Ibid.: p. 274.

universities, where scientific research was actually conducted. The next section surveys Gorter's standpoints regarding the Dutch scientific and educational system, and his proposals to improve this. Furthermore, the developments at Leiden University are taken into account. What means were used for a rapid recovery, and to what extent was America involved in this progress?

3.4. Diminishing the knowledge gap: Gorter, Bloembergen & Leiden University

3.4.1. Plea for a students' community

Gorter proclaimed the fear of being excluded from international scientific activities as well, and in order to prevent this, he promptly made an example of America as the direction to go in. In a handwritten record dating from 'Amsterdam, September 1945', Gorter expressed his concern on Dutch scientific progress, making several suggestions for the enhancement of the organization of Dutch science, including a plea for a 'students' community'.[128] Supporting Heringa (1980-1972) and Van der Leeuw – respectively a professor in Histology at Amsterdam, and the minister of Education– who favored an American university campus, Gorter also argued for a 'students' community, one that is much more on the foreground, and one that advocates sports, music and other leisure activities for its students in addition to the study activities. From his point of view, the university's aim should be to shape its students' characters instead of solely teaching them a subject. His arguments followed American examples, just like his comments on the educational system: Gorter urged that more social contact between professor and students was necessary in order to stimulate 'character formation'.[129]

In addition, Gorter expressed his discontent with the University of Amsterdam: he claimed that there was no students' community in Amsterdam – it solely consisted of fraternity members.[130] Fortunately, Gorter was offered the position of scientific director of the Kamerlingh Onnes Laboratory in Leiden, where a strong feeling of solidarity reigned among university staff and students, as a consequence of the war. The 'Foundation Pro Civitate' (*Stichting Pro Civitate*) was newly established, specifically to pursue this compassion. The ideas for this foundation were raised during the German occupation, by students as well as lecturers. Together, they wrote an article in underground journal *De Geus*, prescribing what was necessary to alter after the end of the war, pursuing to 'improve the students' community and their contact with professors.' In order to achieve this, they proposed to constitute a community center, which would serve as meeting place for gatherings, or for activities in the arts. Additionally, they proposed to consolidate all the students'

[128] MB, Gorter archive, inv. 479, folder 5(2), 'Amsterdam, september 1945'.
[129] Ibid.
[130] Ibid.

unions into one: the 'Leiden's Students Corporation' (*Leidsch Studentencorps*). Furthermore, being domiciled in Leiden would be obligatory for students. The purpose was to avoid nihilism: students who did not participate in the students' community.[131] In November 1945, the 'Foundation Pro Civitate' was officially installed with similar targets as described in *De Geus*.[132]

Even though no references were made to American universities, these purposes bear a passing resemblance to these standards. Indeed, Gorter's notifications made in his record from September 1945 show close similarities with American university policies: playing sports are endorsed, as well as creating a students' community with a closer contact between students and professors. All this was praised by the foundation as well. Holding the same values, and considering Gorter's claim that a student's community in Amsterdam was absent, it is no surprise that Gorter was contented to succeed Keesom as professor at the Leiden University. In March 1946, he was installed as professor of physics and in his inaugural speech 'The Progress of Physics' (*De Vooruitgang der Natuurkunde*) in September later that year, he advocated *Pro Civitate*: in his acknowledgements at the end, speaking to the students, Gorter addressed the fact that natural science students and humanity students scarcely have contact with each other. He advocated the prevailing attempts of *Pro Civitate* 'to break through the fence of different student groups and to bear a part of the expenses,' and expressed the hope that these attempts would succeed.[133]

From a record in Gorter's archive, it actually becomes apparent that the foundation was a movement towards Americanization as well. In the letter to 'Mister Chairman', three kinds of universities are described: Middle-European universities with their atomized structure, following the dogma of 'Lehrfreiheit and Lernfreiheit' – respectively the professor's freedom to teach and the student's freedom to learn – and English and American universities in which solidarity among university staff and students has priority, as said before. Dutch universities are classified into the first; yet, according to the writer, a transformation towards the Western universities is readily made.

> 'It is possible to consider the postwar innovative efforts, which in Leiden group are clustered round our *Pro Civitate*, as – albeit sometimes unconscious – attempts to dissociate from the continental system and orient towards the West.'[134]

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[131] The article in *De Geus* is published in an appendix in: P.J. Idenburg, *De Leidse Universiteit* (1978), pp. 340, 416-9. See also: W. Otterspeer, *Een welbestierd budget: honderd jaar Leids Universiteits-Fonds, 1890-1990*, (Leiden: Leids Universiteits-Fonds, 1990), p. 76.

[132] F.J.J. Houps, *Inventaris van het archief der Stichting "Pro civitate academia Lugduno Batavia van de Rijksuniversiteit van Leiden, 1945-1968*, (Leiden: Rijksuniversiteit te Leiden, 1980), p. 5.

[133] Gorter, *De Vooruitgang der Natuurkunde* (1946), p. 22.

[134] My translation; original text: 'Het is mogelijk de in- en na de oorlog ontstane vernieuwingsstrevingen, welke te Leiden zich nu om onze Stichting Pro Civitate groeperen, te beschouwen als – hoewel soms onbewuste – pogingen van het continentale systeem afstand te nemen en in meer Westelijke richting te sturen.' MB, Gorter archive, inv. 479, folder 5(2), 'Mijnheer de Voorzitter'.

Thus, the writer observes a certain Americanization in the activities of *Pro Civitate*, which he strongly extolled himself: 'The innovators, among which I shall be attributed, are highly unsatisfied with the prewar Dutch university and will greet a conciliation to the American, or English system with pleasure.'[135] Unfortunately, the letter is unsigned. However, apart from the question who wrote this, it is clear that Americanization was being advertised and that *Pro Civitate* proclaimed this idea. As Gorter also advocates these ideas, it is likely to assume that he was the writer and hence that he was an advocate for Americanization as well.

In 1949, the problem of nihilism among natural science students was still not resolved. This appears from a report of a faculty committee that was established to comment on several outcomes of Reinink's report from 1949 regarding the Faculty of Physics and Mathematics.[136] In the report, similar motivations were given why natural science students were excluded from students' community. Moreover, comparable solutions were provided to resolve this issue, such as low-priced student accommodations, and the establishment of common rooms. As a short term solution, they also proposed to advocate an active participation in the faculty community of all students. Despite the importance of the problem, the committee was skeptically about any improvement of the situation, due to the practical difficulties. Gorter was also still concerned about the issue of aloofness of science students in the students' community. This is reflected in his involvement as head of the Social Council of the foundation from 1948-1950.

[135] My translation; original text: 'De nieuwlichters, waartoe men ook mijzelf wel zal rekenen, zijn grondig ontevreden over de vooroorlogse Nederlandse Universiteit en begroeten toenadering zoniet tot het Amerikaanse, dan toch tot het Engelse systeem met vreugde.' Ibid.

[136] KOL-archive, folder 'Unknown', 'Verslag over de besprekingen van de "Faculteitscommissie tot bestudering van universiteits- en faculteitsaangelegenheden, zoals gedeeltelijk neergelegd in het Rapport van de Staatscommissie tot reorganisatie van het hoger onderwijs", ingesteld door het bestuur van de philosophische faculteit der Leidse studenten.'

Figuur 3, Gorter at his desk at the Kamerlingh Onnes Laboratory. (KOL-archive)

3.4.2. Gorter and Bloembergen: raise the number of scientific workers

In the content of his inaugural speech, Gorter discussed the difference in the number of physicists in America and Europe. Comparatively, the USA had many more physicists: 'It is absolutely no exception that the Department of Physics at an American University consists of more than a dozen professors.'[137] Consequently, American professors are more specialized in their field. Bloembergen made comparable observations in his first letter from Harvard to his former professor Milatz: 'Harvard has ten associate professors for physics, an equal number for mathematics, and similar numbers at M.I.T., with which a close cooperation exists.' Moreover, he also commented on the courses in specific subjects, and recommends to provide comparable courses at Dutch universities.

> 'It would be advisory for Holland to provide more courses in specific subjects, to be taught by conservators or senior assistants. After all, associate professors are no different.'[138]

Since specialization in subjects goes together with more scientific staff, Bloembergen indirectly recommended to increase the number of scientific workers at Dutch universities. Gorter did this publicly. In the same speech, he highlighted the fact that the United States reaped the benefits of having a substantial number of scientific workers during war. Furthermore, Gorter observed that England and France were examples of countries which raised the number of scientific workers directly after the war according to the American model, while assuring that they did not copy the

[137] Gorter, *Vooruitgang der Natuurkunde* (1946), p. 12.
[138] My translation; original text: 'Het goed zou zijn als in Holland ook meer college was in speciale onderwerpen, bijvoorbeeld te geven door conservatoren of hoofdassistenten. Tenslotte zijn de associate professors niet veel anders.' UU-archive, box 08047, Bloembergen to Milatz, 27 February 1946.

American system. In view of this, Gorter argued that the Netherlands should promptly increase the number of salaried scientific workers as well, 'if it does not want to lose the significant role that Dutch physics played in the past seventy years.'[139]

> 'The adoption of the certainly more democratic American system, constituting a tripling of the number of professors in physics, seems rather impossible in the current state of our universities, apart from the fact that such a raise will result in a decrease of the social position of professors, which many will not relish. The appropriate method appears to be to create a considerable amount of positions at the university – for example, scientific researchers – which are attractive for intelligent graduates without the prospect of becoming a professor.'[140]

This indicates that Gorter initially argued that the number of professors needed to be increased, yet realized that this may cause problems due to the conservative attitude of the contemporary professors. They were accustomed to their high prestige as the sole professor and desired to maintain this. More professors at their laboratory, however, would result in a decrease of their value. As more scientific staff member were necessary, Gorter resolved this issue by proposing to increase the number of scientific workers. This was presumably a convenient solution for Gorter, as he displayed this conservative attitude himself as well, as will be shown below.

Eventually after more than a decade, it turned out that the number of scientific workers was indeed increased. In a speech, devoted to the opening of a new wing of the Kamerlingh Onnes Laboratory, Gorter considered the number of scientific workers and the available working space in the prewar as well as the postwar era, concluding that the number of researchers was increased from 35 in the 1930s to approximately 80 in the late 1950s. Regarding the working space, on the other hand, the increase was marginal. Gorter uttered: 'It is no wonder that Dr. Proctor, an American physicist who has frequently visited Leiden and have seen many of the world, uttered to me: "I have never seen such a crowded laboratory as yours."' [141] The number of scientific workers was, thus,

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[139] Gorter, *Vooruitgang der Natuurkunde* (1946), p. 13.

[140] My translation; original text: 'De invoering van het ongetwijfeld democratischer aandoend Amerikaanse systeem, hetgeen minstens een verdriedubbeling van het aantal hoogleraren in de natuurkunde zou meebrengen, lijkt binnen het raam onzer huidige universiteiten nauwlijks uitvoerbaar, afgezien van het feit nog dat de daling der sociale positie der hoogleraren, die van een grote opvoering van het aantal het gevolg zou zijn, velen niet zal toelachen. De aangewezen weg lijkt dus te bestaan in het scheppen van een vrij groot aantal functies aan de universiteit – laat ons zeggen van wetenschappelijk onderzoeker – die aantrekkelijk zouden zijn voor begaafde afgestudeerden ook zonder dat uitzicht bestaat later hoogleraar te worden.' Ibid.: pp. 13-4.

[141] My translation; original text: 'Geen wonder dan ook dat Dr. Proctor, Amerikaans physicus, die hier geregeld als gast werkt, en die heel wat van de wereld gezien heeft, mij eergisteren zeide: "I have never seen such a crowded laboratory as yours."' MB, Gorter archive, inv. 479, folder 13, 'Dames en heren, ik heet u welkom op deze bijeenkomst…'.

increased; in fact, Gorter claimed that the number was equal to America![142] Remarkably, Bloembergen made converse claims:

> 'It is true that in the early fifties the number of chairs in experimental physics at Dutch universities was still very limited. It is curious, however, that a second chair at Leiden, next to Gorter's remained vacant for years. Professor van Itterbeek, who had tenure at the University of Leuven in Belgium, served on a part-time basis in Leiden. Gorter was apparently not keen on filling it permanently. He was very generous and helpful to his subordinates, but he also wanted to remain the uncontested leader at the top.'[143]

Bloembergen experienced the consequences of Gorter's 'one-man empire' himself as well.[144] Gorter wanted Bloembergen to stay in the Netherlands, however he did not offer a similar amount of freedom that Bloembergen could receive at Harvard, implicating that Gorter desired to be the sole on top. Consequently, it can be concluded that Gorter prevailed the fear for a decrease of the professor's social position himself as well. I will take this further into account in the fifth chapter.

3.4.3 Funding

In section 3.3, I showed that with the foundation of FOM and ZWO more funds were made available for Dutch physics. Gorter's early involvement in the establishment indicates that he also supported an increase in scientific funding. Indeed, Gorter's first call for more financial resources for scientific research was in his record of September 1945, expressing his concerns on lagging behind regarding the international scientific level.

> 'During the war, the USA and Great-Britain spent an enormous amount of financial resources on research. Don't get behind! (…) Duty for our people; for humanity. Share secrets. Atom bomb. Knowledge has become more important. Internationalism!'[145]

Next to the indirect plea for scientific funding, this citation illustrates that Gorter did not solely see America as a model. He was enthusiastic concerning the amounts of money spend on science, yet he

[142] MB, Gorter archive, inv. 479, folder 5(2), 'Wetenschap en universiteit in Amerika'.
[143] Bloembergen, *Encounters in Magnetic Resonances* (1996), pp. 16-7.
[144] In a letter to the Casimir Committee, Bloembergen used the term 'one-man empire' to describe the state of Dutch universities. University Library Leiden (hereafter, UB-Leiden), *Collection J.H. Oort, 1900-1992* (hereafter Oort archive), inv. 238, Bloembergen to Casimir, 27 May 1958. For more details, see Chapter 5.
[145] My translation; original text: 'Gedurende de oorlog zijn in Amerika en Engeland fantastische bedragen aan research uitgegeven. Niet achter raken! (…) Dienst aan ons volk; aan de mensheid. Bekend maken met geheimen. Atoombom. Intellectueel van meer belang geworden. Internationalisme!' MB, Gorter archive, inv. 479, folder 5(2), 'Amsterdam, september 1945'.

expressed his discontent with the fact that America kept important knowledge on nuclear science secret. I will discuss this issue in Chapter 4.

Comparisons to the American financial situation are observed in other records as well. In a record in which Gorter examines the Dutch financial situation regarding science, he evaluated that in a few years the level of support would reach five million guilders. Additionally, he made a comparison with America, taking number of inhabitants and salaries into account, and concluded that 'the equivalent sum for the USA would probably be forty to fifty million dollars a year which is probably much less than what is spent on fundamental scientific research by the US Army, Navy and Air Force alone.' In all, he was very satisfied with the sharp increase for fundamental science over the pre-war level owing to FOM, and hoped this would 'enable Dutch research to acquire again a standard comparable with the surrounding nations,' and he hoped that the establishment of ZWO would further increase the financial resources.[146]

In 1948, the issue of lagging behind was still noticeable, and Gorter still advocated more financial support. In an article on Dutch physics in the prewar era, he concluded with the expectation that the 'thriving developments in nuclear physics would proceed.' Hence, he contended that the Netherlands should expand nuclear research in their laboratories if they wished not to lag behind. It would require serious governmental investments, in order for the Netherlands to do so. Furthermore, he argued that other branches of physics should not be subjected to reductions in investments, as he expected some fundamental discoveries in the field of low temperature scientific research in Leiden.[147]

Yet, despite these claims, it also appeared that Gorter's desires a few years earlier came out, namely that Dutch science was elevated:

> 'It may be emphasized that the Netherlands on the whole holds a high academic level of education and research in the field of physics, of which the material exploitation shall be of considerable, economical meaning in our country on many levels.' [148]

Whereas Gorter often compared the Dutch with the American situation, Leiden University actively searched for financial resources *in* America, as shall appear from the section below.

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[146] MB, Gorter archive, inv. 479, folder 5(1), 'PT October'.
[147] C.J. Gorter, 'Natuurkunde', in: K.F. Proost, and J.M. Romein (eds.), *Geestelijk Nederland, 1920-1940, deel II*, (Amsterdam: Kosmos, 1948), p. 83.
[148] My translation; original text: 'En er mag nog wel eens de nadruk gelegd worden, dat Nederland, in zijn voortreffelijk algemeen peil van natuurkundige onderwijs en onderzoek een groot kapitaal bezit, waarvan de materiële exploitatie op vele gebieden voor ons land zeker van uitnemende economische betekenis zal kunnen worden.' Ibid.

3.4.4. Harvard-Leiden Institute

In his book on the Americanization of Dutch universities, Rupp observed that, contrary to other Dutch universities, Leiden University orientated considerably to the Anglo-American countries in the prewar era. Given that after the war the orientation of all Dutch universities shifted towards the American direction, Rupp argued that 'Leiden was far ahead regarding the developments of the total Dutch academic field.'[149] Indeed, Leiden resumed its international interest, and again focused primarily on America. For example, Leiden's scholars immediately expected American financial support. Although the Minister of Foreign Affairs Eelco van Kleffens (1894-1983) warned to proceed cautiously, banker Emile Menten (1882-1970) went to America, and ascertained that America initiated a special commission to provide aid for universities that had suffered during war: the *National War Fund*. Later, this would become a subdivision of the Marshall Plan.[150]

In 1946, the Secretary of Leiden University P. Idenburg visited America, with a Rockefeller grant. During his stay, he got enthusiastic about the closer community, the student solidarity and the close contact with the surrounding society that was apparent in the American university system. Despite some criticism, he was especially enthusiastic about Harvard's activities, and consequently, a cooperation was initiated: the *Harvard-Leiden Institute.* Consequently, several American professors had visited Leiden University for one academic year to teach, and 'to contribute to strengthening the relations between Leiden and American universities.'[151]

Philosopher W.E. Hocking (1873-1966) visited Leiden and gave lectures during the academic year 1947-1948. During his residence in Leiden, he delivered a speech together with Gorter on the differences between Harvard and Leiden Universities. Whereas Hocking considered the university as a center of scholarship, research and education, Gorter provided remarks on the America and its educational system – basing his arguments on his experiences of the previous summer, during which he was a guest lecturer at Harvard.[152] In his part, Gorter remarked upon the 'superiority of private business management over government administration' and how this was reflected on the differences between state and private universities. Furthermore, he described the general system of education and linked it to the Dutch one – the American bachelor 'roughly corresponds with the Dutch 'candidate's examination''. Additionally, Gorter outlined the hierarchal structure at American universities – from the President, via the deans of a school (e.g. medicine, law, divinity, arts and science), and the heads of a department (e.g. physics, chemistry, biology), to full, associate and

[149] Rupp, *Van oude en nieuwe universiteiten* (1997), p. 40.
[150] Otterspeer, *Een welbestierd budget* (1990), pp. 91-2.
[151] UB-Leiden, *Instellingen nauw verbonden met de Rijksuniversiteit Leiden*, *Periode 1828-1994* (hereafter AUI), inv. CB8 –DA1, 'Amerikaanse Centrum aan de Leidse Universiteit'.
[152] Unfortunately, Hocking's part of the speech was not included in Gorter's archive, solely a draft of his own part.

assistant professors – emphasizing the democratic character of the social interaction between the different positions.[153]

The boards of both universities were enthusiastic about their cooperation. The president of Harvard, Conant, for example, wrote to Van Kleffens:

> 'I may only state that I have enthusiastic comments about the possibilities from Professor Hocking who was in residence in Leiden a year ago and from Professor Arthur Schlesinger who is there now and speaks equally highly of the opportunities afforded a professor from the United States and of the importance of the Netherlands in relation to the present European situation.'[154]

Yet, after three years, due to financial reasons, the Leiden-Harvard interchange of professors could not proceed solely between Leiden and Harvard, and therefore the arrangement was extended to the scientific circles in America and the Netherlands in general. At this time, the Fulbright Act was also constructed, and hence provided the possibility 'to finance guilders liabilities easier than before.'[155]

The Leiden-Harvard Institute illustrates that a comparable agreement existed before the Fulbright Program was signed. Scott Smith observed that the Fulbright Program was an effective means for America to transfer American norms and values to the Netherlands. The above examination illustrates that Leiden received this import much earlier through the Leiden-Harvard Foundation. As this foundation was extended to a national agreement, more Dutch universities welcomed American professors. Hence, the Dutch scientific system in general was exposed to the American norms and values even before the Fulbright Program. Indeed, the speech of Gorter and Hocking exemplify that American norms and values, such as the democratic character of the educational system, reached the Netherlands. In the next chapter, I shall further describe how the democratic character became apparent in Dutch universities, and among its professors.

3.4.5. Bloembergen back to Harvard

The Leiden-Harvard Foundation primarily supported the exchange between American and Dutch professors and lecturers, whereas the Fulbright Program provided the opportunity for graduate students to join an exchange program as well. Bloembergen, for example, profited from the Fulbright Program to return to Harvard after obtaining his doctoral degree in Leiden. In the spring 1948, Van Vleck informed Bloembergen that he was elected as a Junior Fellow in the Society of Fellows at

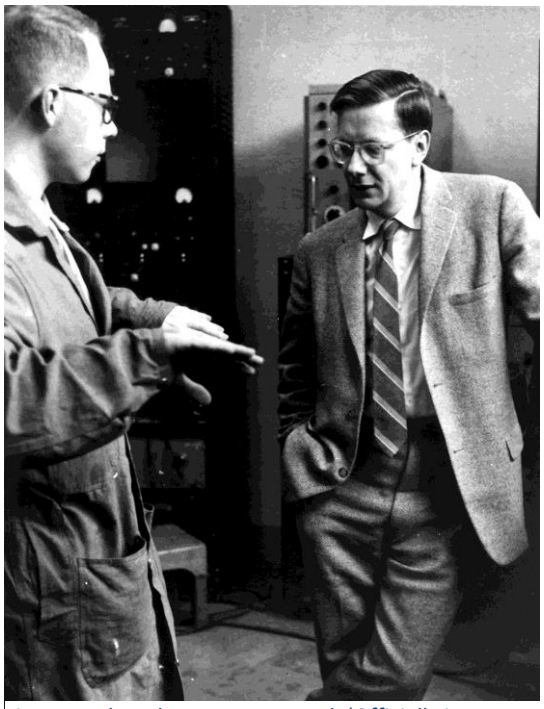
[153] MB, Gorter archive, inv. 479, folder 5(2), 'The differences between Harvard and Leiden Universities'.
[154] UB-Leiden, *AUI*; inv. CB8 –DA1, draft from Conent to Wriston, included in the letter from Conant to Van Kleffens, 14 March 1949.
[155] Ibid: Idenburg to Marshall, 10 November 1949.

Harvard University. Despite his positive experiences in Leiden, 'life in the Netherlands was still subjected to many war restrictions.' Furthermore, Bloembergen stated that:

> 'The excitement of the academic life I had experienced at Harvard beckoned to me and the long-range of opportunities opened for me by the offer from Society of Fellows, proved irresistible.'[156]

Consequently, Bloembergen accepted Van Vleck's offer, and when he informed Gorter about his leave, Gorter appeared to be 'quite unhappy'. Indeed, Gorter feared the lack of knowledge in the Netherlands as a consequence of the departure of prominent students, which is why he offered Bloembergen a position as 'Associate professor at the Foundation for Fundamental Research of Matter'. However, Bloembergen was determined: 'this FOM foundation was new at the time and my position had been quite satisfactory, but Gorter could not offer any further prospects.'[157]
At Bloembergen's farewell party, Gorter expressed his hope that Bloembergen would eventually return to the Netherlands. However, this never happened. After three years of being Junior Fellow, Bloembergen seized the opportunity of becoming Associate Professor of Applied Physics at Harvard, being permanently connected to Harvard.[158] Gorter still attempted to get Bloembergen to the Netherlands. When in March 1955, the vacancy for Zeeman's chair in Amsterdam occurred, Gorter corresponded to Bloembergen. However, after several reconsiderations Bloembergen decided to maintain his residence in America. Despite the higher salary that Amsterdam offered, Bloembergen argued that the organizational structures of US education and science influenced his final decision to stay in the USA

> The salary and the living standards play an insignificant role in my decision. The prime case is the organizational structure of the university that please me: the separation of the administration tasks and education, more incentives as result of the higher



Figuur 4, Bloembergen at Harvard. (Officially in *Nederlands Tijdschrift voor Natuurkunce*, vol. 76, no. 6, p. 229. Originally from: Cruft Laboratory, Harvard University)

[156] Bloembergen, *Encounters in Magnetic Resonances* (1996), p. 13.
[157] Ibid.
[158] Herber, Bloembergen to Gorter, 29 June 1951.

concentration of lecturers and students. Moreover, my research group at the new Gordon McKay Laboratory is working well, and currently, I cannot wish anything better for my scientific research.'[159]

3.5. Conclusion

Despite the fact that America was named 'New World' long before the start of the Second World War, after the war in 1945, this name became even more suitable. The metaphor clearly illuminates the relation between America and Europe (the 'Old World'): the latest discoveries were developed in the USA while Europe, and thus the Netherlands, aimed at the prewar pace of scientific development.

The fact that the relations between America and Europe were dispersed was not at all remarkable, given that the war affected the nations in opposite ways. The correspondence between Gorter and Bloembergen in 1946 clearly illuminated the converse effect that war had on America and the Netherlands. In America, Bloembergen profited from the new achievements and advanced instruments he suddenly had at his disposal, while Gorter had to cope with a lack of resources and a lack of trained scientific workers. The fact that Bloembergen left the Netherlands again in 1949, because the Netherlands was still not recovered from the war, illustrates that the recovery after the war was an arduous task. Moreover, the fact that Gorter attempted to offer Bloembergen a working position in the Netherlands illustrates that the lack of trained scientific workers was still problematic.

Given the good situation in America, it is not remarkable that the Dutch scholars, scientists as well as politicians, immediately looked to America. New was that Dutch physicists were occupied with science policies. As a consequence of the atomic bomb, research in the field of physics received high priority; hence, Dutch physicists realized that a science policy and investments in science were necessary in order to diminish the gap between American science and theirs. Although the cooperation between scientists and politicians was not always smooth, they agreed to advocate focus on fundamental science. Among other institutes, FOM was established to support 'pure' science, physics in particular.

Pointing to the policy of fundamental research, Hoeneveld and Van Dongen illustrated that Dutch scholars chose a policy that corresponded with the American future plans for Europe. This indicates that Dutch scholars transformed according to the American model in order to facilitate a US partnership. Indeed, American influences remained absent. Vannevar Bush's report in which he

[159] My translation; original text: 'Het salaris en de levensstandaard spelen echter een mindere rol in mijn beslissing. De hoofdzaak is de organisatie vorm van de universiteit, die me hier beter aanstaat: scheiding van administratie en onderwijs en research, meer stimulans door grote concentratie van docenten en studenten. Daarbij komt nog dat mijn research groep in het nieuwe Gordon McKay Laboratory goed aan de gang is, en ik op het ogenblik niets beters voor mijn wetenschappelijk onderzoek kan wensen.' Herber, Bloembergen to Gorter, 14 March 1955, and 11 April 1955.

advocated fundamental science, was highly influential in the Netherlands and was used as argument to focus on fundamental science. Yet, Bush wrote this report solely to maintain American support, and not to influence Europe. While Hoeneveld and Van Dongen surveyed a newly established institute, namely FOM, I considered the case studies of Leiden University and Gorter to examine whether similar conclusions can be drawn regarding the universities – the existing institutes where scientific research was conducted.

As the Kamerlingh Onnes Laboratory has continually specialized in fundamental research in cryogenics since the prewar period, the extraordinary focus on fundamental science is not seen in Leiden's research program after the war. What becomes apparent is a strong orientation to America. Rupp already observed a strong American orientation at Leiden before the war, and this shifted to a total orientation towards America after the war. This can be illustrated with the establishment of 'Foundation Pro Civitate'. Although no direct references were made to America, Gorter's objectives bore a passing resemblance. Furthermore, close cooperation between Leiden and Harvard occurred in the form of the Leiden-Harvard Foundation. Through this connection, American norms and values could reach the Netherlands even before the Fulbright Program.

That American norms and values affected the Dutch educational system can be illustrated with the case of Gorter. In several records, Gorter advocated aspects of the American science and educational system, especially its democratic character: the American students' community, the social contact between professor and students, and the number of professors at an institute. Furthermore, Gorter compared the American financial resources with the Netherlands, supporting a considerable increase in the Netherlands. From his activities in the foundation of FOM and as head of the board of the Social Council of Pro Civitate, it becomes clear he was actively involved in improving the Dutch situation. However, implementation of American ideas was sometimes practically impossible. Nihilism among Leiden's natural scientists, for example, could not be avoided. Furthermore, an increase of the number of professors appeared to be impossible owing to the conservative view of Dutch professors. Interestingly, Gorter appeared to hold on to his 'one-man empire' himself as well. Chapter 5 will further examine this.

From the fact that the Leiden-Harvard Foundation was initiated by Dutch scholars, the conclusion can be drawn that Leiden University embraced and enabled an early American partnership, like Hoeneveld and Van Dongen observed with new institutes. The American influences on these processes remained absent. Considering his strong affinity with America, it can be argued that Gorter also advocated and stimulated this process. However, he was not solely pleased with the American policy; he dissented the US secrecy on nuclear energy, for example. This will be the focus of the next chapter.

Chapter 4

Gorter, Americanization and the *Verbond voor Wetenschappelijke Onderzoekers*

The second chapter illustrated that Dutch universities were isolated from society – scientists worked in an 'ivory tower'. This issue had become subject of debate during the interwar years, until the war put an end to these discussions. In the early postwar period, the debates resumed on an even higher level. Because of the atomic bombs, ethical questions were raised all over the world, as well as discussions on the responsibility of scientists for their scientific discoveries. In Britain and the USA, natural scientists (for America, the Manhattan Project scientists in particular) grouped together and formed foundations – respectively, the *Association of Scientific Workers* (or 'ASW') and the *Federation of Atomic Scientists* (or 'FAS') – in order to participate in these political debates; they wanted to control what happened with their results. In order to collaborate internationally, they also stimulated scientists in other countries to establish such foundations.

Gorter's discontent with US secrecy around the outcomes of scientific research, which he mentioned already in September 1945, motivated him to write ASW-president Patrick Blackett (1897-1974) to ask for advice in order to set up a Dutch counterpart.[160] Publishing Blackett's ideas in *Dutch Journal of Physics* and *Chemical Journal*, Gorter aimed at finding more followers, and succeeded. He assembled a diverse group of supporters, consisting of members of university staff as well as prominent physicists and chemists. Owing to the variety inside the assembly, disagreements soon arose between the different groups of supporters. Physicists, for example, gave high priority to the control of atomic energy, whereas chemists aimed at a more trade-union character, which would labor to increase the status of scientists and the payment of assistant researchers. Eventually, compromises were made regarding the character, the working procedures, and the social basis of the association. Its main targets were set 'to strengthen the social position of the scientific worker, to reach the greatest development of scientific research, and to further extend the scientist's responsibility, in order to attain the highest efficiency for humankind and society'.[161] This was proposed in the declaration of principles on 17 June 1946, and signed by Gorter and others. The

[160] Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), pp. 47, 78.

[161] My translation; original text: 'Het VERBOND streeft naar versterking van de maatschappelijke positie van den wetenschappelijken onderzoeker, naar de grootst mogelijke ontplooiing van het wetenschappelijke onderzoek en naar de verdieping van het maatschappelijke verantwoordelijkheidsgevoel bij den onderzoeker, opdat de wetenschap haar hoogste rendement voor mens en maatschappij zal bereiken.' *Beginselverklaring VWO,* officially published in Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), pp. 60-1.

official establishment of the 'Association of Scientific Researchers' (*Verbond van Wetenschappelijke Onderzoekers*, or 'VWO') was on 13 July 1946, intentionally one week before an international congress on the international counterpart: the *World Federation of Scientific Workers* ('WFSW').[162]

Interestingly, Gorter's role in the foundation and early work of VWO remained limited. When he was asked to become the president of the association in 1947, he declined. Like in the case of the foundation of FOM, he was occupied with his activities as scientific director for the recovery of the Kamerlingh Onnes Laboratory , and as second president of the 'Netherlands Physical Society' (*Nederlandse Natuurkundige Vereniging*, or 'NNV'). Consequently, the Dutch-Belgium astronomer Marcel Minnaert (1893-1970) became the president of VWO. Fifteen other members represented the six departments located in Eindhoven, Leiden, Groningen, Utrecht, Den Haag, and Wageningen. International control on nuclear energy was one of the general issues the board addressed. Besides, all departments considered other urgent problems that Dutch scientists encountered, such as the attitude towards military research, and the gap between science and society. In this chapter, I explore how these three matters developed, and what attempts were made to resolve them. What role did America play in this? During so, I shall take the standpoints of the VWO departments into consideration together with Gorter's view on these problems. As most of the standpoints and activities of VWO appeared to have had a passing resemblance with his, I will claim that, despite his restricted input, Gorter epitomized the Dutch Association of Scientific Workers (VWO) – i.e. he was a representative of the association, as he supported similar standpoints and acted accordingly.

4.1. International control on nuclear science

VWO focused on three aspects regarding nuclear control: the necessity, the possibility and what the Netherlands could do in order to sustain it. International management of nuclear science was vital because of the disastrous consequences – no defense could compete with the power of an atom bomb's destruction. Furthermore, nuclear energy as new energy source would lead to new means of power, which could culminate in a war in the end. This had to be prevented, according to Minnaert, and Belgium theoretical physicist L. Rosenfeld (1904-1974).[163]

From his inaugural speech in Leiden, it follows that Gorter agreed on these points as well. Nuclear energy needed to be peacefully applied instead of being used for military research. He pointed out that after the explosion of the atomic bombs, the scientists' responsibility was suddenly increased, which was acknowledged in America, England and France. In the Netherlands, the KNAW made an appeal to the responsibility of scientists, and with the new association, VWO's attention

[162] Ibid.: pp. 47-56.
[163] Ibid.: p. 86-7.

was drawn to this issue in Holland as well. Furthermore, Gorter highlighted the importance of publicity of scientific outcomes, partly quoting KNAW:

> '"The secrecy of scientific outcomes is unacceptable for the scientific development, and the developments of possibilities in the field of human prosperity and health." Let the consequences of this commotion in the scientific community not fall short of the prospects![164]

Thus, the necessity of nuclear control was felt among Dutch scholars, and the US knowledge on nuclear science needed to be declassified. Interestingly, the United States, despite its secrecy, and the Soviet Union strove for international regulation of nuclear science as well. The fact that both countries independently introduced a plan, was taken by VWO as an argument that that management of atomic power should be possible.[165]

4.1.1. The possibility of control on nuclear energy: Baruch and Gromyko Plan

The American ideas to achieve international control of nuclear energy were presented in the Baruch Plan in June 1946. Its main points were 'to outline a management plan for nuclear energy and nuclear warfare, control on fissile materials and knowledge transfer of all nuclear information to the Unites States.'[166] Three days later, the USSR formulated its ideas on the matter as well in the Gromyko Plan, which proposed an opposed view compared to the Baruch plan. From the Soviet viewpoint, dismantlement of the existing – i.e. the American – nuclear weapons was necessary before any international management of atomic energy could be outlined. Furthermore, the Soviet Union did not want to eliminate the veto of the permanent members of the United Nations Security Council when issues regarding nuclear weapons were addressed; America, on the other hand, made a plea for this elimination. In general, the Soviet Union saw the American proposed control on the development of atomic energy as an American interest rather than a Soviet advantage; hence, it was inconceivable that an alliance would be formed.[167]

The Netherlands held an ambiguous view on both proposals at first. They aimed at a reconciliation of both plans, as Soviet support was necessary in order to let America feel obliged to reveal their know-how on nuclear scientific research. Following this line of argument, the Dutch

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[164] My translation; original text: 'De geheimhouding der uitkomsten van wetenschappelijk onderzoek is onaanvaardbaar voor de ontwikkeling der wetenschap en de daarmede samenhangede ontplooiing van mogelijkheden op het gebied van volkswelvaart en volksgezondheid. Mogen de gevolgen van deze roering in wetenschappelijke kringen niet te ver bij de verwachtingen achterblijven!' Gorter, *Vooruitgang der Natuurkunde* (1946), p. 17.
[165] Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), pp. 86-7.
[166] Van Splunter, *Kernsplijting en diplomatie* (1993), pp. 75-8, 102.
[167] Ibid.: pp. 76-7.

representatives in the United Nations (UN) E.N. van Kleffens and H.A. Kramers reluctantly supported the US Baruch plan, posing many critical notes. However, from 1949 onwards, the Dutch delegation expressed its unconditional support for America. This was as a consequence of the politically turbulent period in 1948, with a blockade in Berlin and a communistic coup d'état in Prague.[168] Moreover, the Dutch economic state was very poor and in order to qualify for American Marshall aid, the Netherlands had to support America.[169] According to political scientist Jaap van Splunter, the American government forced the Netherlands to support the American viewpoint in the UN; yet, not much was needed to persuade the Dutch scholars.[170]

In VWO, the switch to the American side eventually became apparent as well, which was remarkable, because the association did not want to hold any political views, in order to appeal to as many scientists as possible.[171] But when the international counterpart WFSW joined the pro-Soviet *World Federation of Trade Unions* ('WFTU'), the Dutch association decided to resign from the WFSW in 1950.[172] According to Molenaar, VWO had struggled with political issues from the start. Despite its aim of being neutral, the association was initially partially based on communistic ideas. For example, the viewpoints of communist John D. Bernal (1901-1971) – written in 'The frustration of science' (1935) and 'The Social Function of Science' (1939) – were influential in the establishment of VWO.[173] Furthermore, VWO's entry into WFSW also indicated a communistic orientation, as the international association was headed by communists, such as Bernal and the French physicist Frédéric Joliot-Curie (1900-1958). Moreover, Molenaar argued that in the early years of VWO, the American concealing of nuclear information encouraged communistic ideas. This feeling was increased by the negative consequences of the military application of atomic energy and other research fields. Hence, the protest against militarization and monopolization of scientific knowledge could stimulate politic communism among Dutch scientists.[174] Lastly, president Minnaert was a supporter of communistic ideas, hence it is likely that his standpoints were represented in association as well.

After the political developments in 1948, VWO received criticism on being too communistic.[175] One of the fierce critics was the social-democrat J. de Kadt (1897-1988), who wrote about communism as a threat for the Netherlands in 'Socialism and Democracy' (*Socialisme en Democratie*)

[168] Ibid.: pp. 102-3
[169] See: Van Splunter, *Kernsplijting en diplomatie* (1993), p. 103; Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), pp. 81-2.
[170] Van Splunter, *Kernsplijting en diplomatie* (1993), p. 104.
[171] Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), p. 50.
[172] Ibid.: pp. 108-9.
[173] Ibid.: p. 57.
[174] Ibid.: pp. 71-2.
[175] Ibid.: pp. 109-10.

– the journal of the 'Labour Party' (in Dutch: *Partij van de Arbeid*, or 'PvdA') in 1950.[176] That issue was devoted to America to 'give an insight in the character of the American society.'[177] As fervent adherent of social-democracy, Gorter contributed to this issue with an article on the position of natural scientists in the USA.[178] He highlighted the influence of the Soviet dismissal of the Baruch Plan, and stated that even 'progressive groups in America did not see any positive perspectives anymore.'[179] The Soviet opposition against the Baruch Plan and its threat of making an atomic bomb led to a hunt for communists and a persecution of American scientists who refused to work on an American hydrogen bomb. They were accused of being a communist, while they solely strove for peaceful use of atomic energy. Gorter concluded with:

> 'One gets the impression that, when the political situation becomes more hopeful to reach international agreement, the intellectuals – supported by their raised prestige – can have an acknowledgeable influence on the situation. It will be the task of their foreign colleagues to support them with all one's strength.'[180]

This citation illuminates Gorter's endeavors to recover scientific internationalism. VWO strove for internationalism as well.[181] In fact, this was one of the things that the association did to promote atomic control.[182] I will return to this later; first, Gorter's efforts to reestablish international science are described.

4.1.2. What the Netherlands could do (I): Gorter's internationalism

As shown above, Gorter was a strong advocate of scientific internationalism. His first attempt to bring the international community together after the horrors of the war was the organization of the Zeeman congress in September 1946. As second president of the NNV, he invited as many foreign scientists as possible to 'resume normal life and normal relations with the outside world – if possible,

[176] J. de Kadt, 'Van weifeling tot weerstand', *Socialisme en Democratie, Maandblad van de Partij van de Arbeid*, vol. 7, no. 7 (1950), pp. 418-36.
[177] In the preface: *Socialisme en Democratie*, vol. 7, no. 7 (1950), p. 417.
[178] Already during his study years, Gorter joined the Social-Democratic Students' Party, and remained so through the rest of his life. See Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…*' (1994), p. 75, and Van Berkel, *De stem van de wetenschap* (2011), p. 314.
[179] C.J. Gorter, 'De positie der natuurwetenschappelijke onderzoekers in de U.S.A.', *Socialisme en Democratie*, vol 7, no. 7 (1950), p. 479.
[180] My translation; original text: 'Toch krijg men de indruk dat, indien de politieke situatie weer eens gunstiger mocht worden voor de mogelijkheid van internationale overeenstemming, de geleerden – gerugsteund door hun vergroot prestige – weer een niet te verwaarlozen invloed ten goede op de gang van zaken zouden weten uit te oefenen. Het zal de taak zijn van hun collega's in andere landen hun dan uit alle macht steun te bieden.' Gorter, 'De positie der natuurwetenschappelijke onderzoekers in de U.S.A.' (1950), p. 480.
[181] Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…*' (1994), pp. 50-9.
[182] Ibid.: p. 86.

on an even higher and more international level than before.'[183] Soviet as well as American scientists were invited to visit the conference.

According to Molenaar, Gorter wanted to bridge the gap between East and West, pointing to Gorter's attempt to combat 'stigmatization' by speaking in defense of Juliot-Curie at the US embassy in Den Haag in January 1950.[184] However, the turbulent times in the late 1940s seem to have forced him to stop his activities for a while. Indeed, the quote in 'Socialism and Democracy' above, showed that uniting the United States and the Soviet Union was difficult. Furthermore, when Gorter organized another conference at the Kamerlingh Onnes Laboratory in June 1953, Soviet scientists were not invited, while American and other Western countries were.[185] This was probably due to the fierce opposition between the USA and the USSR, and the fact that the Netherlands had chosen the American side.

From the late 1950s onwards, Gorter's attempts to unite the United States and the Soviet Union became visible again. The international, political situation had slightly calmed down by then, in part because of the death of Joseph Stalin (1878-1953) in March 1953. A slow approach between the United States and the USSR became apparent, and in December that year, the American president Dwight Eisenhower (1890-1969) delivered his famous speech 'Atoms for Peace' in which he revealed some American information on nuclear science. In 1955, an international conference was held in Geneva on the same subject, where Western as well as Eastern scientists gathered together. The *International Conference on the Peaceful Uses of Atomic Energy* was the first large international conference after the war. A Dutch delegation, led by Gorter, was also present at this congress, and in the summary for the 'Dutch Journal of Physics' (*Nederlands Tijdschrift voor Natuurkunde*), Gorter remarked that similar results were obtained on both sides.[186]

Although tensions between the superpowers eased slightly, a (close) scientific cooperation was still absent. In several archival records, Gorter's attempts to bridge this gap between East and West became apparent. For example, he surveyed the differences between physics in the Soviet Union and America. Listing the scientific developments in the two superpowers, Gorter concluded that America was far ahead regarding scientific progress. The Soviet scientific level was at most comparable to the West-European level, and no more than half of the American level. Although America was difficult to

[183] KOL-archive, folder 'Zeeman Congres', Gorter to Kapitza, 7 December 1945.
[184] Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), p. 76. Molenaar refers to the following newspaper article: G. Mulder, X. Wiebes, and B. Zeeman, 'De zaak-Kr', *NRC*, 2 May 1992, accessible at: https://www.nrc.nl/nieuws/1992/05/02/de-zaak-kr-een-nederlands-atoomgeleerde-in-de-mccarthy-7142029-a702418.
[185] MB, Gorter archive, inv. 479, folder 14, 'Kort verslag van de bespreking van het Comité ter voorbereiding van de Kamerlingh Onnes-Lorentz herdenking in 1953 op 9 februari 1953.'
[186] C.J. Gorter, 'De Genève-Conferentie over vreedzame toepassing van de kernenergie', *Nederlands Tijdschrift voor Natuurkunde*, vol. 22, no. 4 (1956), p. 107. See also MB, Gorter archive, inv. 494 for the reports on each delegation meeting.

compete with, and even though the Soviet parliament decided what research was given priority in the Soviet Union, Gorter claimed that sorrow over the current situation was not necessary. Renewing contacts and international cooperation would provide a solution to the international situation. Claiming that Soviet scientists were eager to cooperate internationally, and given the fact that in the Soviet Union natural science was highly esteemed, Gorter argued that scientific cooperation may be the most effective means to build a bridge between East and West.[187] An example of a Soviet scientist who was powerful was physicist Pjotr Kapitza (1894-1984). After studying in Leningrad, Kapitza departed for Great Britain to study physics at Cambridge University in 1922. After that, he had worked in the Cavendish Laboratory together with Rutherford on low temperatures until 1934, when he was forbidden to leave the USSR after a family visit.[188] Given his contacts in foreign countries and the fact he was obliged to work in the Soviet Union, it is likely that Kapitza maintained his contacts and (indirectly) encouraged international collaboration as well.

The Soviet scientists' readiness can also be illustrated with the fact that they organized scientific congresses to which foreign scientists were invited as well. Just before the Geneva congress, professor J.H. de Boer (1899-1971) visited a congress in Moscow as representative of the KNAW. During the second delegation meeting of the Atoms for Peace conference, he summarized his experiences. As America and England were also invited, but did not send any representative, the Dutch professor was geographically the most Western foreigner at the congress. Other foreigners – forty in total on the 1200 scientists at the congress – originated from Scandinavia, or from Eastern countries such as China or India. De Boer's general impression was that the Soviet scientists were glad to show some of their work to foreigners and to have had contact with them.[189]

In 1956, the Soviet Union had organized more international conferences, for example one on magnetism which Gorter visited. From his trip to the Soviet Union, he remarked that in the USSR, scientists were well-informed about Western scientific developments, as many translations of American science books were available.[190] Additionally, Soviet scientific education was of high quality, training a remarkably large number of natural science students. Specifically, the number of physics students was high: on average more than ten percent of the students was physics student, compared to approximately three percent in Western Europe and America. Soviet scientists attributed this high percentage to the fact that young intellectuals were fascinated by this discipline,

[187] MB, Gorter archive, inv. 479, folder 13, 'Natuurkunde in Rusland en Amerika'.
[188] MB, Gorter archive, inv. 494, 'Toespraak bij uitreiking Kamerlingh Onnes Laboratorium op 23-9-1968'.
[189] MB, Gorter archive, inv. 494, 'Tweede Delegatievergadering van de Nederlandse Delegatie naar de Atoomconferentie, gehouden in Hotel Richemond, Genève op 7 augustus 1955 te 21 uur.'
[190] MB, Gorter archive, inv. 479, folder 13, 'Natuurkunde in Rusland en Amerika'.

and to the fact that the payment was very good. Furthermore, a 'rather prominent colleague' of Gorter provided him the following explanation:[191]

> 'We realize that our industry lags behind the Western countries in many – although not every – aspects. We want to improve this and we have good experiences with placing young physical graduates in our factories. Indeed, they are not directly trained for this labor compared to our engineers. Yet, they have – more than most of the young engineers, who usually attempt to apply their learned knowledge from Technical Schools – the tendency to cast doubts on procedures and point out alternative methods to older engineers. This has led to valuable, new progress, and that is why we attract many physics students, of which a small number ends in actual scientific research.'[192]

He wrote this in his article on the position of physics in society, and concluded by stating that his American colleagues were very interested to hear this type of reasoning, pointing to the difficulties America had to cope with. Gorter indicated a 'dangerous myopic' in the American industry due to 'the strong governmental focus on technology, the patents and the engineering sciences.'[193] As a consequence, American intellectuals did not see how physics students could be of even more use outside the research field. The fact that Gorter transferred Soviet experiences to the United States shows his desire to build a bridge between the two rivalling nations.

As stated above, Gorter's attempts to unite the superpowers stagnated during the unsettled period. The following section will focus on this period, when the Netherlands sought for cooperation between smaller nations. As mentioned earlier, VWO advocated a neutral standpoint, arguing that the Netherlands should not be 'the obedient follower of one of the standpoints.' Instead, VWO supported cooperation between the smaller nations 'to form independent politics.'[194]

4.1.3. What the Netherlands could do (II): cooperation between small countries

By elevating the Dutch scientific level, especially regarding nuclear science, Dutch scientists would gain a better position in international discussions, and hence would gain a better position to

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[191] Unfortunately, Gorter did not point out the name of his colleague.

[192] My translation; original text: 'Wij beseffen dat onze industrie in vele – hoewel niet alle – opzichten nog bij het Westen achter ligt. Wij willen dat inhalen en wij hebben goede ervaring met het plaatsen van natuurkundig opgeleide jongeren in onze fabrieken. Zij zijn weliswaar niet zo direct als de ingenieurs opgeleid voor het werk in een fabrieksbedrijf. Maar zij hebben – in meerdere mate dan de meeste jonge ingenieurs, die vooral trachten toe te passen wat zij op de Technische Hogeschool hebben geleerd, de neiging om als het ware overal vraagtekens te plaatsen en de oudere ingenieurs er op te wijzen dat het misschien ook wel heel anders kan. Dat heeft vaak tot waardevolle nieuwe aanwinsten geleid en daarom trekken wij zovele natuurkundestudenten aan, waarvan op den duur slechts een klein deel in het eigenlijke wetenschappelijk onderzoek terechtkomt.' MB, Gorter archive, inv. 479, folder 5(2), 'De plaats der natuurkunde in de samenleving.'

[193] Ibid.

[194] Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), p. 87.

persuade America to declassify its knowledge. According to Van Splunter, first attempts to strengthen their position were made by conducting research independently from other countries. Furthermore, new organizations, such as FOM and ZWO would stimulate scientific progress. Regarding nuclear science, Dutch intellectuals realized from the 1950s onwards that cooperation with other (small) countries was essential to be able to establish a nuclear reactor themselves.[195] Norway appeared to be a perfect ally, as it pursued similar objectives, and both nations complemented each other in resources. Norway was building a nuclear reactor in Kjeller and had access to heavy water, but missed the nuclear fuel. The Netherlands, on the other hand, missed the reactor, but had a considerable amount of uranium at its disposal, due to a purchase of W.J. de Haas before the war.[196] This was in the form of uranium oxide, but Great-Britain was willing to trade this for useful purified uranium.

For the Netherlands as well as Norway, cooperating was beneficial to gain experiences in the new field of nuclear research. Additionally, know-how in this field was highly desirable for the Dutch future plans to build a nuclear reactor itself.[197] Moreover, as stated above, knowledge on nuclear energy would strengthen the Dutch and Norwegian international scientific position. In this manner, they could attract American attention, and may even enable an American partnership. That America played a part in the considerations before embarking on the Norwegian-Dutch cooperation, is clearly seen in the activities of both nations. Norway, for example, did not proceed with a potential Norwegian-French partnership, because a cooperation with France would risk an Anglo-American disapproval. After the Second World War, the French prestige had decreased among American scholars, because of difficulties with regard to the French participants in the American nuclear bomb project. Additionally, the French nuclear energy program was led by Joliot, who supported communistic ideas.[198] In the Netherlands, the importance of America is demonstrated by the fact that Dutch scholars informed America about every cooperation that was initiated with other countries, such as with Norway and Great-Britain. As Holland received Marshall aid, it had to conform with the 'gentlemen's agreement'. According to the Dutch government, permission was not necessary, but the USA had to be informed before it would sign the Norwegian-Dutch cooperation.[199] Informing America would be beneficial for the Netherlands in respect to its aim to obtain an American partnership as well. Consequently, for the Netherlands as well as Norway, their cooperation was a strategic alliance to aim at a partnership with their superpower: the United States.

[195] Van Splunter, *Kernsplijting en diplomatie* (1993), p. 108.
[196] See: Dirk van Delft, 'Tegen de roof' (2007).
[197] J.A. Goedkoop, *Geschiedenis van de Noors-Nederlandse samenwerking op het gebied van de kernenergie*, (Den Haag: Reactor Centrum Nederland, 1968), p. 41. Also published in the monthly journal 'Atoomenergie en haar Toepassingen' within the period of March-August 1967.
[198] Ibid.: p. 43.
[199] Van Splunter, *Kernsplijting en diplomatie* (1993), p. 126.

Figuur 5, Kistemaker delivering his enriched uranium to J. Clay and J.M.W. Milatz, the directors of FOM. (Officially in *Nederlands Tijdschrift voor Natuurkunde*, vol. 83, no. 1 (2017), p. 18. Originally from FOM/AMOLF).

The Norwegian-Dutch collaboration, or *Joint Establishment for Nuclear Energy Research* ('JENER'), appeared to be highly successful. After two years, the nuclear reactor *Joint Establishment Experimental Pile* ('JEEP') in Kjeller had produced radioisotopes and several scientific results.[200] Interestingly, Dutch physicist Jacob Kistemaker (1917-2010) had also managed to produce the first milligrams of enriched uranium in the FOM-laboratory for mass spectroscopy in Amsterdam in November 1953. According to Van Splunter, this development was influential in the ending of the American embargo of enriched materials.[201] Together with the fact that the Soviet-Union had tested their atomic bomb since 1949, the American monopoly of conducting nuclear research as well as the peaceful use of nuclear energy was untenable. Consequently, America had to change its policies. The 'Atoms for Peace'-speech was a first public announcement of the break in the American secrecy. Furthermore, the American Atomic Energy Pact was altered, making cooperation with other countries possible.[202] American physicist Walter Zinn (1906-2000) was send to Europe by the American government to survey how Europe could use American help. During his visit to the Netherlands, the Dutch aim to build its own nuclear reactor was announced. Zinn provided advice on the kind of reactor and offered American help to accomplish this. As Dutch scientists were eager for

[200] Goedkoop, *Geschiedenis van de Noors-Nederlandse samenwerking* (1968), p. 97.
[201] Van Splunter, *Kernsplijting en diplomatie* (1993), p. 158
[202] Goedkoop, *Geschiedenis van de Noors-Nederlandse samenwerking* (1968), pp. 107-8, 115, 122.

an American cooperation, a bilateral agreement was signed in 1955.[203] Thus, the Dutch duel aim of openness on nuclear energy and an American partnership were both achieved with their cooperation with Norway.

The main Dutch characters in the Norwegian-Dutch cooperation were Kramers, C.J. Bakker and J.M.W. Milatz – the three members of the Joint Commission. Gorter was an acting member of this committee, and thus indirectly involved. Already from the start, he was highly interested in the Norwegian-Dutch cooperation. Later, Gorter became a member of the 'Committee of Eight', a committee that was installed to reorganize nuclear energy research in order to facilitate another American nuclear cooperation, namely with the *United States Atomic Energy Commission* (USAEC). The new organization 'Reactor Center Netherlands' (*Reactor Centrum Nederland*, or 'RCN') would lead this.[204] Gorter was closely involved in these developments, indicating that he embraced the American partnership as well.

Despite other initial purposes, such as the strive for control on nuclear energy, the Norwegian-Dutch cooperation had led to the facilitation of American partnership. Hoeneveld and Van Dongen had already noticed this in their article on the foundation of FOM. [205] In another article, they showed that courting American partnership also became apparent in Dutch defensive research. The VWO department of Eindhoven considered the issue military science, and will be examined below.

4.2. Military research

In America, military research and scientific research were closely intertwined. This was a result of the significant value of scientific outcomes in the production of war effort. As mentioned in Chapter 3, Bloembergen stated that university laboratories needed to transform from war effort to the peaceful use of scientific outcomes.[206] In the prewar years, investments in science often were provided by private organizations; yet the developments during war resulted in a large increase of federal financial resources for sciences. In his report *Science, the endless frontier,* Vannevar Bush advocated to maintain these resources after the. With the Cold War, university laboratories remained closely involved in military research, and thus received large investments from military organizations, such as the Office of Naval Research, the Army, and the Air Force. Moreover, the Department of Defense was not averse to support fundamental research that was not militarily

[203] Ibid.: p. 108.
[204] Van Splunter, *Kernsplijting en diplomatie* (1993), p. 212.
[205] Hoeneveld en Van Dongen, 'Out of a clear blue sky' (2013), p. 274.
[206] UU-archive, box 08047, Bloembergen to Milatz, 27th February 1946.

relevant at all. Consequently, fundamental scientific research conducted at American universities was difficult to distinguish from military research.[207]

In the Netherlands, military research and scientific research were much more separated. In neutral Holland, defense research was carried out on a modest scale. Three laboratories were specialized in defense research, among them the Central Laboratory of the General Headquarter. Just before the German occupation, the direction of this institute managed to flee to Great-Britain together with, among others, two researchers J. van Ormondt and J.H. de Boer. Near the ending of the war, Van Ormondt and De Boer strongly advised the Dutch government to establish a new defense institute in Holland, using the British case as model. In their view, scientific research, fundamental and applied, should play a substantial role in the nation's defense.[208] When after the war the importance of science became clear, 'the officials in the Ministry of War had become convinced of defense research themselves too, and started to explore its possibilities with TNO as early as on 14 august 1945.'[209] The 'Dutch Organization for Applied Scientific Research' (*Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek*, or 'TNO') was established in the 1930s, yet did not function effectively until the early postwar period.[210] The institute was considered to be the best place to incorporate defense research. The main argument was 'cost efficiency': as TNO was focused on applied science, just like defense research, it would 'avoid the accidental duplication of research work and make special expertise across TNO more readily available to those engaged in defense research.'[211] Hence, the 'National Defense Organization' (*Rijksverdedigings-Organisatie*, or 'RVO') became a subsidiary of TNO in February 1946.

Although defense research was affiliated to a scientific institute, Dutch scientists did not appear to feel obliged to conduct military research. Gorter, for example, was pleased with the separation of scientific and military research, and the fact that an intermingling between the kinds of research was not supported, in contrast with the United States:

> 'In Europe, universities are neither private, nor directly associated to military institutes. Cooperation is not encouraged. However, there is contact on e.g. conscription of graduates, or working in military laboratories.

[207] See, Van Helvoort, *De chemie van de universitaire wetenschapsbeoefening* (2008), and MB, Gorter archive, inv. 479, folder 5(2), 'Gevolgen van wetenschappelijk onderzoek, geheimhouding van resultaten'. For precise information about the US spending on scientific research by the ministry of Defense see for example: Forman, 'Behind quantum electronics: National security as basis for physical research in the United States, 1940-1960', *Historical Studies in the Physical and Biological Sciences*, vol. 18, no. 1 (1987), pp. 149-229.
[208] Van Dongen and Hoeneveld, '*Quid Pro Quo*' (2015), pp. 105-6.
[209] Ibid.: p. 107.
[210] See: Van Berkel et al., *A history of science in the Netherlands* (1999).
[211] Van Dongen and Hoeneveld, 'Quid Pro Quo' (2015), p. 107.

American financial support involves the Air Force (non-tactical). In the Netherlands, it was determined that this would involve ZWO.'[212]

Gorter noticed as well, that the division of military research with universities was difficult:

'In Europe, [defensive research should] not be intertwined with higher education. TNO may be the most suited institute regarding defense, immunization, and medicine (however, elusive to define).'[213]

Indeed, questions were raised whether the division between purely scientific and defensive research was actually clear. Firstly, RVO-employees were obliged to take an oath of secrecy about the developments, because of the defensive purposes of the outcomes. Secondly, the president of RVO-TNO was G.J. Sizoo, who was professor at the Free University of Amsterdam as well. Thus, the institutes may be separated, but 'via the personnel interinstitutional contacts were present.'[214] However, generally, the intertwinement was in no case comparable to the scale in which US science and military research were interwoven. Cooperation between scientific and military research was not encouraged, and fundamental science was not financially dependent on military resources, like in the United States.

Gorter observed that American science was not solely intertwined with military research, but had also become a business matter. He highlighted that American secrecy was not only vital for military reasons, but for business interests as well. Via patents, research outcomes were protected for twenty years, resulting in enormous sums. American universities could receive patents for their research outcomes; indeed, 'it is one of the university's primary financial resources (Boston: MIT, Harvard).' In Europe, on the other hand, this was inconceivable, and should remain so, Gorter argued.[215] This illustrates again that the American organization of science and it financing was not considered as role model for Dutch universities.

The VWO department in Eindhoven addressed the issue of military research in their meetings, and shared Gorter's opinion. The department primary focused on the secrecy of military research that was also apparent in Dutch scientific research. The Philips Physics Laboratory (*Philips Natuurkundig Labotorium*) in Eindhoven – Netherlands' largest laboratory for applied science – received several

[212] My translation; original text: 'In Europa zijn Universiteiten niet particulier en ook niet direct verbonden met militaire instanties. Samenwerking wordt niet bevorderd. Contact wel, b.v. over plaatsing dienstplichtige doctorandi; in militaire laboratoria werken. Amerikaanse steun verloopt over Air Force (ontactisch). In Nederland werd ~10 jaar geleden afgesproken dat dit over ZWO zou lopen.' MB, Gorter archive, inv. 479, folder 5(2), 'Gevolgen van wetenschappelijk onderzoek.'
[213] My translation; original text: 'In Europa buiten instellingen van H.O. te houden. T.N.O. wellicht het juiste kantoor wat betreft verdediging, immuniseren en geneeswijzen (echter moeilijk scherp te definiëren).' Ibid.
[214] Van Helvoort, *De chemie van de universitaire wetenschapsbeoefening* (2008), pp. 252-3.
[215] MB, Gorter archive, inv. 479, folder 5(2), 'Gevolgen van wetenschappelijk onderzoek.'

military orders to manufacture products in secret, such as producing image intensifier tubes for infrared. 'The matter was, to begin with, regarded as very secret; even the fact that such tubes were made was not supposed to leak out,' Casimir stated.[216] Molenaar pointed to the 'pent-up frustration' of Philips researchers, who attempted to alter research in a constructive rather than a destructive direction. According to physicist J.J. Went (1907-1986) 'this was a constriction, that was unimaginable in the prewar era.'[217]

Yet, the introduction of the Truman doctrine and the communistic coup d'état in the Czechoslovakia were pivotal moments that resulted in an alteration in Eindhoven's school of thought. It was realized that it was difficult to prevent natural scientific outcomes to be used destructively. Freedom of research did not harmonize with pacification. The issue of military research was pointless: all scientific outcomes could be used constructively or destructively, especially in a war. Consequently, addressing this issue would lead to this issue of how war could be avoided.[218] To that purpose, the members of the working committee – of whom some worked at the Philips Physics Laboratory, such as J.J. Went – proposed four measures: publications of scientific results, improvement of international scientific contacts, striving for more participation in decisions on the application of scientific research, and striving for the right to conscientious objection.[219]

The fact that RVO-researchers needed to take an oath of secrecy, and the example of the Philips laboratory, that received military orders that had to be conducted in secret, illustrate that defensive research in the Netherlands was slightly similar to the abhorred secrecy in America. The VWO department in Eindhoven comprehended that there was no solution to this problem, as every scientific outcome could be used for military purposes. More valuable would be, to ponder upon how war could be prevented.[220] This appeared to be an enlightened attitude, as military research proceeded. Van Dongen and Hoeneveld argued that the adoption of British ideas, and a cooperation with Great-Britain can be considered as facilitating American partnership.

Via Van Ormondt and De Boer, RVO's contact with the British intensified from the start, and many Dutch researchers visited Britain. Yet, 'after 1949, the willingness of the British to share information with the Dutch was much reduced, most likely because the British did not want to jeopardize their relation with the US by exposing joint work to the Dutch.'[221] Henceforth, American approval was

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[216] Officially quoted in Molenaar, '*Wij kunnen het niet langer aan de politici overlaten…'* (1994), p. 88; originally quoted from: Casimir, *Haphazard Reality* (1983), p. 282.
[217] Molenaar, '*Wij kunnen het niet langer aan de politici overlaten…'* (1994), pp. 88-9.
[218] Ibid.: p. 89. See also: 'V.W.O. en militaire research, Rapport van de studie-commissie voor militaire research van de afdeling Eindhoven van het V.W.O.' *Atoom, Maandblad gewijd aan de ontwikkeling der wetenschap en haar betekenis voor de mens en maatschappij*, vol. 2, no. 8 (1948), pp. 135-9. The working committee constituted of G. Diemer, J.D. Fast, J.F. Klinkhamer, A.W.M. Paling, and J.J. Went.
[219] 'V.W.O. en militaire research' (1948), p. 135.
[220] Ibid.
[221] Van Dongen, and Hoeneveld, 'Quid Pro Quo' (2015), p. 109.

needed to collaborate with Britain. In response, RVO-president Sizoo traveled to the United States in order to establish a direct cooperation with it, and eventually succeeded. Consequently, researchers and knowledge were exchanged both ways. Van Dongen and Hoeneveld argued that America was interested in the Dutch RVO due to the high quality of research that was conducted there, such fire control and its digital-image communication. Furthermore, America was 'confident of RVO's security regime and like its embedding through TNO.'[222] This illustrates that the Dutch security regime was good for American standards.

Although America was no direct example regarding the extent of intertwinement of military and scientific research, Van Dongen and Hoeneveld argued that RVO and its structure enabled a partnership with the USA, and they were successful:

> 'Not only did the desired *quid pro quo* around knowledge actually ensue, the Dutch initial investment also persuaded the Americans to fund an entirely new facility in The Hague, SHAPE TC. Clearly, this greatly facilitated Dutch contributions, through science, to the shared interest of North Atlantic defenses.'[223]

As we saw earlier, Gorter strongly expressed his disgust about the American secrecy, but he appeared not to interfere in the Dutch defensive research at RVO. Given the fact that Gorter wanted to build a bridge between East and West, we can presume that his view coincided closely with the pacifistic attitude of VWO-Eindhoven. The real issue was how to prevent another war instead of avoiding the use of scientific outcomes in military investigations.

By means of bridging East and West, Gorter strongly advocated scientific internationalism. The American secrecy was out of line with this purpose, and was not comparable to the secrecy regarding Dutch defense research. In the Netherlands, pure science was not intermingled with defensive research, and as a consequence its secrecy was less influential. Moreover, internationalism in the scientific field was still possible. Presumably, that is why Dutch secrecy in defensive research was not of Gorter's interest: it still happened on a modest scale, as compared to America. Clearly, America was no role model for Gorter in this case.

In the next section, Gorter's strive for public openness of scientific results will be further elucidated. The relation between science and society will be scrutinized. Interestingly, the American means appeared to be valuable for Gorter in this case.

[222] Ibid.: p. 110.
[223] Ibid.: p. 120.

4.3. Science and Society

Next to the international problems, Dutch scientists had to cope with internal structures that had caused conflicts since the end of the war. Recapitulating from Chapter 3, the Reinink-II committee was installed to survey what reorganizations in the Dutch science and educational system were necessary in order to elevate the level of scientific research. Its report 'Reorganization of the Higher Education' (*Rapport van de Staatscommissie tot reorganisatie van het hoger onderwijs*, 1949) was evaluated by the VWO department Leiden.[224] Its first reaction was published in a pamphlet 'Higher Education at risk' (*Het Hoger Onderwijs op de helling*, 1950).[225] This publication summarized the questions that according to the department were neglected, or insufficiently answered in the state's report.[226] One year later, VWO-Leiden organized a conference to share their conclusions with the rest of VWO and the scientific community.[227] From the issues that were discussed, I will examine two, namely the relation between university and society, and the reorganization of the university board. These points already came to the fore before the Second World War, as I illustrated in Chapter 2. Below, I shall explore what influences the American model had on the postwar proposals of reorganization. Furthermore, I shall put forward Gorter's opinion on these points as well.

4.3.1. Relation between university and society

In his speech on the occasion of the installation of the Reinink-II committee, Minister of Education G. van der Leeuw addressed the conflicting issue that faced universities. On the one hand, universities needed freedom to conduct research and come to new developments; on the other hand, it was necessary for the institutes to strengthen their position in the center of society.[228] As stated in Chapter 2, Dutch universities were isolated from society before the start of the war. First discussions arose to get scientists out of their ivory tower. In the postwar period, it became even more important for universities to strengthen their position in society. As the Dutch government invested considerably in scientific research and technology after the war, the necessity for social relevance of scientific research arose; the expenditures called for justification. Moreover, after the nuclear bombs, ethical questions were raised, and hence more public debates on the social importance of science ensued in the Netherlands. Especially, since the scientific developments would

[224] *Rapport van de Staatscommissie tot reorganisatie van hoger onderwijs* (1949).
[225] The title is a play on words due to the ambiguity in 'op de helling': this can either mean 'under review again', or 'being at risk'. The writers attempted to illustrate that both meanings were valid regarding Higher Education.
[226] A.J. Staverman et al., *Het Hoger Onderwijs op de helling*, *Verslag van discussies van een werkgroep van de Afdeling Leiden van het Verbond van Wetenschappelijke Onderzoekers en van de Wetenschappelijke Staf van de Rijks Universiteit te Leiden, gehouden in de eerste helft van 1950*, (Leiden: Stenfert Kroese, 1950). See also, Molenaar, '*Wij kunnen het niet langer aan de politici overlaten…*' (1994), p. 92.
[227] H.R. Kruyt et al., *Het Hoger Onderwijs op de helling, Verslag van het congres gehouden te Leiden op 3 maart 1951*, (Leiden: Verbond van Wetenschappelijke Onderzoekers, 1951).
[228] Staverman, *Het Hoger Onderwijs op de helling*, *Verslag van discussies* (1950), p. 8.

affect society more than ever, for example because nuclear energy was expected to become *the* new energy source. Consequently, the need for a stronger position of universities in society was more urgent than ever.

To deal with this issue, the Reinink-committee held the view that society and science should have such an interplay that they supported each other. Through an enquiry, the committee gained knowledge on the needs of society and concluded that the main proposal should be to implement a 'bachelor degree' so that a study could be finished within three years.[229] VWO-Leiden concurred with the idea that universities should break through their isolation, but held the view that the state committee proposed insufficient changes to improve the situation. Next to the implementation of a bachelor degree, it suggested, for example, to improve the selection procedure of students. In order to bridge the gap between higher education and society, a wider community should be able to go to university, and students should be selected regarding their competences. Furthermore, the VWO department stated that knowledge transfer between universities and the wider public should be enhanced, as well as the contribution of society in the university board. In making these suggestions, America was considered as example of the direction to go in:

> 'To implement these means will be a difficult task; yet, it is known that in the United States similar measures are successful.'[230]

Interestingly, Gorter also pointed to the necessity of publishing scientific outcomes to a wider public. In a short article, he made a plea for science education in public journals. Before the war, articles on a specific subject, written by professors themselves, were incidentally published in daily news. In the Anglo-American countries and Scandinavia, on the contrary, scientific popularization was highly valued. 'Scientific reporters' were trained to interview scientific specialists about their research field and to work this up into an article for a specific journal, or for a group of journals. Gorter proposed a comparable system for the Netherlands as well, emphasizing that scientific popularization was of high importance. He argued that it was highly important to attract public attention on Dutch attempts to diminish the knowledge gap with the Anglo-American nations, because this was a cultural and economic matter, hence concerned everybody. Furthermore, many young intellectuals and technicians expressed a growing interest in new scientific discoveries. To increase the number and frequency of the publication of scientific articles for a wider public, Gorter offered an alternative of the American system for the Netherlands.

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[229] *Rapport van de Staatscommissie tot reorganisatie van hoger onderwijs* (1949), pp. 104-111.

[230] My translation; original text: 'Zeker wacht de door ons voorgestelde instantie een zware taak, doch het is bekend dat in de Verenigde Staten soortgelijke instanties met succes werken.' Staverman, *Het Hoger Onderwijs op de helling*, *Verslag van discussies* (1950), p. 12.

> 'Alternatively to the American system, I would like to propose frequent scientific columns, which will be edited by a senior researcher, with great interest in subjects outside his own field. He shall ask colleagues, and especially younger scientists, to write articles on their own research field. (…) In this manner, it seems possible to publish a decent article of 1,500 words once in fourteen days, with one or two figures for the purpose of illustration.'[231]

Gorter's plea for close contact between universities and society is reflected in other works as well. In his inaugural speech in Leiden on the progress of physics, he described scientific and technical developments that had affected the society positively as well as negatively.[232] Furthermore, in 'The Position of Physics in Society' (*Plaats der Natuurkunde in de Samenleving*), Gorter summarized the value of physics for society, exemplifying this with the splitting of atomic nuclei that 'most probably would substitute a part of the energy production for companies and households.'[233] In another article, Gorter examined the role of physics in applications such as the radio, stressing the importance of a close intermingling between scientific outcomes and their applications.

> 'Although a certain division between conducting scientific research and the development of its applications is unavoidable, too sharp separation can have serious consequences for physics as well as the national wealth.'[234]

Gorter noticed that in the Netherlands, financial support from the private sector was considerably less compared to other countries. He indicated that this was a cause of concern, as science did not solely affected society: publicity played a vital role in science as well. He also illustrated this in his speech 'The Differences between Harvard and Leiden Universities', in which he recognized the large financial resources that were available in the United States for major scientific projects and instruments, and attributed the possibility of these large investments to the 'publicity value' that was apparent in the USA.

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[231] My translation; original text: 'Als alternatief van het Amerikaanse systeem zou ik daarom regelmatige rubrieken in weekbladen willen voorstellen, welke geredigeerd worden door een physicus of chemics met ruime belangstelling buiten zijn speciale studiegebieden, die aan collega's, maar vooral ook aan jonge specialisten vraagt onder hun naam artikelen te schrijven over het gebied waarop zij deskundig zijn. (…) Het lijkt mij mogelijk zo b.v. eens per 14 dagen een behoorlijk artikel van b.v. 1500 woorden te krijgen, waarbij vaak ook één of twee tekeningen dienstig zouden zijn.' MB, Gorter archive, inv. 479, folder 5(1), 'Natuurwetenschappelijke voorlichting in de pers.'

[232] Gorter, *Vooruitgang der Natuurkunde* (1946), pp. 7, 16.

[233] MB, Gorter archive, inv. 479, folder 5(2), 'De plaats der natuurkunde in de samenleving.'

[234] MB, Gorter archive, inv. 479, folder 5(1), 'Radio en natuurkunde'. See also: folder 5(2), 'De plaats der natuurkunde in de samenleving.'

As science had a large influence on social issues, Gorter held the opinion that a close contact between the science institutes and society was vital. For example, through publications in the media, the gap could diminish. Interestingly, Gorter used the American situation as example to propose a Dutch alternative. As shown above, the American model was also often used as example in the final conclusions of the VWO-Leiden. Following the situation in the USA, it claimed that education should be possible for everybody who was intelligent. This was also the subject of debate one year earlier in the Utrecht department of VWO, that strove for 'study payment'.

According to VWO-Utrecht, higher education should be available for everybody, rich or poor. Student selection should not involve financial criteria; only suitability should be of importance. To serve this purpose, it introduced a study scholarship for *all* students.[235] Arguments for such an implementation were made more explicit during a VWO congress in December 1949, that was devoted to this subject. The congress was organized in cooperation with the *Civitas Academica* in Amsterdam and with endorsement of all universities. Gorter was also present as head of the social council of Leiden's Civitas. As shown in third chapter, Gorter expressed his wish that all students could join in the student's community during his inaugural speech in Leiden. From the report of the VWO conference, it appears that Gorter was an advocate of study scholarship indeed.

The ideas of the Reinink Committee, however, did not coincide with VWO-Utrecht. Merely a minority report was included, which stated that, when the government wished for more scientific manpower, it had to pay the expenses, instead of shifting this onto the young students.[236] This received support from a students' faculty committee in Leiden, that was established to comment on several outcomes of Reinink's report from 1949 regarding the Faculty of Physics and Mathematics. They similarly claimed that a scholarship should be implemented to enable those who are talented to begin a study.[237] Comparable payments were eventually introduced. In 1953, a first scholarship was made available for students from wealthy families, and in the course of time, study grants were implemented for less wealthier students as well. Yet, these were solely provided under the condition that these students were highly talented. By the early 1960s, more than a third of the students received a scholarship.[238]

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[235] See: Molenaar, 'Wij kunnen het niet langer aan de politici overlaten…' (1994), p. 90; *De toelating tot het hoger onderwijs: Verslag van het congres gehouden te Amsterdam op 9 en 10 december 1949*, (Leiden: Verbond van Wetenschappelijke Onderzoekers, 1950). A study payment was earlier proposed by professor A.H. Blaauw in *Socialisatie van het Onderwijs als plicht en oplossing*, Baarn (1921), see 'Toelating tot het hoger onderwijs', p. 51.

[236] The minority report in: *Rapport van de Staatscommissie tot reorganisatie van hoger onderwijs* (1949), p. 167.

[237] KOL-archive, folder 'Unknown', 'Verslag over de besprekingen van de Faculteitscommissie'.

[238] P. Slaman, W. Marchand, and R. Schalk, *Kansen in het koninkrijk, Studiebeurzen 1815-2015*, (Amsterdam: Boom, 2015), pp. 159-60.

The plea for a study grants for everybody indicated a plea for a democratic character of Dutch universities. These democratic relations also become apparent in the proposal the reorganization of the university board. The next section is devoted to the comments that VWO-Leiden made about the proposals in the Reinink report regarding this issue.

4.3.2. Reorganization of the university board

With its plan for the reorganization of the university board, the Reinink Committee aimed at narrowing the gap between society and university. However, according to the VWO department in Leiden, the suggestions in the report were not effective. The state committee had put forward an autonomous board – that is, a board that operates independently from the government – but VWO-Leiden claimed that these proposals would not serve its purpose efficiently. In fact, through these means, the gap between society and university would further expand. In the state's proposed reorganization of the Dutch university board, for example, the society had to be represented by former alumni, but according to VWO-Leiden, this could only be valid when former alumni represented the whole society. However, this was solely the case when the students' population was represented by the wider community, and as shown above, this was not the case.[239]

Furthermore, VWO-Leiden argued that the Reinink report did not resolve the issue of a good balance between hierarchy and democracy. By appointing only professors in the board, the Reinink committee attributed difficult managerial tasks to the wrong persons. When someone was appointed as professor, it was due to his scientific competences, but this did not necessarily entail that he was also qualified to deal with the board's tasks, such as managing institutes or determining job requirements. Hence, VWO-Leiden argued that it would be much more 'logical and effective' to follow the American system, and to appoint someone who was specifically adequate in these tasks.[240] Moreover, democracy was in danger when the board constituted solely of professors. As their sovereignty implied that anyone else was subordinated to them, the gap between professors and other scientific staff members would further increase. According to the VWO department, every university group had to have a voice in making decisions; hence, a more democratic university board than the Reinink-committee was proposed.[241] In order to accomplish these purposes, VWO suggested two administrative bodies: firstly, a university council, in which the broader society was represented and which determined the directions to go in, and secondly, a university board, that had an executive function.

[239] Staverman, *Het Hoger Onderwijs op de helling*, *Verslag van discussies* (1950), p. 15.
[240] Ibid.: p. 17.
[241] Ibid.

> 'Additionally, the effectiveness of the university board has to be increased by dividing large faculties into smaller departments, and by including scientific staff members [other than professors], who currently play no role in the university board at all.'[242]

The ideas of VWO-Leiden appeared to be very similar to the American organization of the university board. When reconsidering Gorter's speech on the differences between Harvard and Leiden Universities, the American hierarchal structure becomes clear. The president was the highest rank in the system and appointed by the state or a businessman depending on whether it was, respectively, a private or a state university. The deans led the schools: medicine, law, divinity, arts and sciences. Each school was divided into smaller departments, e.g. physics or chemistry, which were led by separate chairmen. 'And under him [come,] finally, the full, associate and assistant professors and the instructors. Really under for it is a hierarchy, just as we have in our laboratories with me [as] director,' Gorter said.[243] He continued by claiming that American universities managed the perfect balance between hierarchy and democracy, as its social intercourse was 'very democratic':

> 'The full professor has no direct contact with the president. The contact goes through the head of [department] and the dean. If however he happens to meet the president the social intercourse is very 'democratic' like everywhere in the USA. The president does not make himself important, but he is a big shot and simply has no time to know all his professors. Also between students and professors the social intercourse is "democratic". The student interrupt during the course and question him and graduate students often call [their] younger professors with their Christian name. I have never heard of any deliberate impoliteness.'[244]

The fact that VWO-Leiden wanted to diminish the gap between the professor and his workers, and strove for more involvement of other scientific workers, thus bore a resemblance to the American system. Their proposed hierarchical structure was also very similar to the organization at American universities. Furthermore, in the American system the administrative tasks were separated from the scientific activities, which was also advocated by Leiden. Given that they often referred to American examples, it is likely to conclude that VWO-Leiden was strongly oriented to the American model. However, actual implementations of VWO-Leiden's proposals did not ensue. Several years

[242] My translation; original text: 'Daarnaast zal de doeltreffendheid van het bestuursapparaat nog verhoogd moeten worden door een onderverdeling der grote faculteiten in afdelingen en door inschakelen van de Wetenschappelijke Staf, die momenteel in het geheel geen rol speelt in het bestuur.' Ibid.: p. 18,22-3.
[243] MB, Gorter archive, inv. 479, folder 5(2), 'The differences between Harvard and Leiden Universities;' emphasis as in original.
[244] Ibid.

had passed before actual reorganizations in the university board were introduced. Even then, ad hoc solutions, that Baneke described as 'cosmetic measures', were introduced rather than large reorganizations according to the American model.[245]

Considering Gorter's case, we already saw in Chapter 3 that he was an advocate of the democratic system; yet, he simultaneously held on to his authority as scientific director of the Kamerlingh Onnes Laboratory. The fear of a devaluation of the professors' status prevailed among Dutch professors, and Gorter as well. Being director of the institute, he received the highest status, and this should remain so. Yet, despite this attitude, Gorter valued the democratic character. According to physicist A.N. Gerritsen (1913-2009), he was indeed very democratic.

> 'Gorter was someone who was unenthusiastic about the old system of professors. He wanted to have a group, because he enjoyed cooperating, and making people independent. He applied this attitude at FOM, and hence belonged to the scarce professors with which Leiden University's staff members could act in their strive to democratize the university board.'[246]

Similar attitudes were demonstrated by Dutch astronomer Adriaan Blaauw (1914-2010) at the University of Groningen. When he returned from the Yerkes Observatory (University of Chicago) in the USA, he became the head of Groningen's Kapteyn Astronomical Institute. He was clearly the executive director, yet he maintained a democratic social atmosphere which he had adopted from the American educational style.

4.4 Conclusion

This chapter described Dutch attempts, especially these of VWO and Gorter, to resolve three major problems that the Netherlands had to cope with after the Second World War: control on nuclear energy, military research and the altered role of science in society. This conclusion will focus on Gorter's perspectives in particular. Considering his activities, two main purposes illuminated, namely his strive to repair international scientific relations, and his strive to quickly diminish the knowledge gap between the Netherlands and the Anglo-American countries. Gorter's emphasis on the latter already came to the fore in Chapter 3: immediately after the war, he joined a group of Dutch professors to ponder upon strategies to regain lost ground as rapidly as possible, and

[245] Baneke, 'Sterrenkunde na Oort' (2014), p. 31.

[246] My translation; original text: 'Gorter was een man die niets voelde voor het oude systeem van de hoogleraar. Die wilde een groep hebben, omdat hij het prettig vond om samen te werken, en mensen onafhankelijk te maken. Bij de Stichting FOM paste hij dat al toe,' vertelt A.N. Gerritsen. Hij behoorde daarmee tot de weinige hoogleraren waarmee de Leidse stafleden samen konden optreden in hun streven naar democratisering van het universitaire bestuur.' Molenaar, *'Wij kunnen het niet langer aan de politici overlaten…'* (1994), p. 76; he refers to an oral interview he had with A.N. Gerritsen on 20 September 1991.

contributed to the foundation of FOM. The fact that he put a lot of effort into the recovery of the Kamerlingh Onnes Laboratory, explained, on the one hand, why his actual contributions to FOM remained low, but, on the other hand, also exemplified his endeavors to elevate the Dutch scientific level on a smaller scale. This chapter showed that a similar argument can be made regarding his small contributions to VWO; I will return to this shortly.

Revival of the international community was a prime concern as well. As shown in the first two chapters, Gorter was an outspoken internationalist, hence it was of importance to quickly renew his contacts abroad. Moreover, international cooperation would lead to a step forward in Dutch scientific enhancement, and was thus one of Gorter's strategies to recover lost ground. Accordingly, Gorter adopted a Lorentz-like attitude of being a mediator. Whereas Lorentz attempted to include German scientists in international collaborations after the First World War, Gorter endeavored to bridge the gap between the USA and the Soviet Union. Scientific cooperation between the rivalling nations would result in US declassification of nuclear knowledge, and to a higher scientific level, of which the Netherlands could benefit. However, the turbulent situation starting from the late 1940s, caused that Gorter's attempts stalled. But when the political situation had slightly calmed down, and a slow approach between the United States and the Soviet Union became apparent, Gorter optimistically continued his endeavors. With the outcomes at the Atom for Peace conference – where America and the Soviet Union presented similar results in the field of nuclear science – Gorter had clear evidence that international cooperation would, indeed, elevate the general scientific level.

Everything that hindered international cooperation, and thus scientific improvement, was abhorred by Gorter. American secrecy on nuclear scientific outcomes, for example, was a development that Gorter protested. Additionally, he strongly opposed the American intertwining of military research and pure science. Military purposes were so closely interwoven with fundamental science, that it reinforced the declassification of scientific outcomes. In the Netherlands, the separation between defensive and scientific research was also vague, yet this was not comparable to American standards. International cooperation was still possible, which can be illustrated with the Norwegian-Dutch collaboration, that was initiated in order to counter American secrecy and to gain experience in the know-how of nuclear science. Unsurprisingly, Gorter was highly interested in this cooperation, and participated as acting member of the Joint Commission.

His arguments to support publications of scientific results for the wider community illustrate another strategy to elevate the Dutch scientific level. With such publications, he hoped to draw public attention on the importance of science for recovery to gain more support for scientific developments. All his writings on how scientific outcomes affected society, or on the position of science in society indicated similar purposes. Furthermore, his democratic pleas for scholarships for

all talented young students, regardless their background, pointed to his endeavors to increase the Dutch scientific manpower, and thus the Dutch scientific level.

In his strategies to enhance the Dutch scientific level, Gorter seemed to be biased towards the American methods: he used American means in his proposal to increase scientific publicity in the press, and he maintained his contacts with American scientists rather than his Russian colleagues during the politically turbulent period. Furthermore, his democratic attitude became visible, which was also seen in Chapter 3. Regarding the fact that the Netherlands saw America as its superpower, rather than the Soviet Union, his imbalanced orientation is not very remarkable. The Dutch government had chosen to support the Western side, and the Netherlands perceived '[a] technological gap, not with the Eastern Bloc, but with other Western countries, especially America and Britain.'[247] The fact that VWO-Leiden was entirely biased towards American models should not be a surprise as well; in Chapter 3, the strong orientation towards the US system was already discussed.

As I stated above, Gorter's involvement after the establishment of VWO reduced to a minimum. However, I claim that despite his low activity, he still epitomized VWO, because the association operated from similar perspectives: advocating neutrality and internationalism to sustain control on nuclear energy and to prevent another war. Both purposes were of Gorter's interest as well: his pacifism came to the fore in his attempts to build a bridge between East and West. Furthermore, Gorter was highly interested, and partly involved in the Norwegian-Dutch cooperation, which, among other things, aimed at a declassification of US nuclear knowledge. Also the democratic proposals of VWO-Leiden and VWO-Utrecht, such as a study scholarship for every student, coincided with Gorter's ideas and working style. Given that VWO and Gorter shared similar interests, and acted accordingly, the conclusion can be drawn that Gorter epitomized VWO indeed.

At this point, we saw that Gorter put a lot of effort in recovering from the war, and elevating the Dutch scientific level. Chapter 3 mainly described proposals for reorganization of the Dutch science system, and this chapter mainly focused on other strategies, such as encouraging international collaborations. In the late 1950s, the Dutch scientific situation had made small steps forward, yet it appeared difficult to maintain this status quo. Hence, a new committee was introduced to report on the essential means to support science properly. The endeavors of the committee, of which Gorter was a member, will be the subject of the next chapter.

[247] Baneke, 'Absence of the East' (2015), p. 171.

Chapter 5

The aftermath: Casimir Committee

From Chapter 3, it became clear that the number of scientific workers at the Kamerlingh Onnes Laboratory was more than doubled between the 1930s and 1958, but the amount of working space had remained the same. This was mentioned by Gorter during a speech on the occasion of the opening of a new wing of the laboratory. With this new wing, the amount of space per person would be raised with one square meter, but he suspected this would be lowered again within one year.[248] Although the number of researchers doubled, concerns about the low number of scientific workers reigned among Dutch scholars. Due to social-economic developments, the student admission rates grew in 1950s: more middle class youth attended universities. Furthermore, the exceptional large number of children who were born in the early post-war years were expected to attend universities, which would double the number of students by 1970.[249] To cope with this expansion, considerable changes were necessary, and hence the educational minister Jo Cals (1914-1971) was working on a fundamental improvement of the entire educational system.[250]

Although minister Cals acknowledged that large investments in fundamental science were necessary, a shortage on the Dutch balance of payments resulted in a restricted budget. Consequently, a hiring freeze at the universities was implemented. Astronomer Jan Hendrik Oort (1900-1992) was highly astonished and complained that there was no decent science policy. From his perspective, a radical change was necessary in order to maintain the level of Dutch research. In a letter to Prime Minister Willem Drees, Oort mentioned the threat of America and argued that the Netherlands would lose their small steps forward in science and hence would lose their good reputation in the scientific world. In response to his letter, a committee was established to explore what essential measures needed to be taken in order to support science properly: the 'Committee Development of Natural Scientific Research', known as the *Casimir Committee*.[251]

This chapter focusses on the endeavors of the committee of which Gorter was a member. In earlier chapters, it was shown that Gorter advocated the American educational system. How did this come to the fore in this committee? Furthermore, Bloembergen, among others, was asked to give advice on improvements of the Dutch science system. What were his recommendations?

[248] MB, Gorter archive, inv. 479, folder 13, 'Dames en heren…'.
[249] D. Baneke, 'De Vette Jaren: De Casimir-Commissie en het Nederlandse wetenschapsbeleid, 1957-1970,' *Studium, Tijdschrift voor Wetenschaps- en universiteitsgeschiedenis*, vol. 5, no. 2 (2012) , p. 113.
[250] Baneke, 'Absence of the East' (2015), p. 171.
[251] Baneke, 'De Vette Jaren' (2012), p. 119.

5.1 The Casimir Committee

On 9 December 1957, six prominent professors and industrial managers were installed in the Casimir Committee. Gorter was one of the professors and covered the physics discipline together with H.B.G. Casimir – head of the Physics Laboratory in Eindhoven, and also appointed as chairman of this committee. The committee further consisted of: professor of astronomy in Leiden J.H. Oort, professor in physiology of plants at Groningen University W.H. Arisz (1888-1975), professor in chemistry at Utrecht University J.Th.G. Overbeek (1911-2007), and head of the research department at Shell Laboratory H.W. Slotboom (1904-1996).

The committee was asked to report about the status of natural scientific research at universities, and to propose new procedures to transform or improve its position in the short term. To make a thorough examination of the Dutch situation, the committee asked the help of several science departments, such as geology, the 'Institute for Nuclear Physics Research' (*Instituut voor Kernfysisch Onderzoek*, or 'IKO'), and biochemistry. Through an inquiry, Dutch science professors were asked to give their opinion on the situation at their laboratory.[252] The committee also sought advice from Dutch scientists working or studying abroad, mainly from the USA. Among others, Nico Bloembergen (USA), George Uhlenbeck (USA), Samuel Goudsmit (USA), Gerard Kuiper (USA), Dutch biologist Niko Tinbergen (GB, 1907-1988), and Dutch chemist Izaak Kolthoff (USA, 1894-1993) were requested to give their view on the Dutch science system. According to Oort, the committee asked Dutch scholars who worked abroad who knew the Dutch system sufficiently to give their opinion. Yet, interestingly, many correspondents started their letter with the comment that they were not updated on the current system. Kuiper for example wrote:

> 'I am not sufficiently acquainted with the present level and programs of the universities in Holland to give well-informed comments on this subject.'[253]

Others acknowledged as well that they were biased to the American system (Kolthoff), or interpreted the Dutch science system from an American perspective (Uhlenbeck).[254] Given the fact that the members of the Casimir Committee solely approached Dutch scientists with experience in either America or England, it seems that they favored the Anglo-American system and desired a similar organization of science in the Netherlands. This preference is also reflected in the final report, in which many points of the scientists abroad are included, as will be shown below.

[252] UB-Leiden, Oort archive, inv. 238, P. Winkel (the secretary) to Casimir, 12 March 1958 (copy). This was the draft of the letter to be send to all professors. See also: Baneke, 'De Vette Jaren' (2012), pp. 110-27.
[253] UB-Leiden, Oort archive, inv. 238, Kuiper to Oort, 3 July 1958.
[254] UB-Leiden, Oort archive, inv. 238, Kolthoff to Casimir, 27 May 1958 (copy); Winkel to the Casimir Committee, 31 May 1958; Winkel forwarded Uhlenbeck's recommendations.

5.2. Content of the report

From the content of the report, it appears that both sources – the survey among Dutch professors and the advice from abroad – were equally taken into account. From the inquiry among Dutch departments, it appears that the chief concern among Dutch scientists was the lack of working space. As stated above, Gorter was troubled by this issue as well. As a consequence, the committee claimed in the report that laboratories needed to be expanded considerably, namely ten times faster than in the previous five years.[255] Furthermore, many scientists complained about the large amount of administrative work. The small number of professorial chairs, on the other hand, was not a matter of concern for the professors at the Dutch institutes.

The Dutch emigrants, however, claimed that this number should increase considerably, for it would resolve other issues as well. Bloembergen, for example, was a strong advocate of an increase in chairs, and devoted his whole letter to the solutions that this could bring.[256] Chapter 3 showed that Bloembergen indirectly advised to raise the number of scientific workers. In his letter to Casimir, he directly commented on the limited increase of the number of professorial chairs, especially compared to 'the exponential growth of scientific research around the world.' Interestingly, he illustrated his statement with the situation in Leiden: 'Under these circumstances, it is especially regrettable that the chair that became vacant after the retirement of De Haas has been occupied on a part-time basis.'[257] As Bloembergen finished his doctoral dissertation three months before De Haas retired, this seems odd indeed. Especially since Bloembergen returned to Harvard University, because Gorter 'could not offer him better prospects.'[258] Why was Bloembergen not offered the position of De Haas? In the third chapter, this was ascribed to Gorter's conservative attitude. By looking more closely to the situation, it appears that Gorter, indeed, evinced such an attitude.

In an archival record on the situation in Leiden in March 1957, Gorter mentioned his endeavors in 1948 to fill De Haas's chair, stating that 'two men' were asked – without any specification who they were. Both declined, however, and hence it was proposed to appoint A. van Itterbeek (1904-1968) as part-time professor.[259] Van Itterbeek was a Belgium physicist, who had close relations with the Kamerlingh Onnes Laboratory since he had conducted research under supervision of Keesom from 1928 to 1932. After he was awarded a doctorate by Gent University, he obtained a professorship at the University of Leuven, where he initiated the physics laboratory of low temperatures and technical physics. As he was still the scientific director and reluctant to give that

[255] *Voorzieningen ten behoeve van de research binnen de faculteiten der wis- en natuurkunde der Nederlandse universiteiten*, (Den Haag, Staatsdrukkerij- en Uitgeversbedrijf, 1958), p. 4.
[256] UB-Leiden, Oort archive, inv. 238, Bloembergen to Casimir, 27 May 1958 (copy).
[257] Ibid.
[258] Bloembergen, *Encounters in Magnetic Resonances* (1996), p. 13. See also section 3.4.5.
[259] MB, Gorter archive, inv. 479, folder 13, '1 Maart 1957'.

up, he solely agreed to accept a position as part-time professor in Leiden.[260] Given his background in low temperature physics, and the fact that the Kamerlingh Onnes Laboratory was known for its cryogenic research, it seems to have been a requirement to be a specialist in that field in order to fill De Haas's chair. Bloembergen was more specialized in the field of nuclear magnetic resonance (NMR); hence he may have not been suitable to occupy the professorial chair. This indicates that Gorter did not want to change the laboratory and its policies as Kamerlingh Onnes had initiated it; he held on to its old principles. Furthermore, Gorter held on to the idea that the institute had the same 'temple position' that the Kamerlingh Onnes Laboratory adopted due to the early successes in low temperature, while in fact, it presumably had lost that position.[261] After the war, more institutes devoted a considerable section to cryogenic research, such as the Cavendish Laboratory in Oxford, and obtained prestige. Furthermore, due to the old principle that researchers were only appointed when they were familiar with low temperature research, the Leiden's physics research group consisted almost entirely of Leiden's students and academics. Especially after the war, when it was difficult to attract foreign scientists due to the poor state of Dutch physics. As everybody had a similar educational background, and thus was taught similar ideas, the institute did not receive many new approaches on scientific research and how it was conducted – which was vital for further progress.

Gorter's conservatism is acknowledged by two emeritus professors who worked in the laboratory in the 1960s. In 1967, Joan van der Waals (1920) was appointed as professor at Leiden University on condition that he had not studied at Leiden University or obtained his doctorate degree there like the other 34 scientific workers in experimental physics.[262] This shows, indeed, that the Leiden research group had become an isolated group of Leiden's physicists. According to R. de Bruijn-Ouboter (1933), a Leiden's physicist from the start, the physics community of Gorter's time originated from the time of Kamerlingh Onnes. He recalled that Gorter was pushed by the university board to implement new developments; yet, Gorter struggled to do so.[263]

Ironically, these new developments involved American ideas, which Gorter appeared to advocate. He confirmed that being the sole director of the Kamerlingh Onnes Laboratory was a difficult task.[264] When Keesom and De Haas were the scientific directors, the laboratory was much smaller, and even then the workload was heavy. When in the 1950s, the laboratory expanded, the

[260] See: MB, Gorter archive, inv. 494, 'Van Itterbeek's verlies'; C.J. Gorter, 'Levensbericht A.F. van Itterbeek', in: KNAW Jaarboek, 1968-1969, (Amsterdam), pp. 240-2.
[261] Dirk van Delft used the term 'temple position' in an oral conversation on 5 January 2016.
[262] Oral interview with Joan H. van der Waals, Amsterdam 20 January 2016.
[263] Oral interview with R. de Bruijn-Ouboter, Leiden 29 March 2016.
[264] MB, Gorter archive, inv. 479, folder 13, '1 Maart 1957'.

workload was even heavier for one fulltime and one part-time professor. In 1957, Gorter compared the situation with other laboratories abroad and in the Netherlands:

> 'Difficult issue. [In] England [the situation is comparable to that of] K.O.L. America has many professors; everyone with his own specialty and 3-5 staff members. [One professor is the] Head (or chairman) [of the] department. Delft and here biology and geology [partly adopted this organizational structure with more professors at one institute]. Utrecht [as well]: [its] laboratory [is directed by a maximum of] four professors and [a] secretary scientific senior official.'[265]

In order to solve his problem of the heavy workload, Gorter proposed to implement a business model, comparable to America, with a pyramid structure to obtain a labor division. In this manner, more professors could work in the laboratory, while he was still the sole director, and he did not have to worry about a devaluation of his professorship, as mentioned in chapter 2. This proposal was not included in the report of the Casimir Committee, but the example of the growing number of professors at Delft, and a recommendation of appointing a Head of the Department to structure this increase, were.[266] Given the above citation, it can be presumed that these suggestions, that copy the American situation, came from Gorter. Hence, this illuminates Gorter's distinct preference to Americanization of the Dutch science system, despite conservative attitude.

The Casimir report also stressed the prevailing fear of devaluation of their status among other Dutch professors, and argued that, due to that reason, Dutch professors did not evaluate the low number of professorial chairs as problematic. With the proposed tripling, the committee made a plea to 'break the system where one professor is the leader of a whole institute'. This was strongly supported by the correspondents abroad. Bloembergen claimed that with more professors 'the danger of inbreeding of 'one-man empires' and 'dukedoms' [would] be eliminated', and according to Goudsmit, one needed to 'detract from the prestige and glamour now attached to a professional "chair".' Instead, he urged to promote teamwork among scientists and scientists and engineers. Furthermore, Bloembergen argued that the enthusiasm among students would rise, which would raise the chance that students would remain at the universities to further develop instead of transferring to the industry or foreign universities. With one professor at the top, there was little to look forward to for students.

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[265] My translation; original text: 'Ingewikkeld probleem. Engeland als in K.O.L. Amerika vele hoogleraar; ieder met eigen specialiteit en 3-5 medewerkers. Head (of chairman) departement. Delft en hier biologie en geologie een beetje. Utrecht: laboratorium – met 4 hoogleraren en secretaris wet. hoofdambtenaar voor de directie.' MB, Gorter archive, inv. 479, folder 13, '1 Maart 1957'.

[266] *Voorzieningen* (1958), p. 7.

> 'There is a considerable risk waiting for that one vacancy with several others, and at best, the professorial chair is obtained at an age when productiveness for research is ebbing away. (…) No wonder that many of the better younger workers go into industry or abroad before they reach the age of thirty-five.'[267]

According to Bloembergen, the most productive age to conduct scientific research was between twenty-five and forty-five years. This viewpoint was adopted by the Casimir Committee, as they also claimed that professorships should be occupied by younger scientists in order to avoid a loss to industry. In order to do so, the duration of the study needed to be reduced, and an exemption for military service was proposed.[268] Furthermore, the committee agreed that the prospects of an academic career were not attractive. Following Bloembergen, they claimed that a rise in professorial chairs would already provide better perspectives. Additionally, they urged for a different payment system. Whereas salaries of industrial positions were raised constantly, the maximum payment at universities was soon reached. As a consequence, it was more attractive to work in industry.[269]

The salary system was also problematic for attracting foreign scientists. Contrary to foreign university salaries, the salaries in the Netherlands were fixed. As a result, it was difficult to compete in the international market, as Uhlenbeck pointed out. He was certain: 'the fixed salary is to idealistic, and just wrong.'[270] In response, the committee asked Kuiper specifically how the salary system at the University of Chicago worked and whether he would recommend this for the Dutch system.[271] This illustrates again the strong orientation to the Anglo-American system.

Although this chapter mainly focused on Bloembergen's response, it is important to notice that other correspondents' advice was often literally cited as well. Most of the researchers abroad commented on the low number of professorial chairs and cautioned against a shattering of universities. As stated above, Uhlenbeck additionally commented on the Dutch salary system. Although his opinion on the Dutch salary system was left out, his observation of the necessity to improve it, was literally quoted in the report:

> 'One of the correspondents abroad noticed: "One of the worst qualities of Dutch universities is the fixed salary, that causes that it cannot join the international market, compared to Switzerland, for example."'[272]

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[267] UB-Leiden, Oort archive, inv. 238, Bloembergen to Casimir, 27 May 1958 (copy).
[268] *Voorzieningen* (1958), p. 8.
[269] Ibid.
[270] UB-Leiden, Oort archive, inv. 238, Winkel to the Casimir Committee, 31 May 1958.
[271] Ibid: Draft of the letter to Kuiper, 3 July 1958.
[272] My translation; original text: 'Een onzer buitenlandse correspondenten merkt op: "Eén der slechtste kanten van de Nederlandse universiteiten is het vaste salaris, zodat men niet op de internationale "markt" mee kan bieden in tegenstelling met Zwitserland b.v.".' *Voorzieningen* (1958), p. 11. See also, UB-Leiden, Oort archive, inv. 238, Winkel to the Casimir Committee, 31 May 1958.

Furthermore, Niko Tinbergen commented on Dutch education as well, arguing that it was too much focused on learning facts rather than the 'spirit of enquiry', which was also literally included in the report:

> 'Many foreigners and Dutchmen abroad correctly criticized our system: too many lectures, an insufficient number of tutorials and seminars, less contact with lectors, too many facts, less methodology and no fostering of a 'spirit of enquiry'.'[273]

5.3 Conclusion

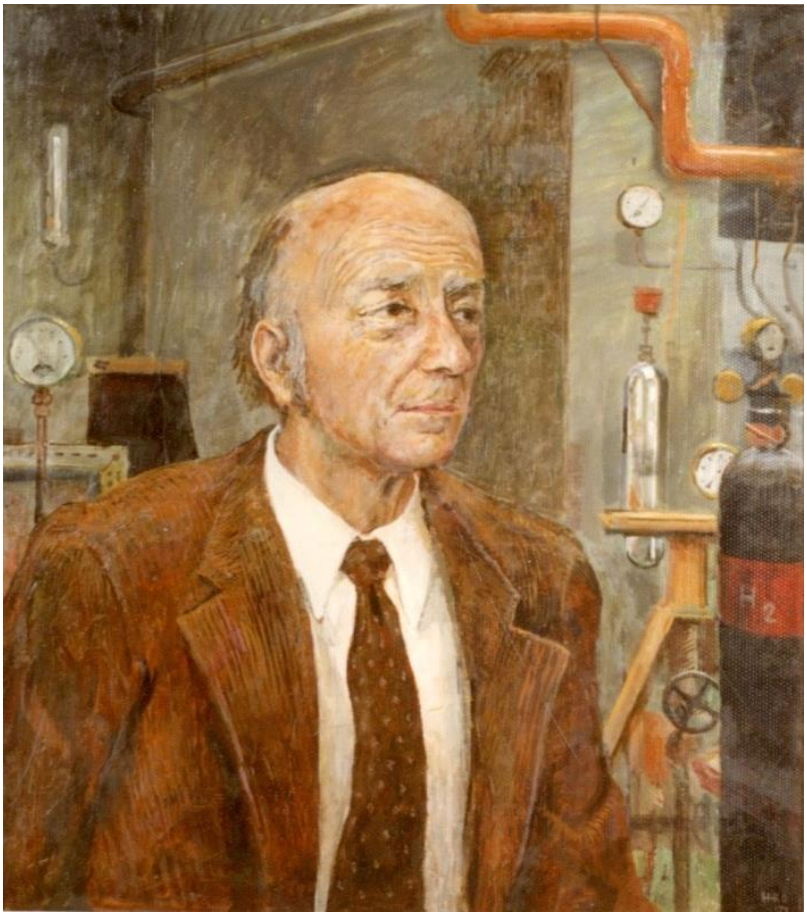
From Baneke's survey, it appeared that Casimir Committee and its recommendation report were not as influential as some historians claimed. Indeed, faculties were expended and the number of professorial chairs was increased, yet not as much as the committee had recommended. By 1970, the number of professors had doubled, but it had decreased in relation to the number of students. According to Baneke, 'the committee's recommendations were presumably surpassed by the general developments.'[274] Although the Casimir Committee's approach towards the 'one man empires' at an institute was new, it still held the view that solely professors could conduct scientific research independently. However, this view changed considerably in the 1960s, when the number of non-professorial staff was increased dramatically, and 'teamwork and egalitarian structure' replaced the central role of professors.[275]

Despite the fact that the recommendations were not directly implemented, this chapter showed that prominent, internationally oriented Dutch scientists were advocates of the American system and favored to transform according to this model. This is clearly illustrated by the literal quotes used in the report that originated from letters of (former) Dutch scientists working abroad, such as Bloembergen's view on how the loss of scientific manpower to industry, Uhlenbeck's comments on the Dutch salary system and Tinbergen's 'spirit of enquiry'.

Gorter's orientation to the American system also emerged from this chapter. In 1957, he made notes on his situation as sole scientific director of the Kamerlingh Onnes Laboratory, which was a too heavy task for him. In his attempts to lighten the workload, he obviously looked to the American system; these were implemented in the Casimir report as well. Ironically however, Gorter hung on the old system of the Kamerlingh Onnes. The laboratory's focus on low temperature research needed

[273] My translation; original text: 'Vele buitenlanders en Nederlanders in het buitenland bekritiseren terecht ons system: te veel "luistercolleges", te weinig werkcolleges en seminaria, te weinig contact met docenten, te veel aan feitenkennis, te weinig aan algemene methodiek, te weinig aankweken van een "spirit of enquiry".' *Voorzieningen* (1958), p. 8. See also: UB-Leiden, Oort archive, inv. 238, Tinbergen to Casimir Committee, June 1958.
[274] Baneke, 'De Vette Jaren' (2012), p. 125.
[275] Ibid.: pp. 125-6.

to be maintained, in order to preserve its prestige in this research field. However, as the laboratory was not influenced by different schools of thought, the conservative attitude may have stagnated the level of scientific work, and the adoption of American structures.



Figuur 6, Portrait of C.J. Gorter by H.H. Kamerlingh Onnes. (Gorter, *Departure 19 October 1973* (1973))

Chapter 6

Conclusion

The aim of this thesis was to explore the extent of Americanization of the Dutch science after the Second World War. I defined Americanization as the process of a country or region – in this case the Netherlands – developing in such a way that it follows American standards. This thesis focused on several aspects of this process – such as the adoption of reorganizational structures in science and education, or the embracement of American norms and values – by examining the career of experimental physicist Cornelis Gorter and the institute he worked for: Leiden University.

First, it was excluded that Americanization occurred in the prewar era. During this period, Dutch orientation to the American science and educational system started. Its structures of how its science and education were organized became subject of debate in the Netherlands, but consensus never ensued, nor did transformations in the Dutch science and education appear. The war had stopped the discussions entirely. Furthermore, the bad conditions owing to the German occupation had caused a considerably languishment of Dutch scientific research. Contrary, during this period US science flourished. This contrast was clearly illustrated with the early correspondence between Gorter and Bloembergen. While Bloembergen wrote about the great advances of the war, such as the great number of scientific workers and the usefulness of new scientific outcomes, such as radar research, Gorter listed the deficiencies in the Netherlands: the lack of resources, and the lack of scientific manpower. This enormous contrast left Dutch scientists with two primary concerns after the war: their scientific level needed to be enhanced, and they had to deal with the altered role of science in society, as a consequence of the atomic bombs in August 1945. In this conclusion, I will recapitulate the primary developments that occurred as a result of these concerns, and explore to what extent Americanization was noticeable in these developments.

6.1. General developments

New scientific organizations were established in the Netherlands as first attempts to resolve the two major issues. The 'Foundation for Fundamental Research of Matter' (FOM) and the 'Dutch Foundation for Pure Scientific Research' (ZWO) were founded in order to diminish the knowledge gap. Both organizations received large governmental sums to support fundamental scientific research. The arguments for supporting pure science were motivated by using the American report *Science the endless frontier* by Vannevar Bush. Furthermore, the third chapter showed that their policies both aligned American structures: FOM allocated large sums of money on physical research,

especially nuclear science, and ZWO formulated its policy according to the Rockefeller Foundation. Next, the 'Association of Scientific Researchers' (VWO) was established to give scientists a voice in political discussions on their scientific outcomes and to be able to influence what happened with their findings. Its organizational structure did not particularly align with US ideals. Its purpose was to evince a neutral character to attract all scientists, yet this was difficult to maintain due to the political turbulence which resulted from the Cold War. In its initial form, VWO expressed influences of the British counterpart *Association of Scientific Workers*, and the communistic ideas of J.D. Bernal. Molenaar argued that despite the foreign influences, VWO maintained a Dutch character: '[the Dutch association] was a fusion of different desires [such as the focus on the outcomes of nuclear energy research and being a labor union for scientists], which in countries like France, England or America often were separated.'[276]

Gorter contributed to the foundation of FOM and of VWO, sharing the strive to elevate the Dutch scientific level as rapidly as possible, and to revive scientific internationalism. He was a member of 'Committee on Nuclear Physics' (*Commissie voor Atoomphysica*) that was installed to ponder upon measures to gain nuclear knowledge; this led to the foundation of FOM. Furthermore, he was the founder of VWO. He wrote to the president of the British association P. Blackett to gain inspirations for a Dutch counterpart to combat, among other things, the American secrecy regarding atomic energy. Despite his efforts in both establishments, a trend of low activity was clearly visible in Gorter's further contributions in the early years of their existences. This can be explained by the fact that Gorter was occupied with the rejuvenation of the Kamerlingh Onnes Laboratory in Leiden, of which he was the new scientific director. Furthermore, he was engaged with making other attempts to repair the scientific international community, such as organizing the Zeeman conference in Amsterdam – one of the first international scientific congresses after the war.

Next to the establishment of new national scientific organizations, Dutch scientists aimed at international scientific collaborations in order to diminish the knowledge gap. A partnership with America was most desirable, yet also quite inconceivable due to the American monopoly in the nuclear science field. According to Van Dongen and Hoeneveld, new foundations, such as FOM and the 'National Defense Organization' (RVO) aligned American ideals in order to facilitate a partnership. Furthermore, the cooperation with Norway also had this underlying objective. Regarding the examination in Chapter 4, the Norwegian-Dutch alliance was successful, and according to Van Splunter it contributed to the declassification of American nuclear knowledge.[277] As more countries gained knowledge in this field, and given that the Soviet Union was involved in its own nuclear research problem, control on nuclear science had become a greater concern for America. As a

[276] Molenaar, *'Wij kunnen het niet langer aan de politici overlaten'* (1994), p. 74.
[277] Van Splunter, *Kernsplijting en diplomatie* (1993), p. 158.

consequence, the American president Eisenhower delivered his famous 'Atom for Peace'-speech, which was followed by the first large international conference on nuclear science in Geneva. The fact that similar results were expressed, indeed, show that America did not hold the monopoly in this field anymore; other countries gained similar understandings.

Gorter did not appear to strive for an American partnership in particular. His greatest concern was the revival of the scientific internationalism and the elevation of the Dutch scientific level. He can be regarded as a 'second' Lorentz in his attempts to build a bridge between Soviet Union and United States. American secrecy was one the things that disturbed scientific internationalism, and was therefore deplored by Gorter. Furthermore, he abhorred the fact that the US military and its pure scientific research were very closely interwoven. As this intertwinement stimulated the US secrecy, it also stagnated the possibility of scientific internationalism. Gorter clearly expressed that Europe should not adopt these attitudes.

6.2. Gorter's suggestions

Although Gorter condemned America for its approaches regarding military and science, he admired the way America had structured its scientific and educational system. Immediately after the Second World War, he followed American examples when he advocated for a Dutch students' community which would go further than only teach a subject, and also aimed to form the characters of its students. In Leiden, a strong feeling of solidarity reigned as a consequence of the war. Hence, similar ideas took root, which resulted in the establishment of 'Foundation Pro Civitate'. This foundation put efforts to avoid nihilism in the Leiden student community by consolidating all the students' unions into one, and making it obligatory for students to be domiciled in Leiden. After his first years as scientific director of the Kamerlingh Onnes Laboratory, Gorter became president of social's council of Leiden's Civitas.

Together with his pleas for a students' community, Gorter advocated an increase in the number of scientific manpower, especially in professors. However, later developments showed that, even though opportunities to increase the number of professors arose in Leiden, this did not happen due to various reasons. Firstly, Gorter appeared to hold on strongly to the old principles of the Kamerlingh Onnes Laboratory, such as the policy that vacant position could solely be filled by a scientist who had experience in conducting cryogenic research. As a consequence, Bloembergen was not offered to fill the vacancy of De Haas' chair in 1948. Instead, Van Itterbeek was appointed, even though he was only available on a part-time basis. Approximately a decade later, a committee was installed to examine the Dutch scientific situation: the Casimir Committee. It asked the advice of Dutch professors and Dutch scientists who gained experiences in working abroad, in America in particular. Bloembergen was one of the correspondents in America, and in his letter, he composed

his recommendations to improve the Dutch science system. By then, there was still no rise in the number of professors noticeable, which he strongly spoke out against. The other correspondents abroad made similar claims. Interestingly, the Dutch professors did not evaluated the low number of professors as problematic, illustrating the fear of devaluation of the professors' status that prevailed among them. In Gorter's case, this fear also illuminated: although he proposed to increase the number of professors to reduce the heavy workload, he suggested to implement a pyramidal organizational structure. Through this measure, he could maintain his sole position at the apex.

Regarding the problems of the role of science in society, Gorter looked to America as well. In many archival records, he highlighted the influence of science after the war, especially since nuclear energy appeared to become a main energy source for households and industry. To improve public understanding of the importance of science and its outcomes, he emphasized the need for more scientific publications in the press. Contrary to other nations, among them America, the Netherlands barely drew attention to such publications. In his suggestions to increase and improve this situation, he followed American examples.

Also Leiden University and its VWO department primarily focused on America. Shortly after the war, a cooperation between Leiden University and Harvard University was established: the Leiden Harvard Foundation. Through the exchange of professors, American norms and values could easily reach the Netherlands. One clear example, that came to the fore throughout this thesis, is the democratic character that reached the Netherlands. This was for example reflected in VWO-Leiden's proposals to reorganize the university board. Furthermore, Gorter evinced a democratic attitude as well; in fact, he endorsed it. He enjoyed the social democracy among professors and students. Yet, this democratic attitude was expressed within the bounds of his directorship: he was still the head, and wished to be treated so.

The above listing illustrates that many suggestions were made to improve the Dutch scientific situation. However, many of these proposals were not realized. The next section will provide an answer why many implementations remained absent.

6.3. Absence of implementations

As shown above, many suggestions for reorganizations of old institutes followed the example of the American model, but actual implementations often remained absent. This was sometimes due to practical reasons, such as the fact that it was difficult to avoid nihilism among natural science students. According to Baneke, the fact that new ideas were not taken into consideration, fitted the passive working style of the Dutch government:

> 'Ad hoc [measures] suited the passive attitude towards science that the Dutch government had evinced since the war. The government provided the means, yet initiative was left to the scientific field itself.'[278]

The first postwar government consisted primarily of scientifically educated ministers, and gave high priority to recovering the Dutch scientific level. Yet, the fact that the second postwar government ignored the Reinink-I report of August 1946, until January 1947 illustrates that the governmental focus had shifted.

When looking at the scientific field, we saw firstly, that universities were stuck to old traditions, especially Leiden that had continued Kamerlingh Onnes' style for over twenty years. Secondly, conservatism among Dutch professors stagnated the process of appointing more professors, as shown with Gorter and Bloembergen. Considering these developments, it is not strange that it was difficult to implement radically new ideas; they were blocked by the prevailing principles. Furthermore, the influence of the conservative attitudes can illustrated with the fact that new organizations, such as FOM, ZWO, and RVO were more likely to adopt American structures, as these foundations did not have old habits to hold on to. Moreover, when ideals were in accordance with the existing principles, it was highly more likely that these were adopted. This can be illustrated with several developments.

Firstly, after the war, an extraordinary focus on pure scientific research was advocated using Bush's report. This could readily be implemented, as most of the Dutch research centers already focused on pure scientific research. For example, the Kamerlingh Onnes Laboratory was specialized in its fundamental research in cryogenics, and the Physics Laboratory of the Free University in Amsterdam focused on research in radioactivity. In fact, the Physics Laboratory of Philips was the first and sole large applied science laboratory in the Netherlands. Even though the general thought reigned during the prewar period that more application oriented research was necessary for the application of scientific knowledge to practical manners, there was no increase in applied institutes. The 'Dutch Organization for Applied Scientific Research' (TNO) was initiated in the 1930s, but this institute started to flourish yet, after the war.[279]

Secondly, the Leiden-Harvard Foundation suited Leiden's ideals of scientific internationalism, and thus could be introduced. Interestingly, through this foundation, American norms and values could reach the Netherlands, such as the democratic character. This thesis showed that several suggestions followed democratic principles: the plea for more scientific manpower, a democratic structure of the university board, and the study payment. Furthermore, Gorter desired a democratic intercourse

[278] My translation; original text: 'Ad-hoc [ingrepen] paste in de passieve houding die de overheid al sinds de oorlog had aangenomen ten aanzien van wetenschap. De overheid stelde wel middelen beschikbaar, maar het initiatief werd aan het wetenschappelijke veld zelf overgelaten.' Baneke, 'De Vette Jaren' (2012), p. 124.
[279] Van Berkel et al., *A history of science in the Netherlands* (1999), pp. 205-6.

between professors and students. However, it also became clear that this was within the bounds of his professorship's attitude: he was and remained the head of the laboratory.

Lastly, the establishment of Pro Civitate also exemplified that American ideas could be introduced as long as it was in line with the central ideas already in place. It was set up to pursue the feeling of solidarity that arose during the German occupation. Given Gorter's recall of his study years and the nihilism among natural science students, it became apparent that this foundation strove to resolve problems that were apparent in the prewar period. Furthermore, the letter to 'Mister Chairman' illustrated that the organization made pleas for American structures in Leiden University. The its proposals were not always implemented, was due to practical reasons, as mentioned above.

6.4. Final conclusions

The answer of the main research question whether Dutch science was Americanized depends on which aspect of Americanization is taken into account. Throughout this thesis, four different aspects of this process were clearly illuminated: the adoption of reorganizational structures in science and education, the influence on research subjects, the adoption of its financing system, and the embracement of American norms and values.

Regarding the aspect of reorganizations, Americanization at old institutes was difficult to notice. Although proposals often followed American ideas, the actual transformations towards the American model did not occur, such as reorganization of the board. In meetings of VWO-Leiden, Leiden's professors had proposed new structures, but the actual reorganizations several years later were still ad hoc solutions or 'cosmetic measures'. This can be explained by the fact that institutes had to follow the existing regimes that were difficult to alter. As new institutes, such as FOM and ZWO, did not have to take old traditions into account, American structures were more noticeable here.

Concerning the subject of research, Dutch science was influenced by America to some degree. The new scientific organizations FOM and ZWO both advocated fundamental research. As this focus was motivated by using Bush' report, it is likely that Americanization is apparent in this case. However, it is noteworthy that this focus suited the Dutch research programs already. As stated above, many Dutch laboratories were already oriented to fundamental research, and this was simply continued in the postwar period.

These new foundations were installed, among other things, to allocate governmental financial resources to particular research fields. Given the fact that ZWO was organized regarding the Rockefeller Foundation, and the fact that an exceptionally large amount of money made available for natural science, the Dutch financial system also showed American influences, hence was Americanized. Again, this was to a limited degree, as Dutch universities were not able to receive patents and were not supported by the military, which was the case in America.

Although Scott-Smith showed that the Fulbright Program had an influence on Dutch norms and values towards science, this thesis showed that this development was noticeable already before this cooperation, namely via the Leiden-Harvard Foundation. The American democratic character, for example, was embraced by Gorter and other Dutch scientists. However, this happened to a limited degree. The old-fashioned view that professors had the highest prestige still prevailed among them; hence the democratic attitude was evinced within the boards of this view. Furthermore, a speech of Gorter showed that the Dutch attitude of scientists was still typical:

> 'Our national character tends more to – at least in the past centuries – reliability, prudence, versatility, and critical notes than to brilliant ideas, decisiveness or the romance and the fanaticism of forcing the pioneer.'[280]

According to a correspondent of the Casimir Committee this caused that new developments often remained absent, and needed to be altered.[281]

Generally, the influence of America on the Netherlands to adopt American ideals remained small. Before the great American influences came to the fore via the Marshall Plan and the Fulbright Program, Dutch counterparts were introduced: the Marshall Plan strongly advocated fundamental research, but in the Netherlands this was already supported with FOM; moreover the Leiden-Harvard Foundation was a precursor of the American Fulbright Program, through which American norms and values could enter the Dutch scientific community. Gorter's democratic attitude is a clear example of the result of this development.

Given that the American influence remained small, the conclusion can be drawn that the Netherlands deliberately formulated its policies towards American ideas. Like Van Dongen and Hoeneveld showed by exploring the establishment of FOM and RVO, the facilitation of American partnership also illuminates from Leiden University and some of its professors. Many proposals were in accordance with American structures and policies, and the Leiden-Harvard Foundation showed that Leiden's professors were keen on collaborating with their American colleagues. Given the good relations Leiden University had with America in the prewar era, Rupp correctly stated that 'Leiden was far ahead regarding the developments of the entire Dutch academic field.'[282] However, it is important to notice that American policies were solely implemented when it suited the existing rules and principles. This is clearly seen when looked at Gorter and his career.

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[280] My translation; original text: 'Onze volksaard neigt – althans in de laatste eeuwen – meer naar betrouwbaarheid, voorzichtigheid, veelzijdigheid en critische zin dan naar geniale invallen, besluitvaardigheid of de romantiek en het fanatiek doordrijven van de pionier.' MB, Gorter archive, inv. 479, folder 13, 'Toespraak van Prof. Dr. C.J. Gorter, ter gelegenheid van P'.
[281] UB-Leiden, Oort archive, inv. 238, Van Hove to the Casimir Committee, 25 May 1958.
[282] Rupp, *Van oude en nieuwe universiteiten* (1997), p. 40.

Gorter appeared to be situated in a sort of transitional period: a period in which new developments were proposed, yet implementations were difficult due to the old manners according to which institutes were ruled. Gorter's case showed that he often observed American structures that seemed to be useful in the Dutch system. However, the existing regimes and habits stopped him from making actual implementations of the American model. For example, the fact that experience in cryogenic research was necessary in order to be appointed at the Kamerlingh Onnes Laboratory, impeded the appointment of more professors. Additionally, the fact that Gorter was educated with the idea that professors had the highest status, prevented an increase in the number of professors as well. The democratic character could come to the fore, but within the boards there remained the sole directorship of Gorter. The fact that Groningen's professor A. Blaauw evinced a similar attitude, indicates that this was peculiar to this period. By the 1960s and 1970s, the attached importance to old-fashioned ideals faded away, hence actual American ideas could be implemented more readily regarding the reorganization aspect.

As other aspects already evinced the adoption of American ideals, I draw the final conclusion that the process of Americanization of Dutch science started during the early postwar years. This development was most clearly apparent in new organizations, in which new principles needed to be formulated, or when the American ideals suited the prevailing dogmas of an institute. The existing institutes with a fixed regime, such as Dutch universities, got into a transitional phase in which new ideas were proposed – often in accordance with American examples – but were not implemented yet, due to the fact that its professors held on to the prevailing, and occasionally old-fashioned principles.

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