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Sarton Chair of History of Science
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Introduction

R. Rubens

The new volume 28 of Sartoniana, reflecting the 29 th year of the Sarton Chair for the history of sciences, contains a broad spectrum of lectures in the history of sciences.

Roy MacLeod from Sydney the chairholder for 2014-15 gave a very well documented talk and paper about the development of the sciences during World War I. His viewpoint is the ineluctable differentiation of science with the disappearance during the war of a universalism so common in science. Furthermore he documents the important influence of the scientists on the development of weapons. The importance of the ministry of munitions in the United Kingdom is stressed.

The lecture by Monballyu details the legal procedures during the first world war in the Belgian army. The legal procedures were difficult and the absence of a parliament made it difficult for this young state without any history of war. However by simple deduction and a careful legal reasoning the problems were resolved.

In her paper Lourenço explains the three challenges for science museums: history, science and heritage. By quoting important examples she details the outline of the emerging questions and tries to solve them. She also lances an appeal to the historians of science to become more interested in the preservation of goods and apparatus. The latter being very useful for understanding the evolution of thinking in science.

The lecture of Segers explains the ideas of Lourenço. By a careful history of instruments he explains the history of physics. Based upon the tradition started with Plateau , he embraces a long period in the evolution of physics from Simon Stevin to the 20th century. By choosing vivid ex-

amples the meanders of thought in the explanation of natural phenomena are detailed.

The biography of Dupuytren by Wylock cites an important chapter in the history of surgery. The beginning of modern medicine in the Parisian hospitals has frequently been mentioned. However the radiation of the cardinal figures such as Dupuytren has been very formative in the career of numerous academics, the examples of Ghent and Louvain being quoted and explained.

The last paper by Staubman is much more philosophical. It goes back to the main ideas of Sarton . In a beautiful essay he details the rise and decline of functionalism in the social sciences. In this he not only uses sociology but embraces all kind of sciences and tries to reconciliate even rationalism and empirism..

We hope this new volume of Satoniana may keep the ideas of Sarton alive and explain why a modern university never can live without remembering the past of thinking and reflecting about the history of all sciences.

R.Rubens

Sarton Chair Lecture

Laudatio Roy MacLeod

Peter Van Nuffelen

It is a tribute to the wide scope of Roy MacLeod's intellectual personality that today his praise is being sung by a historian of Antiquity, whereas his particular field of specialisation is the history of science in the nineteenth and twentieth century. (To re-assure the audience: the other proximus, Christophe Verbruggen, is more at home in the intellectual history of the past two centuries.) Indeed, besides producing important scholarship in his particular field of study, Roy has, for example, been member of the executive committee of the Australian friends of the *bibliotheca alexandrina*, the re-creation of the famous library of ancient Alexandria in the contemporary town of Alexandria. The library was known in Antiquity as the *Mouseion*, the place where the Muses were to be worshipped through study, and, in fact, another of Roy's occupations has been to advise the creation of university musea, in which collections originally gathered for study are presented to a wider audience. His combination of erudition and outreach, as well as his wide view from Antiquity to the twentieth century, he is a worthy heir to the person after whom the chair is named which he is to receive today: indeed, George Sarton's monumental and unfinished history of science starts with Homer.

Roy has described himself once to me as a grand-child of Sarton: he studied History and Science at Harvard University, effectively being taught by students of Sarton. After Harvard he went to Cambridge, as a Fulbright scholar, where he obtained his PhD. Subsequently, he took up appointments at the Universities of Sussex and London, before serving 21 years, from 1982 to 2003 as Professor of Modern History at the University of Sydney. If anything, retirement has increased his activity, as the long list of fellowships held since 2003 indicates – and it is, indeed, during one of

these stays, *in casu* in Göttingen in 2012, that we met. It would, however, be sad to reduce a career to names and numbers, even if Roy's career is very rich in them: a truly global scholar, Roy has held appointments on all continents that have universities. But lists rarely succeed in conveying the spirit of an intellectual endeavour.

Reading through Roy's vast oeuvre – from his first paper in 1965 on Richard Owen, a contemporary critic of Darwin yet also (at least in his claims) a predecessor of evolution theory,[1] to more recent work on university collections of scientific objects[2] – he shows a distinct interest in the human side of science: the formation of scientific institutions, science's entanglement with other social actors, such as the army and politics, the subtleties of individual psychology and social esteem, and the often complex interaction between science and education. Such a focus on the human is something one is entitled to expect from a historian. More unusual, however, is the eminently humane character of his analysis. His writings demonstrate a rare sensitivity for the complexity of all of these factors in shaping science and its face in society and for the authenticity of the actor's motivations, even if this may lead them on the wrong track. Roy does not project straightforward and stark judgements on a complex reality, and his publications therefore often end with more questions than he started with, but questions that are more precisely calibrated and more profound. For example, Roy has pointed out that relations between science and religion in the nineteenth century cannot be described as a history of outright conflict, but are better understood as a steady-state controversy, in a context in which different positions jostled for cultural leadership.[3]

A major concern in Roy's thinking is the role played by science in society, and, in particular, within democratic society. In methodological terms, he has a keen attention for the importance of self-images and rhetoric, and the friction between such ideological self-images of science and its actual functioning in society lies, in my view, at the heart of Roy's research. For example, the Enlightenment rhetoric of the harmony between science and democracy is quickly put under pressure by the growing institutionalisation of science and the concomitant development of the elite scien-

1 'Evolutionism and Richard Owen 1830-1868: An Episode in Darwin's Century,' *Isis*, 56 (185), (Fall, 1965), 259-280.

2 'Museums and the Cultivation of Knowledge in the Pacific', *Pacific Science*, 55 (4), (2001), Editorial Introduction, 325-326.

3 The 'creed of science' in Victorian England, Variorum Reprints, 2000, Introduction: xi.

tist. This then results into the belief of the late nineteenth century that "if politics were run by scientists, all issues of moment would eventually be depoliticised; and once reduced to science, all political questions could be solved".[4] During the Cold War, in turn, science was seen as inherently reliant on the values of Western liberalism, as if there was no true science across the Iron Curtain.

Such an analysis of the obscured dialectic between science's claim to independence, founded on a claim to objectivity, and its profound submersion in society, has not lost anything of its edge today. Indeed, as so many other institutions (think of politics), science has lost much of its social standing and credibility (a situation for which we too bear responsibility). To quote Roy from a paper of 1997 which has lost none of its relevance: "To rebuild that trust (i.e. public trust in science) is a goal of science in the twenty-first century"[5]. Yet we should not imagine this to be a unidirectional effort by ivory tower scientists who have to go out and tell the truth to our fellow citizens: to quote Roy again, from a different paper: "Today, we still mourn the difficulty of joining, through our educational system, the instrumental creed of technical competence with a passion for humane understanding. Looking to the 1890s from the 1980s, freedom from a belief in the unlimited power of science compels us to question authority allegedly based on science and chastens us to work with, rather than apart from, our fellow men and women".[6]

It is unsurprising, then, that in recent years Roy has developed a particular interest in the role played by scientists in the first World War: it is a moment of intense interaction between science and society, and in a way we tend to think is wrong – although I am not sure the same constellation would not be possible again in our society. 'Scientists go to war' is the title of one of his next books and Roy will be a keynote speaker at a conference held here in Ghent about intellectuals and the Great War, a conference that is co-organised by Christophe Verbruggen.[7] It is also the topic of his lecture today.

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4 'Science and Democracy: Historical Reflections on Present Discontents', *Minerva*, 35 (4), (1997), 369-384, 375.

5 'Science and Democracy: Historical Reflections on Present Discontents', *Minerva*, 35 (4), (1997), 369-384, 384.

6 'The 'Bankruptcy of Science' Debate: The Creed of Science and its Critics, 1885-1900,' *Science, Technology and Human Values*, 7 (41), (Autumn, 1982), 2-15, reprinted as 'Il diabattito sulla 'bancarotta della scienze': Il credo della scienza e i suoi critici, 1885-1900,' *Intersezioni*, III (2), (August, 1983), 361-382, 15

7 Intellectuals and the Great War, 17-19 December 2014.

Roy's work is history at its best: it brings depth to contemporary debates, does not eschew the complexity of reality and conflicts, and restores human and intellectual dignity to the actors of the story. These qualities have been often recognised, and he has been the recipient of many honours, of which I only mention (to avoid lapsing into names and numbers again) a Humboldt Prize in 2002 and a honorary doctorate of the University of Bologna in 2005. Yet, as the genre of panegyric demands, I cannot but contend that the present honour of the Sarton chair marks the culmination point of a rich and fruitful career and singles out his immense contribution to the history of science. Dear Roy, we are extremely honoured that you will hold this year's Sarton Chair and we express our warmest congratulations.

The Great War and Modern Science: Lessons and Legacies[1]

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Introduction

A century ago the world saw the beginning of what is known as the 'Great War'. It is received wisdom that the war of 1914-18 acted as a catalyst of most, if not all, modern social and political life. With nearly 10 million military dead, and twice that number wounded, it saw three empires come to an end, and shook a fourth to its foundations. It reduced Britain to a debtor nation, and promoted the United States to the status of a global creditor. It redrew the map of Europe, Africa, the South Pacific and the Middle East, with consequences that live with us today. With more truth than reason, as Sellar and Yeatman famously put it, the Great War was 'the cause of nowadays'. [2]

This year, we look back upon the War in reverence, as many countries commemorate the centenary of 1914. However, these events have called upon us not only to recall the war's beginnings, but also to explain its conduct, its climax in the Armistice of November 1918, and its legacies in

[1] This essay is a shortened version of the Sarton Chair Lecture delivered in Ghent in December 2014. I wish to express my appreciation to Professor Robert Rubens and the Sarton Committee for their kind invitation, to renew my thanks to Mrs. Rita Malfliet for helping make my visit to Ghent so memorable and Peter Van Nuffelen, my proximus in Ghent. This work forms part of a larger project on the relations of science and war, supported by the Australian Research Council, the Humboldt Foundation, and the Smithsonian Institution, which is being prepared for publication.

[2] W.C. Sellar and R.J. Yeatman, *1066 And All That: A Memorable History of England* (London: Methuen, 1932),

the wake of Versailles. Many historians are recapturing the stories of those millions whose lives were disrupted and destroyed.

As historians know all too well, the War had many causes and many consequences. It was not just one war, nor can it be seen fully from a single perspective. In truth, as Trevor Wilson has put it, it had 'myriad faces.' For Samuel Hynes, it was the most terrible disaster in history, which has had to be imagined because it cannot be comprehended. For George Kennan, the diplomat, it was 'the great seminal catastrophe of the 20th century'. For John Morrow, it was an imperial struggle, best seen from a political standpoint; for Nicholas Saunders, its history embraces art and beauty through a lens of 'unimaginable technologies of destruction'. For Avner Offer, it was a struggle of alternative rationalities on an epic scale. For Jay Winter, it marked a climatic moment in modern memory. In Britain and Australia, it is still the subject of reflective debate and public memorial. In France, the war still enrages the political left and right, which either makes or rejects the existence of a 'war culture'. As Winter has put it, 'elegy displaces anger; [where] touches of the sacred are always at hand.'[3] The demands of 'total war' introduced a total history, one that would shift the historian's gaze from the demands of formal armies and navies, to the service and suffering of civilians who enabled nations to wage war. It was, in language with which we are all too familiar, a 'people's war', leaving images of suffering in memories and memorials across the world.

Within this wide arc of reflective scholarship, the historian of science finds himself without an assigned place. General historians are all too prone to miss the sciences entirely. John Keegan's popular First World War (1999) shows a very British disdain for technical histories, which he regards as a 'pointless waste' of historical effort. Niall Fergusson's *Pity of War* (1999) mentions chemistry only once; and the words 'science' and 'technology' are absent from his index. This neglect is as remarkable as it is regrettable. The Great War was not the first technological war, but it was the first in which all the industrial powers of the world were engaged. As such, it was a turning point in the making of modernism, welding men, women and machines into gigantic organizations driven by electricity, steam, and coal. It was the first war fought in the air; the first undersea war; the first war using the internal combustion engine; the first, of wireless telegraphy, the first dominated by artillery; the first chemical war, and the first war of modern

[3] Jay Winter, 'P. vs. C.', *Times Literary Supplement*, 16 June 2006.

mass production. It was the first war in which it cost as much as £6000 in artillery shells to kill a single man, and the first to produce millions of shells, costing hundreds of millions of pounds.

For historians of science, the War has a special meaning. It is the first modern war in which a small number of men (and women) of science, trained as professionals, serving in uniforms and laboratory coats, were organized and pitted against each other with devastating effect. Across Europe, the Americas, and the wider world, the natural sciences were, in the phrase of the American astronomer, George Ellery Hales, 'forced to the Front'. In many ways, they have remained at or near the front ever since. Although the service of scientists, as well as other scholars, has been well documented in what has become known as the *Krieg der Geiste*r, historians of science have been slow to recognize the war as a turning point in the way in which science was put to military use, and the ways in which society thereafter saw the uses of science. Nearly thirty years ago, Daniel Kevles observed, 'There is no general history of science in the war'.[4] This has remained the case, despite attempts to fill the gap. [5]

Now, however, in an age made familiar with Weapons of Mass Destruction, the experience of *quatorze-dix-huit* has come back to haunt us. We look back upon the carnage, mass produced by science-based weaponry, and the military application of technologies that may have been invented before the War, but which were given new meaning by the application of wartime research, development, management and production. As Stanley Jaki put it, introducing the work of Pierre Duhem, 'War was no longer so much a question of personal bravery as a matter of technological excellence which largely depended on the harnessing of science….'[6]

I. Science, War and Memory

Why – until quite recently - has the role of science in the Great War been so little studied? Perhaps there has been an unspoken barrier between those who have seen, and those who have not. Certainly, the Second World War has made far greater claims. In any case, the progress of science has not

4 Daniel J. Kevles, *The Physicists* (New York: Knopf, 1978), 446.
5 Guy Hartcup, *The War of Invention* (London: Brassey's, 1988).
6 Stanley Jaki, 'Introduction' to Pierre Duhem, *German Science* (1916; La Salle, Ill: Open Court, 1991), xiv.

been part of the war's general history, nor did it bring about a 'turning point'; it was not one of the 'Big Words'. Science indeed had a war, but for many of its practitioners, this was a time when they learned much, forgot much, and in the years to come, said nothing.

However, this silence masked a major transformation. Science in the Great War did not reflect the progressive impulse towards human betterment that the Nobel Prize, established in 1901, wished to commemorate, but was rather the impulse behind materials and machines having a 'dual use' – adopted, promoted, designed and improved to kill. It is deeply ironic that, given the ethos of internationalism in science, both university and industrial scientific laboratories on both sides played a critical role in prolonging the War – the famous Haber-Bosch process, for which Haber received the Nobel Prize in 1918, gave Germany enough nitrate to fight for at least two years longer than expected; while on both sides, improvements in medical services, together with a reduction in disease mortality, returned wounded soldiers to the Front in unprecedented numbers, and so may have even helped prolong the slaughter.

Across Europe, North America and the British Dominions, the needs of war recast the methods of science. Laboratories and museums were sacred no longer to the Muses, but to Mars, mobilised by Minerva. The transformation was sudden, widely understated, but remarkably complete. A new symmetry thus appeared. 'New Ways of War' is the title given by the UK National Archives to its 'Essential Guide to Sources on the war, published in 2002. [7] The New World of Science was the title given by the U.S. National Research Council to its report on wartime science in 1920.[8] The distinguished Oxford chemist, Brigadier Sir Harold Hartley, sent by London in 1919 to inspect the perfectly functioning factories of defeated Germany, observed that, 'In the future . . . every chemical factory must be regarded as a potential arsenal . . ..' [9] After the war, no one could turn back the clock, although the victors at Versailles tried to do so. In this war of 'materiel', the university and industrial scientist joined the engineer in both substance and

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7 Ian F.W. Beckett, *The First World War: The Essential Guide to Sources in the UK National Archives* (London: Public Record Office, 2002), 39-121.

8 Robert M. Yerkes (ed.), *The New World of Science: Its Development during the War* (New York: Century Company, 1920).

9 National Archives (Kew), MUN 4/7056, Report of the British Mission Appointed to Visit Enemy Chemical Factories in the Occupied Zone Engaged in the Production of Munitions of War (London: Ministry of Munitions of War, Department of Explosives Supply, February, 1919), 12. A shorter version, with this quotation, was published in 1921.

symbol. Lloyd George, Britain's first Minister of Munitions and wartime Prime Minister, was fond of calling it an 'engineer's war' – not only in the construction of warships and landships, railways and bridges, but also in the social engineering of education, manufacture, public health, and agriculture. Similar stories have been told of the acoustic war of the trenches, the air, and the oceans – including sound-ranging, sound-location, mining and submarine detection.[10] In each field, the 'knowledge makers' worked hand in hand. In the famous dictum of Fritz Haber, the scientist is 'to serve humanity in peace and the Fatherland in war'.[11]

Science – the harbinger of peace, the companion of internationalism, the spirit of progress – had apparently revealed its dark side. If the sciences were not new to war, nor to European ideas of warfare, their recent manifestations were to have a profound effect, not least on the disciplines of learning, and on the political and economic interests that looked to academics for ideas, advice, and legitimation. In future, wars would not be won entirely by science, but nations without science could not entirely win wars – or so went the claim that resonated throughout the rest of the twentieth century and beyond.

Taking all this into account, we can bestow upon the Great War a serious claim to being the first war conducted in the name of science. This outcome was by no means inevitable. In Europe, as late as the Solvay Congress of 1913, such a war seemed unthinkable. Even as the diplomatic situation worsened, British scientists tried to avert Britain's entry into a European conflict. As late as 1 August 1914, Sir J.J. Thomson, FRS, No-

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10 Roy MacLeod, 'The Geologists go to War: Geology on the Western Front, 1916-1919', in D.F. Branagan and G.H. McNally (eds), *Useful and Curious Geological Enquiries Beyond the World: Pacific-Asia Historical Themes*, 19th International INHIGEO Symposium (Sydney: International Commission on the History of Geological Sciences, 1994), 289-302; *'Kriegesgeologen* and Practical Men: Military Geology and Modern Memory 1914–1918', *British Journal of the History of Science*, 28 (4), (1995), 427-50; Roy MacLeod and E.K. Andrews, 'Scientific Advice on the War at Sea, 1915-1917: The Board of Invention and Research', *Journal of Contemporary History*, 6 (2), (1971), 3-40; Willem Hackmann, *Seek and Strike: Sonar: Anti-submarine Warfare and the Royal Navy, 1914-18* (London: HMSO, 1984); Helmut Trischler, 'Die Neue Räumlichkeit des Krieges: Wissesnschaft und Technik im Ersten Weltkrieg', *Berichte zur Wissenschaftsgeschichte*, 19 (1996), 95-103.

11 The classic source of this much mis-quoted statement can be traced to Haber's farewell speech to his Institute, preserved in the Archiv der Max-Planck-Gesellschaft, Dahlem, Va. Abt., Rep. 5 (Haber, Fritz), Nr. 1946: Abschiedsbrief an das Kaiser-Wilhelm-Institut für physikalische Chemie und Elektrochemie (1 October 1933), cited in Margit Szöllösi-Janze, *Fritz Haber, 1868-1934* (Munich: C. H. Beck, 1998),686-687. I owe this reference to Professor Jeffrey Johnson, to whom I express my thanks. A similar, but much earlier variation can be found in Fritz Haber, 'Die chemische Industrie und der Krieg', *Die chemische Industrie*, 43 (1920), 350-352, on 352, cited in Szöllösi-Janze, *op. cit.,* 261.

bel-Prize-winner and Director of the Cavendish Laboratory at Cambridge, was the first signatory of a letter to *The Times* that urged the British Government to avoid war with Germany. 'We regard Germany as a nation leading the way in the Arts and Sciences', he said; ... 'with a nation so near akin to our own, and with whom we have so much in common ... war [would be]... 'a sin against civilisation.' [12]

This was a cherished illusion. Throughout the first weeks of the war, the response of British scientists reflected disbelief, denial, and only then, outrage at the complicity of German scholars in the Kaiser's war aims. Dismay and disillusionment followed the publication in Berlin on 4 October of the infamous Manifesto, 'To the Civilised World', which was signed by ninety-three influential German professors and intellectuals, including twenty-two scientists and physicians, and several Nobel Prizewinners.[13] Although later repudiated by some of its signatories (including Max Planck), the Manifesto was widely taken as a declaration of war in Britain, across the Empire, and in the United States. This was a declaration of war. Sir William Ramsay**,** the Nobel Prize-winning chemist at UCL, educated in Germany, and long-standing admirer of German methods, led the first British counterattack. 'German ideals', he wrote to *Nature* on 8 October 1914, 'are infinitely far removed from the conception of the true man of science; and the methods by which they propose to secure what they regard as the good of humanity are, to all right-thinking men, repugnant…. Indeed, it is a common saying that science is international. But we are beginning to revise our verdict', he said.[14] The motto of the Allies must be 'Never Again.'

There quickly followed, in the words of the American physicist, Robert Millikan, an international division of men of science 'into hostile political camps.'[15] In late October, another letter to *The Times* signed by 120 British academics set aside their 'real and deep admiration for German scholarship and science':

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12 'Scholars Protest against War with Germany', *The Times*, 1 August 1914, 6.

13 See Jürgen von Ungern-Sternberg and Wolfgang von Unger-Sternberg, *Der Aufruf 'An die Kulturwelt'.Das Manifest der 93 und die Anfänge der Kriegspropaganda im Ersten Weltkrieg* (Stuttgart: Franz Steiner Verlag,1996). There is an English translation of the *Manifesto* in Ralph H. Lutz, *The Fall of the German Empire, 1914-1918* (Palo Alto: Stanford University Press, 1932), vol. 1, 74-78.

14 W. Ramsay , 'Germany's Aims and Ambitions', *Nature***,** 94 (8 October 1914), 137–139.

15 See Daniel J. Kevles, 'Into Hostile Political Camps': The Reorganisation of International Science in World War I', *Isis*, 62 (1971), 47-60.

> We have many ties with Germany, ties of comradeship, of respect, and of affection. [But] we grieve profoundly that, under the baleful influence of a military system and its lawless dreams of conquest, she whom we honored now stands revealed as the common enemy of Europe and of all peoples [who] respect the Law of Nations. [16]

To the editor of *Nature*, and to readers of *The Times*, war with Germany now meant war with German science. [17] Men of science were asked to abandon their commitment to the values of internationalism which, while sometimes honored more in the breach than in the observance, had been a *leitmotifs* of European culture for over a century. Across the Atlantic, Michael Pupin, a physicist at Columbia University agreed. 'Science is the highest expression of a civilization', he wrote George Ellery Hale at the California Institute of Technology in Pasadena. Allied science is, therefore, radically different from Teutonic science'. So indeed it seemed, when Philip Lenard, professor of physics at Heidelberg, to whom the Royal Society had given its Rumford Medal, rejected what he called the 'supreme academy for all hypocrisy in the world, located on the Thames…', and Wilhelm Ostwald, the Nobel-Prize-winning chemist of Leipzig, and prewar protagonist of *Kulturwissenschaft* and *Kulturpolitik*, rejected English and French science which, he said, 'had attained only the degree of cultural development which we ourselves left behind fifty years ago.'

For Ostwald, only a German victory could make Europe better organized and efficient. Whatever the case, no one wanted to hear this from a German. 'It is not a question of geography,' wrote the American astronomer W.W. Campbell, 'it is a question of fundamental differences in civilization'. By January 1915, a chasm of hatred had opened across the academic world. 'Not merely must the dangerous and insufferable despotism which has eaten like a cancer into the morals of the German nation be annihilated', Ramsay wrote in 1915, 'but all possibility of its resuscitation must be made hopeless. The nation, in the elegant words of one of its distinguished representatives, must be "bled white".[18]

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16 *The Times*, 21 October 1914, 10. For French reactions, see Gabriel Petit and Maurice Leudet, *Les Allemands et la Science* (Paris: Felix Alcan, 1916), 87, 118, cited in Rainald von Gizycki, 'Centre and Periphery in the International Scientific Community', *Minerva*, XI (4), (1973), 474-494 at 478; Anne Rasmussen, 'La science française dans la guerre des manifestes, 1914-1918', *Mots: Les Languages du politique*, 76 (2004), 9-23.

17 Roy MacLeod, 'The Social Framework of *Nature* in its First Fifty Years', *Nature*, 224 (5218), (1 November 1969), 441-446.

18 Sir William Ramsay,'Germany's Aims and Ambitions', *Nature*, 94 (18 October 915), 137-139 at 138.

That bleeding was to prove immeasurable, and its costs, incalculable. As casualty lists rose into the hundreds of thousands, losses to science became commonplace. Henry Moseley, arguably the most promising young physicist in England, was killed at Gallipoli; and hundreds of his contemporaries fell in the trenches. One in four Oxford and Cambridge undergraduates were killed, along with many of their tutors. The immediate effect on science was profound, if not always explicit. Even greater were the losses in Germany and France. The Ecole Normale Superiore lost nearly half of its students, and a whole class of the Ecole de Physique et Chemie disappeared at Verdun. The losses of other *grandes ecoles* was comparable or worse. For Germany, comparable figures are less clear, but the universities and the Kaiser Wilhelm Institutes lost many of their young staff who, like their Allied colleagues, flocked to the colours.[19]

Apart from the loss of life came a loss of moral sensibility. Across Europe, the high Humboldtian vision of pure science vanished before a demonstration of its material manifestation.[20] The War became a ghastly fulfillment of the contradictions of reason – the embodiment of its Enlightenment promise, and the incorporation of its destructive power. Where scientific neutrality disappeared, 'objectivity' itself was questioned. In England, cautioned by H.G. Wells' forewarnings of catastrophe, many scientists, like Wells' suburban 'Mr Britling', might just 'see it through'; but others saw the war portending a new, disturbing, and politically revolutionary future.[21] In Germany, these fears went even deeper. In 1917, Max Weber appealed to students in Munich to reject militarism, to restore liberal values, and to recapture the spirit of *Wertfreiheit* – on the grounds that only a proper understanding of *Wissenschaft als Beruf* could prevent a cataclysmic *Krise der Wissenschaft* – a crisis that would undermine not only political security, but also intellectual purpose, professional confidence and epistemological certainty.[22] But the crisis came, and touched the young Karl Popper in Vienna - and through him, a revolution in the philosophy of science.[23]

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19 *50 Jahre Kaiser-Wilhelm-Gesellschaft und Max-Planck-Gessellschaft zur Forderung der Wissenschaften, 1911-1961* (Gottingen, 1961), 89.

20 Fritz Ringer, *The Decline of the German Mandarins* (Cambridge, MA: Harvard University Press, 1969).

21 H.G. Wells, *Mr. Britling Sees it Through* (London: Cassell and Co., 1916).

22 See Max Weber, 'Wissenschaft als Beruf', translated as 'Science as a Vocation', in B. Barber and W. Hirsch (eds.), *The Sociology of Science* (New York: The Free Press, of Glencoe, 1962).

23 Karl Popper, *Unended Quest: An Intellectual Autobiography* (London: Fontana, 1976).

The new world of science was not one of fulfillment, but of danger. Far from alone, Prof. A.F. Pollard of the University of London, writing in *History* in April 1916, condemned a world in which 'poison gas, Zeppelin bombs, floating mines and submarine torpedoes discount our modern debt to science, and its victims outweigh its martyrs'.[24] The winning weapons of this 'reasoning war' were not simply the 'mechanical contrivances' of the battlefield, as Sir Douglas Haig called them. [25] They also invoked the most complex lines of communication and supply the world had ever seen, and the costliest uses of the world's natural resources. Invention was driven by conflict. The war that altered the landscape was fought by the typewriter as well as by the tank. Quite apart from machines, it was, lamented British administrators, a test of German organization against Allied improvisation.[26] The task for the Allies was to become better organized - and once that organisation came, so came adaptability, flexibility, inter-allied cooperation, inter-operability, and a persistent push to economize. The doctrine of Clausewitz – that war is a continuation of policy by other means – was subtly replaced by the doctrine that war was a continuation of scientific method by other means. To counter German superiority in weapons, the Allies brought a completely unforeseen, and ultimately winning weapon – what was to prove the unbeatable combination of French insight, British instrumentation, Imperial enterprise, and American industry, delivered by convoys across oceans defended by the largest navies of the world.

The work of science had immediate consequences for the war, especially in chemistry and agriculture, guns and butter. But the consequences of war for science were no less profound. For even the casual observer, some changes were conspicuous. The Great War was the first to see academic scientists put into uniform. The *Naturwissenschaftler* merged into the *Kriegswirtschaftler*; the 'man of science', into the 'scientific soldier'. With the War's unexpected continuation into 1915 came new government agencies – first in France, then in Britain, then the Central Powers – established to forge links between science and the war effort. [27] In the process, the academic acquired a wholly new influence in the machinery of government. This was repeated across the Empire. So came about that the 'chemists of Cockspur Street', as Lord Cur-

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24 A.F. Pollard, 'History and Science: A Rejoinder', in Pollard, *The Commonwealth at War* (London: Longmans, 1917), 102; reprinted from *History*, I (April 1916-Jan 1917), 25-39.

25 Field Marshall Sir Douglas Haig, 'Final Despatch', *London Gazette*, 8 April 1919, 4693-4712.

26 Arthur J. Meadows, *Science and Controversy. A Biography of Sir Norman Lockyer* (London: Macmillan, 1972).

27 Roy MacLeod and Kay Andrews, 'The Origins of the DSIR: Reflections on Ideas and Men', *Public Administration*, 48 (1970), 23-48.

zon endearingly, if misleadingly, called the New Zealand physicist Ernst Rutherford and the Australian physicist W. H. Bragg, both Nobel Prize-winners, became advisors to the Admiralty. [28] They and hundreds of less well-known 'scientific ANZACs' , Canadians and South Africans ran munitions factories, manned mapping, mining and wireless stations, and performed minor miracles of parasitology and serology in Egypt, Palestine, East Africa, and Mesopotamia. They won special praise from statesmen, including A.J. Balfour and Winston Churchill, who both then and later saw in science a weapon of statecraft. The British Empire became a showcase in which science militant became science militarized. Equally significant, was Britain's new 'special relationship' with America – prepared by chemists, physicists, and physicians long before the United States entered the war, which established scientific and intelligence links that presaged – even upstaged – the arrival of Pershing's army, and continue today.

Across the Channel, the changes were no less remarkable. French science was mobilized more completely than ever, and across Paris, the École des Mines and the Conservatoire des Arts et Metiers, the Institute Pasteur, and the Prefecture de la Police were to solve problems set by the Armée de la Terre. For the first time, the City of Light saw academic *chimistes* and *ingenieurs* given secret tasks, testing captured equipment, and developing new weapons. In parallel, arose new research establishments from Brest to Toulon. In London, following the precedent set by the Academie des Sciences, the Royal Society set up War Committees to advise on food, fuel, transport, and aviation. Such experience was not limited to the scientific elite. Borrowing a phrase from Emile Durkheim, the war 'accommodated' and empowered new professional groups, previously outside the settled order, and gave them 'social space'. A new professional 'working class' of scientists emerged in Britain, with the Association of Scientific Workers created to advance professional 'pay and prospects'. [29]As the *Cambridge Magazine* commented:

> The word 'science' was on everyone's lips and does yeoman's service in almost every newspaper ... Its very name seems to have suddenly discovered a talismanic power which is somewhat perplexing to those who find their paths menaced by the glare of limelight. [30]

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[28] Roy MacLeod and Kay Andrews, 'Scientific Advice in the War at Sea, 1915-17: The Board of Invention and Research', *Journal of Contemporary History*, VI (1971), 3-40.

[29] Kay and Roy MacLeod, 'The Contradictions of Professionalism: Scientists, Trade Unionism and the First World War', *Social Studies of Science*, 9 (1), (1979), 1-32.

[30] *Cambridge Magazine*, *6* (4 November 1916), 76.

Of course, none of this took place in a vacuum. The war accelerated the rise to power of new disciplines and specialties in the natural and social sciences that had come into existence in the previous quarter century. Europe saw a wave of psychologists and pathologists, of chemical engineers and photographic cartographers, physicists and physiologists, mathematicians and metallurgists, many of whom found the war an unprecedented opportunity for professional advancement.[31] In the words of A.P. Rowe, a young English physicist who later rose to fame in the invention of radar, 'I can now have all the money I want, within reason'. With personal recognition came, as Hyman Levy of Imperial College put it: 'a new sense of solidarity among the younger scientific workers .... The war of 1914-18 was the occasion for the birth of the scientific profession'. [32]

J.D. Bernal, FRS, the distinguished Marxist crystallographer, too young to serve in the First War, but playing a formidable role in the Second, recalled what war service meant to his generation:

> The collaboration of (the) scientists in the late War… went beyond anything that had happened before. It was not a matter of the application of well known scientific principles by a small number of technicians and inventors, but the total mobilization of scientists in every country, for the purpose of increasing the destructive power of weapons, and devising methods of protection against the other side.[33]

As Bernal knew well, it was on both sides that men of science 'self-mobilized' and, even before conscious opportunities arose, seized the initiative to apply their tradecraft and show what they could do.[34] In so doing, they were to encounter both pride and prejudice. Pride in their patriotic achievement; prejudice, in response to the terrible consequences of their work.

Lecturing to the victors at Versailles in January 1919, Woodrow Wilson mused on what he considered one of the truly revolutionary changes wrought by the War:

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31 Robert M. Yerkes, 'The Role of Psychology in the War', in Yerkes (ed.), *The New World of Science: Its Development during the War* (New York: Century Company, 1920), 351-392.

32 Hyman Levy, *Modern Science* (London: Hamish Hamilton, 1939), 95.

33 J.D. Bernal, *The Social Function of Science* (London: Routledge, 1939), 30.

34 Kay and Roy MacLeod, 'The Social Relations of Science and Technology, 1914-1939', in Carlo Cipolla (ed.), *The Fontana Economic History of Europe: The Twentieth Century* (Glasgow: Fontana/Collins, 1976), Vol. 5: *The Twentieth Century*, Part I, 301-335.

> We must take, so far as we can, a picture of the world into our minds. Is it not a startling circumstance for one thing that the great discoveries of science, that the quiet study of men in laboratories, that the thoughtful developments which have taken place in quiet lecture rooms, have now been turned to the destruction of civilisation? … The enemy whom we have just overcome had at its seats of learning some of the principal centres of scientific study and discovery, and used them in order to make destruction sudden and complete; and only the watchful, continuous cooperation of men can see to it that science, as well as armed men, is kept within the harness of civilization.[35]

George Sarton and others of his generation saw the warwork of German science as embodying a *Kultur* that celebrated wanton destruction. His personal history found expression in wartime and post-war appeals for 'scientific humanism'. But for later generations – and ours – this hope would prove elusive. Instead, the first scientific war – and the value structures it imperiled – was relegated to a place of forgetting, which our generation is only now retrieving.

II. Learning from History

Students fresh to this field confront a lopsided literature. On the one hand, there is much about military technology and armaments manufacture; [36] the details of military and naval engagements, the role of aviation, transportation, communication, shipping, and the changing roles of propaganda, intelligence, munitions, economic warfare, and the emancipation of women. All this contributes to an abiding view that there were many factors involved in waging the War; and because science was not decisive in its

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35 Woodrow Wilson, addressing the Second Plenary Session of the Peace Conference, January 1919, in State Department, *Papers relating to the Foreign Relations of the United States: The Peace Conference*, 13 vols. (Washington, DC: USGPO, 1942-47), vol. 3,179, cited in Warner R. Schilling, 'Scientists, Foreign Policy and Politics, ' in Robert Gilpin and Christopher Wright (eds), *Scientists and National Policy-Making* (New York: Columbia University Press, 1964), but published earlier in *The American Political Science Review*, LVI (2), (June1962), 287-300.

36 W. Sombart, *War and Capitalism* (trans.) (New York: Arno Press 1975); Michael Bliss, 'War Business as Usual: Canadian Munitions Production, 1914-18', in N.F. Dreisziger (ed.), *Mobilisation for Total War* (Waterloo: Wilfred Laurier, 1981); J.M. Winter, 'Introduction: The Economic and Social History of War', in Winter (ed.), *War and Economic Development* (Cambridge: Cambridge University Press, 1975); J.U. Nef, 'War and Economic Progress, 1540-1640', *Economic History Review*, 12 (1942), 13-39; H. Kamen, *The Iron Century: Social Change in Europe, 1550-1660* (London: Weidenfeld and Nicholson, 1971); Merritt Roe Smith (ed.), *Military Enterprise and Technological Change. Perspectives on the American Experience* (Cambridge, MA: MIT Press, 1987).

outcome, it can for that reason be safely disregarded. Certainly, the War was not brought to an end by a single stroke- there was no an atomic bomb – no *Vernichtungsschlacht*- but rather came to an end in exhaustion, poverty, disease and revolution. These developments were not to be seen only in terms of science-based weapons. Nevertheless, the War brought with it a wide range of shortages and revisions that overtook the professions, the exploitation of natural resources, the provision of housing, the uses of agriculture, the control of chemicals, and the creation of precision manufacture. There came about a greater emphasis on the promotion of science in education, transportation, and communication, and in the prevention and control of disease.

All the warring nations faced the four Horsemen of the Apocalypse, with the threat of famine and pestilence followed by social disintegration and political collapse. But beneath and beyond these uncertainties lay the recognition that science held the power to bring about change, whatever its unintended consequences. For the historian, scientific war thus becomes a history not of single great battles, but a contest of small encounters (albeit, sometimes with large outcomes), a form of submerged history in which there are many hidden dimensions, all of which must be seen in context. One must be reminded, for example, that at a time of rapid advances in quantum physics and the physics of radioactivity, the Kaiser Wilhelm Institute of Physics in Berlin, directed by the 'pragmatic pacifist' Albert Einstein, helped design aircraft wings and gyroscopes for U-boats.

Forty years ago, Clive Trebilcock wrote that in 1900, the most scientific sector of British industry was to be found in Britain's major armaments firms.[37] Even so, we await an analysis of science as a factor in the history of military procurement. The war saw not only new technologies, but also new thinking about technology – echoed in the work of Lewis Mumford and Buckminster Fuller – which in many respects had wartime origins. The Great War introduced the idea of the military-academic-industrial complex, and in so doing, forces its attention on what may yet become a new field of contemporary history. This will look to a literature that includes Michael Sanderson, Jack Morrell, Dong-Won Kim, and Carol Gruber on the

[37] R.C. Trebilcock, 'A "Special Relationship" - Government, Rearmament, and the Cordite Firms', *Economic History Review*, 2nd Series, XIX (2), (1966), 364-379; Clive Trebilcock, '"Spin-Off" in British Economic History: Armaments and Industry, 1760-1914', *Economic History Review*, 2nd Series, XXII (3), (1969), 474-488.

universities in Britain and the United States;[38] Harry Paul on Franco-German academic rivalries, [39] and Brigitte Schroeder-Gudehus and Elizabeth Crawford on the history of scientific internationalism. [40] This new field will build on a generation of early studies – such as those of Lothar Burchardt, on Germany; Robert Marc Friedman on Norway; Barbara Reeves on Italy; Gilbert Whittemore on the United States;[41] Donald Cardwell and myself on Britain and Australia[42] – to produce comparative studies of wartime biology, physiology, geography, geology, or the social sciences. Recent work by Chartlotte Bigg on wartime physics in France, and Stefan Wolff on wartime physics in Germany, has been followed by a consortium led by David Aubin and Christine Goldstein working on the contribution of mathematics, and mathematicians, to the war effort. Fresh studies by Arne Schirmacher in Berlin, Ernst Homburg in Maastricht, Graeme Gooday at Leeds, and Elizabeth Burton at Oxford are promising to extend our knowledge of wartime practice. At the same time, historians at the Fritz Haber Institut of the Max Planck Gescellshaft in Berlin, as well as Tony Travis,

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38 Michael Sanderson, *The Universities and British Industr*y (London: Routledge and Kegan Paul, 1972), Jack Morrell, *Science at Oxford, 1914-1939: Transforming an Arts University* (Oxford: Clarendon Press, 1997); Don-won Kim, *Leadership and Creativity: A History of the Cavendish Laboratory, 1871-1919* (Dordrecht: Kluwer, 2002); Carol S. Gruber, *Mars and Minerva* (Baton Rouge: Louisiana State University Press, 1975).

39 Harry Paul, *The Sorcerer's Apprentice: The French Scientist's Image of German Science* (Gainsville: University of Florida Press, 1972).

40 Brigitte Schroeder-Gudehus, *Paix, Sciences, Politiques: Les Tribulations des Annes Vingt* (Montreal: University of Montreal Press, 1978); Elisabeth Crawford, *Nationalism and Internationalism in Science, 1880-1939: Four Studies of the Nobel Foundation* (Cambridge: Cambridge University Press, 1992).

41 Lothar Burchardt, 'Halbstaatlische Wissenschaftsföderung im Kaiserreich und in der frühen Weimarer Republik', *Medizin, Naturwissenschaft, Technik und das Zweite Kaiserreich* (Göttingen: Vandenhoeck and Ruprecht, 1977); Robert Marc Friedman, *Appropriating the Weather: Vilhelm Bjerknes and the Construction of a Modern Meteorology* (Ithaca and London: Cornell University Press, 1989; 1993); Barbara J. Reeves, 'Vito Volterra and the Italian Scientific Community', paper presented at a colloquium in celebration of the Vito Volterra Collection at Brandeis University, 29 April 1982; Gilbert F. Whittemore, 'World War I, Poison Gas Research and the Ideals of American Chemists', *Social Studies of Science*, 5 (2), (1975), 135-164.

42 Donald L. 'Cardwell, Science and World War I' *Proceedings of the Royal Society of London*, A 342 (1975), 447-456; Roy and Kay MacLeod, 'War and Economic Development: Government and the Optical Industry in Britain, 1914-18', in J. Winter (ed.), *War and Economic Development: Essays in Honour of David Joslin* (Cambridge: Cambridge University Press, 1975), 165-204; Roy MacLeod, 'The Phantom Soldiers: Australian Tunnellers on the Western Front, 1916-1919', *Journal of the Australian War Memorial, No. 13* (1988), 31-43; 'The "Arsenal in the Strand": Australian Chemists and the British Munitions Effort, 1916-1919', *Annals of Science*, 46 (1), (1989), 45-67; '"Full of Honour and Gain to Science": Munitions Production, Technical Intelligence and the Wartime Career of Sir Douglas Mawson, FRS', *Historical Records of Australian Science*, 7 (2), (1988), 189-203.

Jeff Johnson and myself, promise new perspectives on wartime explosives and poison gas.[43]

Thanks to recently opened archives, the future looks promising. At the Hamburg Institute of Oceanography,[44] and the Rhineland firms of Bayer and Hoechst – we have papers and reports that survived Allied bombing in World War II, and relevant sources in many national and professional archives are being digitized. These will help to show the effects of militarization on 'peacetime science', and the effects of military service upon postwar life. They will also throw light on questions surrounding the nature and outcomes of neutral and inter-allied activity. We know, for example, something of the role of The Netherlands in continuing communications between erstwhile colleagues, but too little of the roles played by Switzerland, Sweden and Spain in the scientific war. We also know the Allies gave America all they knew about anti-submarine devices and much else before 1917, but we know little of the consequences of this traffic in ideas in the eighteen months preceding America's formal entry into the War– or of its bearing on the later chapters of what historians are now beginning to call 'The Great World War, 1914-45'.[45] The wartime present undoubtedly shaped the future. We are told that by 1918, every chemistry laboratory in Britain was doing 'War Office work' – well described by Sir William Pope and Lord Moulton[46] – and this was being reflected in the United States as well, but no one has assessed the post-war consequences of the competitive 'granting' system engineered by the war ministries. It is, ironically, thanks to the careful record-keeping of American attachés, 'spying' on their Allies, that we know as much as we do about secret British and French war-related research, and its implications for post-war civilian developments. [47]

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43 Roy MacLeod, 'Chemistry for King and Kaiser: Revisiting Chemical Enterprise and the European War', in Anthony Travis *et al*. (eds.), *Determinants in the Evolution of the European Chemical Industry, 1900-1939: New Technology, Political Frameworks, Markets and Companies* (Dordrecht: Kluwer, 1998), 25-49; see also Jeremiah James, Thomas Steinhauser, Dieter Hoffmann, and Bretislav Friedrich, *One Hundred Years at the Intersection of Chemistry and Physics: The Fritz Haber Institute of the Max Planck Society, 1911-2011* (Berlin: De Gruyter, 2011). See also the essays devoted to the Great War in Matthias Berg, Jens Thiel and Peter Walther (eds.), *Mit Feder und Schwert: Militär und Wissenschaft - Wissenschaftler und Krieg* (Stuttgart: Franz Steiner Verlag, 2009).

44 Cf. *Aus Achtzig Jahren. Eine Selbstbiographie von Siegfried Passarge (1867-1958),* (Hamburg: Institat fur Geographie und Wirtschaftsgeographie, Universität Hamburg, 1957).

45 Rexmond C. Cochrane, *The National Academy of Sciences. The First Hundred Years, 1863-1963* (Washington, DC: National Academy of Sciences, 1978).

46 Cf. Lord Moulton, *Science in War* (Cambridge: Cambridge University Press, 1921).

47 Roy MacLeod, 'Secrets among Friends: The Research Information Service and the "Special Relationship" in Allied Scientific Information and Intelligence, 1916-18', *Minerva*, 37 (3), (1999), 201-233.

III. Looking to the Future

Today, these questions are becoming of increasing interest, especially if we wish to de-mythologize and reconstruct the past for a generation that knows little of its detail. Pervasive myths, in particular, require analysis and deconstruction. Everyone, apparently, knows that the outbreak of war found Britain vastly deficient across a wide range of science-based industries, from pharmaceuticals to photographic materials.[48] England, it was said, had nothing to match Germany except in the field of recruiting posters. As H.G. Wells remarked, in a rambling, bitter critique in June 1915, Germany was producing 'novelty after novelty', and 'each novelty ... more or less saved their men and unexpectedly destroyed ours'. At that point, Wells observed, Britain lacked aeroplanes capable of destroying Zeppelins; the shortage of high explosives was 'notorious'; and, he might have added, until the summer of 1917, there was no solution to the submarine menace. As late as mid-1915, Wells said, Britain had yet:

> to make efficient use of poison gas and of armoured protection in advances against machine guns in trench warfare. And so throughout almost the entire range of our belligerent activities we are to this day being conservative, imitative and amateurish, when victory can fall only to the most vigorous employment of the best scientific knowledge.[49]

However, the situation quickly changed. Even Wells was forced to admit that, within just twelve months – by the beginning of the Battle of the Somme – Britain, with American and Canadian help, was meeting almost all her munitions needs, and contributing strongly to its French and Russian allies as well. The result was to force Hindenberg to launch 'total war' and the vast and ultimately wasteful munitions program that bore his name. In fact, a long-standing obsession with the shortcomings of Britain's organic chemicals and dyestuffs industry, and with the reputed failures of British management, has distracted us from the successes taking place in many of Britain's mines and factories, its metallurgical and precision-tool industries, as well as in the fields of applied biology, aeronautics, food preservation, preventive medicine, and chemical engineering. In many

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48 The well-known picture is painted in DSL Cardwell, 'Science and World War I', *Proc.Roy.Soc*, A 342 (1975), 447-456.

49 H.G. Wells, *The Times*, 11 June 1915.

fields, as experience was to prove, German superiority was a myth. The wartime history of France affords other examples.[50]

To demythologise familiar accounts is a demanding task, but it must be done. It was said in 1914 – and said again in 1940 – that only a miracle could stop the Germans. But in 1915, the 'usual British miracle' began to arrive, partly taking the shape of the Ministry of Munitions, the biggest industrial concern in the world, employing over 3,000,000 workers, and a network of firms that supplied the Admiralty. Americans were impressed. 'The British war establishment is the most perfect creation made by man, and the French are a good second', enthused the leading American geologist, George Burgess, in a report to Washington, DC, in 1917. The Ministry was in many ways a flawed jewel. Yet, it achieved what no other form of public corporation on either side managed to achieve during the war. Given fresh momentum, and transported to the States, the system began to outpace Germany. Yet, we still have only an internal history of that Ministry.[51] Their French and German counterparts are little better off- despite many volumes devoted to the frustrations of French and German science published in the 1920s.

It is high time to remedy our neglect of the ways by which peacetime science and scholarship were mobilized – from strategic applications, such as naval wireless and photographic sensitizers that made aerial reconnaissance possible – to tactical operations, from submarine signaling to sanitation. Certain concepts, such as 'military geology' incorporated both – including the strategic use of geological information for mapping; as well as the tactical uses of water tables and anti-submarine detection.

So far, no one has done more than hint at the ease with which British and American universities were co-opted overnight into military research, or at the difficulties that met German attempts to do the same. Few visitors to the American University in Washington D.C. would know the place – as it was once known – as 'Camp American University', home of America's pilot mustard gas plant, directed by Lt James Conant, a young Harvard chemist, and many years later President of Harvard.[52] That no German or French

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50 See Oliver Lepick, *La Grande Guerre Chimique, 1914-1918* (Paris: Presses Universitaires de France, 1998); Jonathan B. Tucker, *War of Nerves: Chemical Warfare from World War I to Al-Queda* (New York: Pantheon Books, 2006).

51 Martin van Creveld, *Supplying War* (Cambridge: Cambridge University Press, 1977).

52 James G. Hershberg, *James B. Conant: Harvard to Hiroshima and the Making of the Nuclear Age* (New York: Knopf, 1993). For Conant's view of science and the military, see James Conant, *Science and Common Sense* (London: Oxford University Press, 1957).

university ever played this remarkable role was perhaps not coincidental. That Conant went on to become a pillar of the American scientific establishment in World War II, and a leading figure in the Manhattan Project that produced the atomic bomb, may also not be coincidental. Never again would American forces send large armies over treacherous seas to fight professional adversaries with borrowed artillery and foreign-made shells.

Not least for this reason, historians of science have tended to look, inevitably, to Germany – from the nineteenth century onwards, the 'scientific nation' par excellence, the model for modernizing Asia and non-metropolitan Europe, and the envy of educational reformers in Britain, France and America. Germany, it was thought, could field the big battalions in science; and so they did. But what remains to be demonstrated, is whether, and under what circumstances, the size and strength of German's military industry could have made a lasting difference to the outcome.

Equally, historians must separate reality from romance. Stories of British military ineptitude, for example, are difficult to resist, and are too numerous and telling to be entirely false. But they need careful unpacking. One famous anecdote has a leading physicist offering to organize a meteorological service for the British Army, who is politely declined, on the grounds that this is unnecessary, because the British soldier fights in all weathers. In another, a distinguished chemist offers his services, only to be declined by the Army on the grounds hat the War Office already has a chemist. In both cases, the reality soon trumped the mythology. If, in June 1915, the journal *Nature* could complain that the British government had not yet woken up to the need to use all the talents that Providence had bestowed upon her',[53] within weeks, the tides had turned. Embracing the cause of innovation and research, the Admiralty set up a Board of Inventions and Research, and the government created a Ministry of Munitions, alongside an embryonic Council for Scientific and Industrial Research to link the nation's academic institutions with its manufacturing priorities.

It is unwise, and frequently incorrect, to think of the wartime militarization of science as a departure from a peaceable past. As David Edgerton has reminded us, the sciences in Britain have always been at war; and Left-wing scientists such as J.D. Bernal and J.G. Crowther were never needed to explain that the progress of science is shaped by economic factors.

53 'The Mobilisastion of Science', *Nature*, 95 (1915), 419.

Whether the war was a stimulus to new ideas, or a distraction from them, or both, remains a subject of debate. Nobel Prizes were won by physicists and chemists who served, but not for work they did in the War. On the other hand, many breakthroughs in medicine and surgery, geology and acoustics, chemistry and biochemistry arose directly from wartime pressures. With the Armistice, many saw the devastation associated with the applications of science propelling new visions for mankind. We think today of the scientific humanism of George Sarton, the idealism of Arthur Eddington, the pacificism of Bertrand Russell, and the science-as-socialism of J.D. Bernal. For others, like George Catlin, husband of Vera Britain, the experience of war drove the desperate pursuit of a new politics of reason, a new discipline of political science, a 'Testament of Youth'. For all, for a moment, it was a new world.[54]

What, in 1918, was the future for science in this new world? 'It will be too awful', wrote Harold Nicholson from Versailles, 'if, after winning the war, we are to lose the peace'.[55] International relations would be resumed, slowly and with difficulty, but the world remained divided into hostile camps. Emile Picard and many other Frenchmen nursed an eternal flame of opposition to German recovery. Even Woodrow Wilson feared a future scholarship eclipsed by 'science without conscience'. Years would pass before Germany and Austria were readmitted to the international scientific community. By then, however, it was too late. A sense of betrayal, widely shared, became easily co-opted by National Socialism.[56]

Before the War, Sir Arthur Schuster – a progressive physicist and German-born Secretary of the Royal Society of London, who suffered much during the War for the sake of his name, and whose grieving Muse domi-

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54 Roy and Kay MacLeod, 'The Social Relations of Science and Technology, 1914-1939,' in Carlo Cipolla (ed.), *The Fontana Economic History of Europe:* Vol. 5: *The Twentieth Century,* Part I (London: Collins/Fontana, 1976), 301-335.

55 Harold Nicolson, *Peacemaking* (London: Constable, 1933), diary entry for 24 March 1919, 236.

56 See Anne Rasmussen, 'Réparer, réconcilier, oublier: enjeux et mythes de la démobilization scientific, 1918-1925', *Histoire @Politique: Revue électronique du Centre d'histoire des sciences po*, 3 (2007), 1-14; Eckhardt Fuchs, 'Wissenschaftsinternationalismus in Kriegs-und Krisenzeiten: Zur Rolle der USA bei der Reorganisation der internationalen *scientific community*, 1914-1925', in Ralph Jessen und Jakob Vogel (eds.), *Wissenschaft und Nation: Universalistischer Anspruch und nationale Identitätsbildung im europäischen Vergleich (19. und 20. Jahrhundert)* (Frankfurt: Campus Verlag, 2002), 263-284. See also Paul Forman, 'Scientific Internationalism and the Weimar Physicists: The Ideology and its Manipulation in Germany after World War I', *Isis*, 64 (1973), 151-180 at158n; and Brigitte Schroeder-Gudehus, 'Probing the Master Narrative of Scientific Internationalism: Nationals and Neutrals in the 1920s', in Rebecka Lettervall, Geert Somsen and Sven Widmalm (eds.), *Neutrality in Twentieth-Century Europe: Intersections of Science, Culture and Politics after the Frist World War* (London: Routledge, 2012), 19-44.

nated the banner of the British Association meeting at Manchester in 1915 -- told a London audience that it would ultimately fall to men of science and learning to preserve world peace.[57] By 1919, however, little remained of his optimism. Scientists would, it seemed, serve the order that they helped create. And as many foresaw, it would be only a matter of time before the first scientific war would slip ineluctably into a second, an event for which we now know the world had only twenty years to wait.

British Association banner, Manchester Meeting, 1915
President: Sir Arthur Schuster
(Courtesy of the British Association for the Advancement of Science)

[57] Arthur Schuster, *'Discourse at the Royal Institution'*, 18 May 1906, reported in *Nature*, 74 (12 July 1906), 259.

Sarton Medal Lectures

Laudatio Jos Monballyu

Dirk Heirbaut

Jos Monballyu was born in Roeselare in 1948, but very soon moved to Kortrijk. In 1966 he was one of the first students of the then recently established Catholic University of Leuven, Campus Kortrijk. For his master's degrees in history and social law and his J.D. Monballyu had to study in Leuven, but he returned to Kortrijk for his academic career at the small university he cherishes, never to leave it again.

Kortrijk is a common element between Jos Monballyu and the great Flemish jurist, Philip Wielant, who lived around 1500. Although born in Ghent, the roots of Wielant's family were in Kortrijk. Wielant is still renowned for his ability to bring the best of legal erudition to practitioners. Jos Monballyu shares that talent. Although a legal historian and as such an academic lawyer, he is very familiar with legal practice in the court house and in politics. In the early 1990s when the competence for university education in Flanders had just been transferred from the federal level to the Dutch-speaking community, Monballyu wrote the new decrees on the universities. His experience with the real life of law has enabled Monballyu to turn his books on the history of family law and criminal law into fascinating literature. In his words the old law comes to a second life. Monballyu has never been satisfied with expounding legal theories. He delves into the archives to get to know every day legal troubles. No effort is beyond him, if it can help to unearth that last interesting detail about his subject. For the current crop of university bureaucrats, archival repertories are not worthy of academic recognition. However, for the historian they constitute the foundation of his research. Monballyu has shown this in his career by publishing several surveys of archival records. Not coincidentally, his

student Rik Opsommer, a part-time professor in legal history, became the archivist of the city of Ypres.

Wielant was a learned jurist who wanted his fellow men to profit from his knowledge. Hence, he wrote on Flemish law in the vernacular, so that his countrymen could read and understand his texts. Jos Monballyu has, once again, stepped in Wielant's footsteps and worked on local legal history. His research concerns not only the old county of Flanders in general, but also its many towns, villages and hamlets. A recurrent theme of Monballyu's research are witch trials, but his extensive bibliography deals with a variety of subjects. In some cases the reader may be, at first, a bit baffled and wonder whether the topic of an article is really worthy of an academic's attention. In the rich treasure of Monballyu's publications, one can find articles on e.g. suicide at the devil's request (Sint-Eloois-Vijve, 1601), a dangerous pig (Kortrijk, 1562), a failed hanging (Bruges, 1613); a poison case (Ypres, 1785-1786). Yet, although in all these cases small events are studied, Monballyu always demonstrates that they go beyond local problems. Cases of little importance, concerning ordinary people in Flanders, are still embedded in a broader context and reveal processes of transformation taking place all over Europe. Monballyu who knows the local situation like no one else, manages to present both the broader picture and the complexity of local reality. His studies of criminal and civil procedure, but also of the Council of Flanders and witch trials have become real gems of academic research thanks to his thorough knowledge of both the local and the general perspective.

Wielant was not a scholar locked up in the ivory tower of legal science and neither is Jos Monballyu. Unlike Wielant, he has never been imprisoned for his ideas, but he has been a very active member of Flemish society nonetheless. His 'Sunday hobby', as he calls it, has been the chancellorship of a vocational college. He was the key person in many social credit and building companies. In the academic world the esteem of his colleagues for Jos Monbally is so high that he was chosen to succeed R.C. Van Caenegem as the president of the Scientific Committee of the Royal Flemish Academy of Belgium for Science and the Arts. For seventeen years he was on the daily board of editors of the Tijdschrift voor Rechtsgeschiedenis/The Legal History Review, the flagship of legal history in the Low Countries. He was also a member of the Royal Commission for the publication of the old statutes and customs of Belgium and a

member of the board of editors of the Handelingen van het genootschap voor geschiedenis te Brugge.

As there are many parallels between Monballyu and Wielant, it should come as no surprise that Monballyu has been studying all aspects of Wielant's writings. In fact, he initiated the modern edition of Wielant's manuscripts. Unfortunately, outside Flanders Wielant never received the high acclaim which should have been his due. Likewise, Jos Monballyu is somewhat the best kept secret of legal history in the Low Countries. His reputation amongst Dutch-speaking colleagues is towering. Yet, one of his greatest achievements, his Ph.D. thesis has not (yet) been published. Fortunately, his colleagues in Flanders and the Netherlands have many other occasions to learn from Monballyu. To their sadness, they have noticed several times that a foreign scholar reaped worldwide success with books and articles that are inferior to Monballyu's analysis. Therefore, Flemish and Dutch legal historians have greeted with joy the announcement of an English translation of Monballyu's wonderful book on the history of criminal law.

In the meantime, Monballyu himself has started on another chapter in his academic career. Scholars who are retired either fade away, or are taking off again and become even more productive. Freed of administrative and teaching duties, Monballyu, finally, can devote himself completely to his research with impressive results. Recently, almost no year passes by without a new book of Monballyu on World War I and the law. Needless to say, in every case Monbally's newest output is based on painstakingly thorough research of the original sources. The reader who wants to enjoy this latest research of Monballyu first hand, only has to turn to the next page...

The "force of law" of decree-laws in Belgium during and after the First World War

Jos Monballyu

Il y a des cas où il faut mettre pour un moment un voile sur la liberté, comme on cache les statues des dieux.' Montesquieu, Esprit des lois, XII, 16.

The notions 'rule of law' and 'emergency powers legislation'

At the suggestion of Cato, the Roman Senate sentenced to death a number of Lucius Sergius Catilina's followers in 63 BC because they had conceived a plan to overthrow the Republic. Cicero, who was a consul at the time, had these death sentences immediately executed, even though (1) they had been pronounced by a non-competent body, (2) the sentenced people were neither allowed to defend themselves nor to be defended by legal advisers, (3) one of them (Publius Cornelius Lentulus) enjoyed immunity as a *praetor* and (4) the right of every Roman citizen to appeal to the people against a death sentence was not recognised.[1] Afterwards, Cicero defended this course of action by pointing out that a number of exceptional measures had been absolutely necessary for the survival of the Roman state and that the conspirators had lost their fundamental rights and freedoms[2] because of their conniving.[3] On this occasion, Cicero also formulated the adage *Salus populi suprema lex esto*[4], which is still used today to summarise emergency powers

1 T. Reinach, *De l'état de siège. Étude historique et juridique,* Paris, 1885, p. 40-87.

2 Their 'civil rights', which consist of the current fundamental rights and freedoms: L. Waelkens, *De Romeinse oorsprong van de fundamentele rechten en vrijheden,* Tijdschrift voor rechtsgeschiedenis, 71 (2003), p. 187-191.

3 T. Reinach, *De l'état de siège*, p. 62-87.

4 Cicero, *De legibus*, liber III, 4, § 8. This adage is sometimes formulated as 'Salus rei publicae suprema lex esto' or 'Salus patriae suprema lex esto'.

legislation in one sentence. Emergency powers legislation posits that the highest executive power in a country has the right to temporarily take over the competences of other public bodies in case of war, serious internal disturbances of public order or other general states of emergency[5], and to take a number of measures that are absolutely necessary for the continued existence of the state or the safeguarding of the state's vital interests. If need be, these measures could contravene the fundamental rights and freedoms of citizens[6].

In many countries, emergency powers legislation is currently regulated by the national constitution[7] or an international treaty, for example by article 4 of the ICCPR and article 15 of the ECHR[8]. Essentially, emergency powers legislation amounts to allowing a dictatorship or police state in a country for a short period. This means that emergency powers legislation is contrary to - or an exception to - the idea of the rule of law[9], a notion that was formulated for the first time in the early nineteenth century in Germany, but has deep roots in the important charters of the late Middle Ages and the Early Modern Era, as well as in the writings of several jurists and state philosophers of the

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5 Natural disasters such as a flood or a nuclear disaster, or emergencies of an economic nature such as a banKing crisis.

6 O. Orban, *Droit constitutionnel de la Belgique*, Brussels, 1906, I, p. 334-335; A. Butgenbach, *L'extension des pouvoirs de l'Exécutif en temps de guerre et la révision de la Constitution belge*, La Belgique judiciaire, 93 (1935), col. 386-407 and 417-437; L. Wodon, *Sur le rôle du Roi, comme chef de l'État dans les défaillances constitutionnelles,* Bulletin Academie Royale. Classe des lettres et des sciences morales et politique, 1941, p. 217-218; W. Ganshof van der Meersch, *Preadvies over de schorsing van de vrijheidsrechten in uitzonderingstoestand* (Vereniging voor de vergelijkende studie van het recht van België en Nederland), Zwolle, 1950, p. 1-7; W. Ganshof van der Meersch and M. Diderich, *Les états d'exception et la Constitution belge*, Annales de droit et de sciences politiques, 13 (1953), p. 51-131; H. Balreich a.o., *Das Staatsnotrecht in Belgien, Frankreich, Grossbritannien, Italien, den Niederlanden, der Schweiz und den Verenigten Staaten von Amerika* (Max Planck-Institut für Ausländischen Öffentliches Recht und Völkerrecht, 31), Cologne, Berlin, 1955; C. Huberlant, *Etat de siège et légalité d'exception en Belgique,* Licéité en droit positif et références légales aux valeurs. (Bibliothèque de la faculté de droit de l'université catholique de Louvain, XIV), Brussels, 1982, p. 386; R. Ergac, *L'état de nécessité en droit constitutionnel belge,* Le nouveau droit constitutionnel. Rapports belges au II[e] Congrès mondial de droit constitutionnel, Brussels, 1987, p. 143-171; J. Velaers, *De beperKingen van de vrijheid van meningsuiting,* Antwerp, 1991, II, p. 796; *De transversale bepalingen inzake rechten en vrijheden. Verslag namens de werkgroep belast met het onderzoek van titel II van de Grondwet* (Belgian Chamber of Representatives, 20 Februari 2006, doc. 51/2304/001), p. 61-69.

7 A. Butgenbach, *L'extension des pouvoirs*, col. 387-393, C. Huberlant, *État de siège*, p. 388-398; R. Ergec, *Les droits de l'homme à l'épreuve des circonstances exceptionnelles. Étude sur l'articel 15 de la Convention européenne des droits de l'homme*, Brussels, 1987, p. 61-97.

8 R. Ergec, *Les droits de l'homme*, p. 1-427; A. L. Svensson, McCarthy, *The international law of human rights and states of exception,* The Hague, 1998; B. Van der Sloot, *Langs de lijnen van geleidelijkheid: een jurisprudentieanalyse van artikel 15 EVRM,* NTM/NJCM-Bulletin, 37 (2012), p. 208-229.

9 A.A.L.F. Van Dullmen, *Staatsnoodrecht en rechtsstaat*: voordracht op 17 november 1945 te Amsterdam voor het Genootschap van den rechtsstaat, Alphen aan den Rijn, 1946.

previous centuries[10]. Essentially, a state under the rule of law is a society in which not only the citizens but also the government are obliged to operate within the framework of the law. The state grants a number of fundamental rights to its citizens and inhabitants, but this state itself, or rather its different institutions, are also subjected to this law which, at the macro level, regulates the organisation, competences and decision-making process of its institutions and, at the micro level, allows citizens to turn against a state individually or collectively if it is guilty of illegal conduct. The most ideal version of this concept implies an independent judiciary which manages not only to have the executive power comply with the law, but also to make the legislature comply with the higher norms that were not enacted by this legislature (general principles of law, the constitution, international law). The extent to which the rule of law was respected or undermined by the highest executive bodies in Belgium during the First World War is the framework within which the subject of this discussion must be situated. It is important to mention beforehand that the First World War[11] 'legally' started on 2 August 1914, the day on which a Royal Decree of 31 July 1914 - which put the Belgian army on a war footing - appeared in the Belgian Official Journal and immediately gained the force of law[12]. The war ended on 30 September 1919, when a Royal Decree of 2 July 1918 put the Belgian army on a peace footing[13].

Belgian emergency powers legislation during the First World War

When the Germans invaded Belgium on 4 August 1914, neither the country's military law nor its public law were prepared for war. Until then, many people had believed that Belgium, being a neutral country, would never become involved in a war[14]. In addition, they did not want to incur the reproach that they supported dictatorship[15]. Moreover, many jurists were convinced

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10 R.C. Van Caenegem, *Geschiedkundige Inleiding tot het Publiekrecht,* Ghent, 1985, p. 12-14; R.C. Van Caenegem, *The Rechtsstaat in Historical Perspective,* R.C. Van Caenegem, Legal History. A European Perspective, London, 1991, p. 185-199; R. Van Caenegem, *Democratie en rechtsstaat in het twaalfde-eeuwse Graafschap Vlaanderen*, Tijdschrift voor Rechtsgeschiedenis 61 (1993), p. 205-215.

11 On the notion of war according to internal Belgian law, see W. Ganshof van der Meersch, *Réflexions*, p. 11 and Id, *Les états d'exception*, p. 65.

12 *Pasinomie*, 1914, p. 440.

13 *Pasinomie*, 1919, p. 273. According to a Royal decree of 21 September 1919 the state of siege also ended on 30 September 1919: *Pasinomie*, 1919, p. 485.

14 W.J. Ganshof Van der Meersch, *Preadvies*, p. 1-7.

15 L. De Lichtervelde, *La législation sur l'état de guerre et sur L'état de siège*, C. Dejongh and V. Esseux, Le droit et la guerre. Législation, doctrine et jurisprudence belges en matière de droit pénal militaire, II, Paris, 1918, p. 30-35.

that emergency powers legislation could not be regulated constitutionally or legally (*Necessitas non habet legem! Nécessité n'a pas de loi! Nécessité échappe à la loi!*)[16] and that the reasonability of measures that were taken during a state of siege, even when they were illegal or unconstitutional, could only be determined *post factum*[17]. This is why on 4 August 1914 neither the Belgian constitutional legislator, nor the Belgian legislator had determined how the police powers of the civil authorities could be transferred to the military authorities in the case of a war, serious internal insurgences or another general state of emergency in Belgium. Neither had they determined how the fundamental rights and freedoms of the citizens could be limited or suspended by measures that were absolutely necessary for the continued existence of the State or the safeguarding of its vital interests. On the contrary, article 130 of the Constitution determined that the Constitution and the rights and freedoms it provided could never be suspended wholly or in part. According to Congress member Van Snick, this meant that the National Congress of Belgium had clearly indicated that it would no longer be possible in Belgium to establish an exceptional regime that suspended the Constitution[18] in the name of the so-called higher interest of the Nation[19]. Articles 67 and 78 of the same Constitution, however, strictly limited the competences of the highest executive power by determining that the King and the Government could take decisions that were necessary for the execution of the laws, but were never allowed to suspend these laws or exempt from their execution. In addition, the Constitution determined that the King and the government only had the power granted to them by the Constitution or a law.

Only article 282 of the 'Code of the administration of justice of the land forces' of 20 June 1814[20] and articles 20 and 68 of title 1 of the Code of Military administration of justice of 15 June 1899 offered some solace. Each of these mentioned 'circumstances which constituted a state of siege

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16 Edmond Picard in the Senate on 14 March 1899: *Annales parlementaires*, Sénat, séance du 14 mars 1899, p. 215.

17 Heupgen en Delbeke in the Chamber of Representatives on 20 January 1899 (*Annales parlementaires*, Chambre des représentants, séance du 20 janvier 1899, p. 397 and 493) and Claeys Bouaert, Picard and Lejeune during the sessions of the Senate on 14 and 15 March 1899 (*Annales parlementaires*, Sénat, séance du 14 mars 1899, p. 213-216 and séance du 15 mars 1899, p. 221-224 and 226-228).

18 E. Huyttens, *Discussions du Congrès National de Belgique 1830-1831*, Brussels, 1844, p. 464-465.

19 In his argument, Van Snick expressly referred to the rule 'Salus populi supremae lex esto'.

20 According to article 139 of the Constitution, this Dutch law code had the force of law until the law of 15 June 1899 concerning the above-mentioned title of the Law Code of military administration of justice: judgements of the Court of Military Appeals of 25 October 1831 and 18 February 1832: A. Bosch, *Droit pénal et discipline militaires ou Codes militaires,* Brussels, 1837, p. 105-106, 108-110.

according to the military regulations'. The Belgian legal literature unanimously derived from this that the French decree of 8-10 July 1791 '*concernant la conservation et le classement des places de guerre et postes militaires, la police des fortifications et autres objets y relatifs*'[21], the French law of 10 fructidor, Year V (27 August 1797) '*qui détermine la manière dont les communes de l'intérieur de la République pouttait être mises en état de guerre ou de siège*'[22], the French imperial decree of 24 December 1811 '*relatif à l'organisation et au service des États-majors des places de guerre*'[23] and the Dutch instruction of 11 January 1815 for the commanders and majors of a besieged location[24] still had the force of law and that the Belgian King or the military commander of a fortified location therefore still had the authority to declare the state of war and the state of siege (an enhanced form of the state of war)[25] if the country was invaded by a foreign power[26]. Consequently, they could transfer police powers[27] from the civil to the military authorities[28]. The only dispute concerned the fact whether this King or these military commanders could limit the citizens' freedom of the press[29] and could transfer the competences of the civil courts to the military courts[30]. In practice, this discussion remained purely theoretical[31]

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21 Articles 7 to 12 of this decree. The text of this law can be found in *État de siège*, Pandectes Belges, 38, (1891), col. 545-546 and 550-551.

22 Article 2 of the law. The text of this law can be found in *État de siège*, Pandectes Belges, 38, (1891), col. 554.

23 Articles 50-53, 91-119 of this decree. The text of this decree can be found in *État de siège*, Pandectes Belges, 38 (1891), col. 545-547 and 551-554.

24 Article 43 to 69 of this instruction. The French text of this instruction can be found in *État de siège*, Pandectes Belges, 38, (1891), col. 547-548 and 554-556.

25 Article 53 of the decree of 24 December 1811, in combination with article 50 of the instruction of 11 January 1815.

26 Not in the case of internal uprisings or revolutions: W. Ganshof van der Meersch, *Les états d'exception*, p. 84.

27 For a description of these police powers, see W. Ganshof van der Meersch, *Preadvies*, p. 12-13.

28 Article 10 of the decree of 8 July 1791, articles 101 and 102 of the decree of 24 December 1811 and article 53 of the instruction of 11 January 1815.

29 A power which the King or a local military commander could assign to himself on the basis of article 10 of the decree of 8 July 1791, articles 101 and 102 of the decree of 24 December 1811 and article 53 of the instruction of 11 January 1815 and which was deemed to be contrary to article 18 of the Belgian Constitution.

30 A competence which the King or a local military commander could assign to himself on the basis of article 103 of the decree of 24 December 1811 and article 7 of the Dutch criminal code of 2 July 1814 and was deemed to be contrary to articles 8, 94 and 98 of the Belgian Constitution.

31 H. Rolin, *Sur la mise en état de siège de la ville de Gand, l'arrestation de Mr. Stéven, et l'arrêté de Niellon qui défend la publication de tout journal, pamphlet où écrit périodique sans son autorisation préalable*, Ghent 1832; judgement 69 of the Court of Military Appeals of 18 February 1832 in the case André Benoit Stévin, A Bosch, *Droit pénal*, p. 109-110; *État de siège*, Pandectes belges, 38, Brussels, 1891, col. 557-561 (which includes a discussion of the literature in the field of public law until that time); B. Delbecke, *De lange schaduw van de grondwetgever. Perswetgeving en persmisdrijven in België (1831-1914)*, p. 110-113.

because since 30 January 1833[32] the declaration of the state of war or the state of siege had never been necessary[33].

The Germans invaded the country on 4 August 1914. On the same day, a Royal Decree declared the military strongholds of Antwerp, Liège and Namur to be in a state of war.[34] This declaration was not based on any constitutional or legal text. A second Royal Decree of the same date declared the provinces of Limburg, Liège, Luxemburg and Namur to be in a state of siege and based this declaration on article 53 of the imperial decree of 24 December 1811. This second Royal Decree also regulated the transfer of police powers from the civil to the military authorities[35]. In order to avoid all misunderstandings, it also determined very clearly that the declaration of the state of siege could not lead to a transfer of competences from the civil to the military courts[36]. Three days later, a third Royal Decree of 7 August 1914 declared the rest of the Belgian territory to be in a state of siege[37]. A Royal Decree of 11 October 1916 declared the entire unoccupied territory to be in a state of siege, as well as the occupied territory as it was liberated[38]. Finally, a second Royal Decree of the same date regulated the competences of the different military authorities in those areas that were in a state of siege[39].

None of these Royal Decrees mentioned a limitation of the constitutional rights and freedoms. Because of this, disputes broke out between citizens and the military authorities in the unoccupied territory beyond the Yser when the military authorities removed suspected people from this area, or

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32 On 21 October 1831, the military commander Niellon declared the state of siege in Ghent. One day later, on 22 October 1831, this state of siege was confirmed by the Belgian King. On 25 October 1831, the Belgian King declared a state of siege in the city of Antwerp, which was only terminated on 30 january 1833: *État de siège*, Pandectes belges, 38, Brussels, 1891, col. 557.

33 *Annales parlementaires*. Chambre des représentants, séance du 16 novembre 1898, p. 392-393, séance du 6 décembre 1989, p. 174-175 and séance du 20 janvier 1899, p. 395-405; *Annales parlementaires,* Sénat, séance du 14 mars 1899, p. 209-216 and séance du 15 mars 1899, p. 221-232. During these discussions of the draft law concerning title 1 of the Law Code of military administration of justice, representative Furnémont incorrectly stated that general Alfred vander Smissen had declared the state of siege for the basin of Charleroi: *Annales parlementaires.* Chambre des représentants, séance du 19 janvier 1899, p. 174 and séance du 20 janvier 1899, p. 400.

34 Published in the Belgian Official Journal of 5 August 1914, *Pasinomie*, 1914, p. 458.

35 Articles 2 and 4 of the Royal Decree of 4 August 1914, published in the Belgian Official Journal of 5 August 1914, *Pasinomie*, 1914, p. 459.

36 Article 3 of the Royal Decree of 4 August 1914 published in the Belgian Official Journal of 5 August 1914: *Pasinomie*, 1914, p. 459. According to the Code of military administration of justice of 15 June 1899, such a transfer was possible when there were no ordinary courts in occupied regions, or when these courts had ceased to operate.

37 *Pasinomie*, 1914, p. 460.

38 *Pasinomie*, 1916, p. 51.

39 *Pasinomie*, 1916, p. 51-52.

took all kinds of necessary decisions in the place of the civil authorities, which were sometimes absent[40]. In order to avoid these disputes, the Belgian King enacted the decree-law concerning the state of war and the state of siege on 11 October 1916[41]. Many provisions of this decree-law had been taken from the French war laws of 9 August 1849 and 4 April 1878[42], but - contrary to these French laws - the Belgian decree-law was not based on a formal constitutional stipulation. This decree-law, which contravened the Belgian Constitution of 7 February 1831 and the fundamental rights and freedoms which were safeguarded by this Constitution in several respects, made it possible to take four kinds of measures during the state of war and the state of siege:

1) First, the transfer of the police powers of the local civil authorities to the King, who could in his turn transfer them to a number of civil or military authorities of his choice (articles 1 to 3).
2) Second, the granting of the following extraordinary competences to the military authorities, in so far as they used these competences for the defence of the country and the safety of the army[43]:
   1° The right to remove dangerous people[44] from locations where they could inflict damage (article 4, 1°), which was a limitation of article 7 of the Constitution. This article stated that the freedom of a person is guaranteed and that no one could be arrested without a judge's reasoned order – except in the case of *flagrante delicto*[45]. A decree-law of 12 October 1918, which was later complemented by a ministerial decision of 13 January 1919, extended this right of removal and authorised the Minister of Justice or his authorised representatives to remove certain people from a specific place, oblige them to stay at a specific location or to intern them at a specific location. The people in question were: all foreigners, all people who had become Belgians through naturalisation, all Belgians who did not have a fixed place of residence in Belgium and all Belgians who were suspected of having close relations with the Germans[46]. The possibility of administrative internment was used often when

40 L. De Lichtervelde, *La législation*, p. 34-35.
41 Decree-law of 11 October 1916 concerning the state of war and the state of siege, preceded by a report to the King, *Pasinomie,* 1916, p. 48-50.
42 T. Reinach, *De l'état*, p. 153-154.
43 Report to the King, *Pasinomie*, 1916, p. 48; W. Ganshof Van der Meersch, *Preadvies*, p. 30-58.
44 Recidivists, people who were suspected of being connected with the enemy, foreigners and al people who could prevent military operations from taking place.
45 W. Ganshof van der Meersch, *Preadvies*, p. 30-38.
46 *Pasinomie*, 1918, p. 44-45 and 1919, p. 8.

the country was liberated in the months October and November 1918.

2° The right to perform, by day or night, a search of premises or of a person's body without an arrest warrant (article 4,2°)[47]. This was a limitation of article 10 of the Constitution, which determined that a person's residence was inviolable and that searches of residences could only take place in the cases provided for by the law and in the manner prescribed by the law[48].

3° The right to order the surrender of weapons and ammunition and, if these were not surrendered, the right to look for these weapons and ammunition and to seize them (article 4,3°). This amounted to a limitation of article 11 of the Constitution, which determined that no one could be deprived of ownership - except for the public good in the cases and manner determined in the law, and against an equitable and prior compensation.

4° The right to prevent all meetings that aimed at causing or maintaining disorder (article 4, 4°). This was a limitation of article 19 of the Constitution, which determined that, if the meetings in question were public, Belgian citizens had the right to meet unarmed and in a peaceful manner without a prior permission being required. If the meetings in question were private, their prevention was a limitation of article 10 of the Constitution[49].

5° The right to consult, withhold and seize all correspondence (article 4, 5°)[50]. This amounted to a limitation of article 22, which determined that the privacy of correspondence was inviolable[51].

6° The right to prevent the production or dissemination of publications that could benefit the enemy or could have a negative influence on the morale of the troops or the population (article 8). This allowed

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47 A Royal Decree of 11 October 1916 granted these competences to the military commanders of the billeting locations where the Belgian army in the field was quartered, to a special emissary of this army in the areas where an allied army was quartered and to the Military Security Service in the rest of the territory that was in a state of siege (*Pasinomie*, 1916, p. 51-52). A practical example of the actions of the Military Security during searches of premises can be found J. Monballyu, *De jacht op de flaminganten. De strafrechtelijke repressie van de Vlaamsgezinden aan het IJzerfront,* Bruges, 2010, p. 115-120.

48 W. Ganshof van der Meersch, *Preadvies*, p. 39-43.

49 W. Ganshof van der Meersch, *Preadvies*, p. 53-55.

50 A responsibility which was entrusted to the Military Security Service in the occupied territory in order to enable counterespionage: Royal Decree of 11 October 1916, article 3, last subsection; article 4, last subsection; and article 6, *Pasinomie*, 1916, p. 51-52. A practical example thereof can be found in the case Louis Simonts in 1915: J. Monballyu, *De jacht*, p. 24-27.

51 L. De Lichtervelde, *La législation*, p. 44-46; W. Ganshof van der Meersch, *Preadvies*, p. 57-58.

for the introduction of real press censorship[52] and was therefore a limitation of article 18 of the Constitution, which determined that the printing press was free and that the introduction of press censorship was forbidden under all circumstances[53]. When such publications were issued by ordinary citizens, article 11 of the decree-law declared the correctional courts to have jurisdiction over violations of this prohibition. This competence, in its turn, was an infringement of article 98 (currently article 150) of the Constitution, which determined that only a jury (Courts of Assizes) was competent for printing offences.

3) Third, the military judicial powers (the military public prosecutors and Judge Advocate General, the courts-martial and the Court of Military Appeals were declared to have jurisdiction over all offences against the external and internal safety of the State (articles 101 to 136 of the criminal code), as well as over gangs that were formed with a view to attempts on persons or property (determined in articles 322 to 326 of the criminal code), irrespective of the status (member of the military or citizen) of the principal offender or his accessories (article 7 of the decree-law). Article 13 of the same decree-law added to this that these military judicial powers also had jurisdiction over all traffic offences that were committed in a region that was in a state of siege. Both articles were a limitation of article 8 of the Constitution, which determined that no one could, against his will, be denied the judge that the law provided for him, and of article 94 of the Constitution which determined that no extraordinary courts or commissions, under whatever name, could be established. In so far as the offence against the safety of the state was also a political offence or a printing offence, article 7 was also a limitation of article 98 of the Constitution which determined that the jury was competent to assess crimes, political offences and printing offences.
4) Finally, article 10 of the decree-law determined that during the war the King could grant an authorisation to the military and civil authorities so that they could requisition people and goods in order to guarantee the maintenance of the public order, as well as health, food supply and aid in urgent cases. If people were requisitioned, this provision was a limitation of article 7 of the Constitution, which guaranteed the freedom of individuals[54]. The requisition of goods was a limitation of article 11

52 L. De Lichtervelde, *La législation*, p. 30.
53 W. Ganshof van der Meersch, *Preadvies*, p. 51-53.
54 W. Ganshof van der Meersch, *Preadvies*, p. 51-53.

of the Constitution, which determined that no one could be deprived of ownership except for the public benefit, in the cases and the manner determined by the law, and against an equitable and prior compensation[55].

As soon as these different provisions were applied, several citizens protested against them. Their protest was mainly aimed at the force of 'law' of the decree-law of 11 October 1916 and all of the other decree-laws[56]. The rest of this contribution will detail when and why this protest took place, as well as how the Belgian administration of justice dealt with this protest.

An overview of the decree-laws during the First World War

On the day when the Germans invaded Belgium, 4 August 1914, the members of the Chamber of Representatives and the Senate met in the parliament and voted the law of 4 August 1914 concerning the urgent measures that were necessary because of the developments of the war. This law authorised the King to take a number of urgent and necessary measures in times of war, such as the prolongation of the term of payment of valuable papers, the limitation of withdrawals of money from the banks, the limitation of the exportation of certain products to other countries, the safeguarding of the delivery of supplies to the country and the combating of hoarding. The King passed this law on the same day. It appeared in the Official Journal the next day (5 August 1914) and, as its fifth article determined, it gained the force of law immediately[57]. During the following days and months, the King took several of these measures by means of regular Royal Decrees[58], the legal validity of which would never be contested[59].

In the course of the months November and December 1914, it became clear that another series of urgent and necessary measures had to be taken in the interest of the defence of the country and the safeguarding of its vital interests. These had to be formally provided in a law[60], or were intro-

55 W. Ganshof van der Meersch, *Preadvies,* p. 43-48.

56 On other protests, see J. Monballyu, *La justice transitionelle en Belgique dans les affaires pénales après la Première Guerre Mondiale (1918-1928)*, Legal History Review, 80 (2012), p. 443-479.

57 *Pasinomie*, 1914, p. 454-455.

58 For example the Royal Decree of 14 August 1914 and the Royal Decree of 6 October 1914, which fixed the prices and procedure for requisitioned goods, *Pasinomie*, 1914, p. 466-467 and 475; the Royal Decree of 18 September 1914 concerning seizure before judgement in civil cases, *Pasinomie*, 1914, p. 473-474.

59 H. Ballreich, *Das Staatsnotrecht*, p. 10.

60 For example: in the implementation of articles 110 (the levying of taxes), 113 (the determining of the budget and the accounts), 118 (the determining of the manner of recruitment for the army) and 119 (the determining of the army contingents) of the Constitution.

duced by entirely new legal rules which sometimes contravened an older law[61]. In addition, it was also clear that these measures could no longer be implemented as determined in article 26 of the Constitution, i.e. jointly by the King, the Chamber of Representatives and the Senate, because the King and the Government were in the unoccupied territory and Le Havre, while the members of the Chamber and the Senate were scattered over the occupied territory, the unoccupied territory and foreign countries. The result was that it became impossible in either Chamber to find a majority as defined in the last sentence of article 38 of the Constitution. Being the only operative branch of the legislature, the King felt morally obliged to take these necessary measures independently. The King initially did this by means of regular Royal Decrees in which he did not mention that he was acting as the only branch of the legislature that was still operative. In the introduction of these Royal Decrees he did point out that the country was in a state of siege and that the measure was very necessary in the given circumstances[62].

At the end of December 1914, the Minister of Finance, Van de Vyvere, wanted to make the situation perfectly clear. In his report to the King which preceded a draft concerning the levying of taxes in 1915, he explicitly declared that the Constitution was not suspended by the state of war, but that not all of its parts could be executed. More specifically, according to the Minister, the legislature could no longer function as was prescribed in article 26 of the Constitution because the Chamber of Representatives and the Senate could no longer meet in a legitimate manner. This was why the King, being the only remaining branch of the legislature, had to take legislative action independently. The King accepted this offer and on 2 December 1914, he approved the draft concerning the levying of taxes that was submitted to him - albeit still by means of a regular Royal Decree[63].

In order to distinguish the decrees in which the King acted as the only branch of the legislature from the decrees which he took in order to im-

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61 For example: Royal Decree of 25 November 1914 on the repression of the dissemination of false messages about the military operations (*Pasinomie,* 1919, p. 479-480) and Royal Decree of 31 December 1914 about the possession of pigeons (*Pasinomie*, 1914, p. 483.)

62 For example: Royal Decree of 25 November 1914 and of 12 January 1915 about the repression of the spreading of false messages concerning the state of war among the population (*Pasinomie*, 1914, p. 479-480 and 1915, p. 1-2) and Royal Decree of 31 December 1914 about the possession of pigeons (*Pasinomie,* 1914, p. 483).

63 Royal Decree of 26 December 1914 with report to the King, *Pasinomie*, 1914, p. 482.

plement the Constitution or an existing law (later also to implement a decree-law), the King used the term decree-law (Du. *Besluitwet*, Fr. *Arrêté-loi*) from 13 February 1915 onwards to indicate the former type of decree[64]. That the King was not always absolutely certain and confident is evident from the following noteworthy characteristics of these decree-laws: their name (decree-law instead of law)[65], the fact that the introduction of some decree-laws still referred to the state of war and the necessity of taking the measure(s) in question in the given circumstances[66], the fact that some decree-laws determined that the decree-law would later be submitted to the legislative Chambers for ratification[67], and the fact that the final formulation of some decree-laws mentioned that the decree-law 'would have the force of law'[68], while the final formulation of other decree-laws stated that they 'would be binding'[69] or 'enter into force'[70] on the day of or at some specified time after its publication in the Official Journal. In later decree-laws, the second and third elements are absent. In the introduction to these decree-laws, the King only mentioned that the country was in a state of war, that article 26 of the Constitution could no longer be applied because it was impossible for the Chamber of Representatives and the Senate to meet in a valid manner and that the King had therefore decided to take this measure independently.

Although the state of war and the state of siege lasted until 30 September 1919 in Belgium[71], the King only enacted decree-laws until 16 November 1918[72]. After the Armistice of 11 November 1918 and the departure of the

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64 Decree-law of 13 February 1915 in which the reporting of contagious diseases was rendered obligatory: *Pasinomie*, 1915, p. 4.

65 E. Remy, *De la validité originelle des arrêtés-lois pris pendant la guerre*, La Belgique judiciaire, 77 (1919), col. 897-900.

66 *Ibidem* and the decree-law of 12 April 1915 to amend the legal provisions concerning the delivery of acts of registration of sea-going vessels and concerning mortgages on sea-faring vessels, *Pasinomie*, 1915, p. 7.

67 For example: article 3 of the decree-law of 5 January 1916 concerning the change of residence in order to escape recruitment by the army: 'Il sera soumis à la publication des Chambres législatives dès que celles-ci peuvent se réunir.', *Pasinomie*, 1916, p. 1. Also see article 7 of the decree-law of 1 March 1916 which determined the army contingent, *Pasinomie,* 1916, p. 9-10.

68 Article 4 of the decree-law of 15 March 1915 concerning traffic in the war zone: *Pasinomie,* 1915, p. 6.

69 Article 6 of the decree-law of 13 February 1915 which rendered the reporting of contagious diseases obligatory, *Pasinomie,* 1915, p. 4.

70 Article 13 of the decree-law of 21 May 1915 concerning the state of siege in several regions of the Congo, *Pasinomie*, 1915, p. 13.

71 See above.

72 Decree-law of 16 December 1918 to amend articles 126 to 129, 131, 134 and 137 of the Code of military administration of criminal justice and decree-law of 16 November 1918 to amend the decree-law of 11 October 1916 concerning the state of war and the state of siege, *Pasinomie*, 1918, p. 94-95.

German army from Belgium, the Chamber of Representatives and the Senate were once again able to perform their legislative tasks fully. Therefore, it was no longer necessary in Belgium to govern by means of decree-laws.

During the First World War, the King promulgated a total of 136 decree-laws (26 in 1915, 39 in 1916, 31 in 1917 and 40 in 1918). They dealt with very diverse subjects and only rarely contained penal provisions[73]. In order to give the decree-laws the force of law, the so-called Solvay Commission - the members of which included a number of advocates who would later become Ministers[74] - decided at the end of the war that it would be best if the foreign example were followed[75] and the Chamber of Representatives and the Senate would ratify the decree-laws 'en bloc' post factum and with retroactive effect[76]. Eventually, the legislative chambers did not follow this advice because they wanted to avoid that the population would begin to doubt the immediate effect of the decree-laws in the occupied territory[77]. By treating the decree-laws as full laws in later laws[78], the legislative chambers did ratify them tacitly.

During the criminal trials of the political collaborators Hippolyte Manssens and Louis Craeybeckx in April 1919, their defence lawyers once again tried to emphasise the necessity of the parliamentary ratification of the decree-laws. In this context, they pointed out the fact that the circumstances of war which had made it necessary for the King to take legislative action independently had disappeared at the end of November 1918. Since that time, the legislative chambers had had ample time to ratify the decree-laws and, because they had not done this, the decree-laws had become worthless

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73 Apart from some changes to the Military code of criminal law (*Pasinomie*, 1915, p. 29, *Pasinomie,* 1916, p. 3 and 54, *Pasinomie,* 1917, p. 6-7, *Pasinomie*, 1918, p. 15-16 and p. 35-36) and of the Code of military criminal justice (*Pasinomie,* 1916, p. 16-17 and 21-22, *Pasinomie*, 1918, p. 41-43), the most important changes to penal legislation were the decree-law of 11 October 1916 concerning the crimes and misdemeanours against the external safety of the State (*Pasinomie*, 1916, p. 52-54) and the decree-law of 8 April 1917 concerning the crimes and misdemeanours against the safety of the State (*Pasinomie*, 1917, p. 13-14).

74 The Commission consisted of a number of professors of the University of Brussels and a number of advocates from Brussels like Leon Delcroix and Henri Jaspar who would become members of the Belgian government shortly after the war.

75 On England, see G. Jaenicke, *Das Staatnotrecht in Grossbritannien*, H. Ballreich a.o., Das Staatsnotrecht in Belgien …, p. 75-76. For other foreign examples, see A. Butgenbach, *L'extension des pouvoirs,* col. 387-391.

76 *Le retour à la légalité,* Brussels, 1919, p. 22.

77 H. Ballreich, *Das Staatnotrecht* …, p. 5-6; E. Remy, *De la validité originelle,* col. 897-900; A. Jonckx, *Belgica juris*, Antwerp, 1932, p. 22-23 and 37-39.

78 For example the Elections Law of 9 May 1919 which referred to the penal provisions in the decree-laws of 11 October 1916 and 8 April 1917: A. Jonckx, *Belgica juris*, p. 40-43.

according to these lawyers[79]. The court-martial of the Grand Headquarters of the Belgian army, as well as the Court of Military Appeals and the Court of Cassation rejected this argument by pointing out that the decree-laws were fully-fledged laws which the King, being the only remaining branch of the legislature, had established in all freedom in order to provide what he deemed necessary in the interest of the country. Therefore, it was by no means necessary for these decree-laws to be ratified by the legislative chambers[80]. According to the Court of Cassation, the only consequence of the acceptance of the lawyers' position was that a measure which had been necessary at a certain time to meet an urgent need, became binding when it was ratified later and therefore defeated its purpose[81].

The first - but essential - question which the Belgian judges had to answer after the enactment of the decree-laws was the question of which position these decree-laws occupied in the hierarchy of the Belgian legal norms. Did they merely have the value of a regular Royal Decree - which meant that they needed a constitutional or legal basis (article 78 of the Constitution) and could not contravene existing laws (article 67 of the Constitution) - or did they, as they sometimes expressly determined themselves, have the "force of law" (Fr. *force de loi*), so that they could not only suspend or change older laws, but could also introduce new legal provisions? And how could the latter be reconciled with article 20 (currently article 36) of the Constitution, which clearly stated that the legislative power was exercised jointly by the King, the Chamber of Representatives and the Senate, and with article 130 (currently 187) of the Constitution which determined that the Constitution could not be partially or wholly suspended?

These questions already cropped up in the legal procedures during the war, albeit only outside of the occupied territory. In the Belgian Congo, for example, the Court of Appeals of Katanga already determined very clearly that all decree-laws had the force of law and could therefore amend earlier laws. The Court of Appeals quashed a judgement of the court of

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79 Findings for Hippolyte Manssens Brussels, State Archive 2, *Court of Military Appeals Files 1915-1954*, box 149, file 516/1919 and findings for Louis Craeybeckx in Brussels, State Archive 2*, Court of Military Appeals Files 1915-1954*, box 167, file 59/1920.

80 Court-martial of the grand Headquarters 18 April 1919, Court of Military Appeals 12 July 1919 and Court of Cassation 19 September 1919 concerning Hippolyte Manssens in Brussels, State Archive 2, *Court of Military Appeals Files 1915-1954*, box 149, file 516/1919; Court-martial Grand Headquarters 18 April 1919, Court-martial 3 February 1920 and Court of Cassation 27 April 1920 concerning Louis Craeybeckx in Brussels, State Archive 2, *Court of Military Appeals Files 1915-1954*, box 167, file 59/1920.

81 Court of Cassation 27 April 1920, *Pasicrisie*, 1920, I, p. 124-125.

first instance of Elizabethstad (Lubumbashi) which had determined that a decree-law of 15 September 1915[82] was merely a measure of the legislature and could therefore not amend the colonial law of 18 October 1908[83]. Seven days later, on 9 September 1916, the Court of Military Appeals also determined that all decree-laws had the force of law[84]. It explicitly repeated this standpoint on 13 September 1917[85] and 14 November 1917[86].

After the liberation of the country, the Court of Cassation also confirmed several times that the decree-laws had the force of law. The Court did this first on 30 November 1918 with regard to acts committed outside of the occupied territory[87] and then on 11 February 1919 with regard to acts committed in the occupied territory[88]. In the meantime, the court-martial of the Grand Headquarters and the court-martial of Brabant had already confirmed the force of law of the decree-laws with regard to the latter type of acts on 23 January 1919[89] and 31 January 1919[90].

In order to be able to treat decree-laws as fully-fledged laws, the judges had to answer three questions:

1° First, how could the legal character of the decree-laws be justified theoretically? Or, in other words, how could articles 26, 68, 78 and 130 of the Constitution be put aside in order to grant the King the competence during the War to draw up decrees that had the force of law?

2° Second, were the judges allowed to assess whether the measures taken by the King in his decree-laws were absolutely necessary?

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82 Decree-law of 15 November 1915 to amend article 22 of the colonial law of 18 October 1908, *Pasinomie*, 1915, p. 23-24.

83 Court of Appeals of Katanga 2 September 1916, *Pasicrisie*, 1916, p. 23-24.

84 Court of Military Appeals 9 September 1916 concerning Georges Belloy, *Pasicrisie*, 1919, II, p. 88.

85 Court of Military Appeals 13 September 1917 concerning Jean Masui and his associates, *Pasicrisie*, II, 1919, p. 125 and C. De Jongh and V. Yseux, *Le droit*, I, 1917, p. 571.

86 C. De Jongh and V. Yseux, *Le droit,* I, 1917, p. 712-715.

87 Court of Cassation 30 December 1918 concerning Jean Masui and his associates, *Pasicrisie*, 1918, p. 47-48.

88 Court of Cassation 11 February 1919 concerning Geubelle, preceded by a conclusion of chief public prosecutor Terlinden, *Pasicrisie*, 1, p. 9-16 and *La Belgique judiciaire*, 1919, p. 314. This judgement was explicitly confirmed in Cassation 4 June 1919 (*Pasicrisie,* 1919, I, p. 97-110), Cassation 18 February 1920 (*Pasicrisie*, 1920, p. 62) and Cassation 27 August 1920 (*Pasicrisie*, 1920, p. 124).

89 Court martial of the Grand Headquarters 23 January 1919 concerning Robert De Wael, *Pasicrisie,* 1919, III, p. 33-34.

90 Court martial of Brabant 31 January 1919 concerning Guillaume Van Dieren, *Pasicrisie*, 1919, III, p. 1-8.

3° Third, when did the decree-laws that had been enacted and published in the unoccupied territory become binding for the inhabitants of the occupied territory? Did they become binding ten days after their publication in the Belgian Official Journal or at an earlier date if the decree-law determined this explicitly, or did they only become binding when the country was liberated in the months October and November 1918, when the inhabitants of the occupied territory could become acquainted with the decree-laws?

The answers of the Belgian administration of justice to each of these three questions are treated in the following paragraphs.

A double justification of the "force of law" of the decree-laws

In the unoccupied territory, the Court of Military Appeal was the first court which had to answer the question whether a decree-law had the force of law. The Court of Military Appeal did this after private Georges Belloy from Borgerhout appealed against a judgement of 3 August 1916 of the court-martial of Le Havre, which had sentenced him to a punishment detail for three years[91]. Belloy invoked that the decree-law of 1 March 1915[92], which had resulted in his recruitment, contravened articles 26, 67 and 130 of the Constitution and could therefore not be a basis for criminal prosecution[93].

In its judgement of 9 September 1916, the Court of Military Appeal dismissed this defence argument because in the given circumstances of war, the court - as well as all of the other administrative and judicial authorities - had to respect the binding power of the measures which the King, being the only remaining branch of the legislature, had taken in the interest of the defence of the country and in order to safeguard its vital interests. The Court was also convinced that if the constitutional legislator had foreseen both the grave situation in which Belgium would find itself in 1915 as well as the impossibility for the legislative chambers to meet, he would not have hesitated to grant the legislative power to the King alone[94]. Although the Court of Military Appeals did not explicitly refer to the classical theory of emergency powers legislation, it did use it implicitly in order to point out that in the given circumstances of war, the King, being the highest

91 Brussels, State Archive 2, *Court of Military Appeals Files 1915-1954*, box 23, file 1120.
92 *Pasinomie*, 1915, p. 5.
93 *Ibidem*: 'Mémoire à l'appui de l'appel interjeté par Belloy du jugement du Conseil de guerre du Hâvre du 3 août 1916'.
94 Court of Military Appeal 9 September 1916, *Pasicrisie*, 119, II, p. 88.

executive authority, had the right to exercise the competences of the two branches of the legislature which were no longer operative and, as well as the right to draw up laws that were necessary for the defence of the country or the safeguarding of its vital interests.

This classical theory of emergency powers legislation was also employed by the court-martial of the supply base of the Belgian army in Calais in order to legitimise the force of law of the decree-law of 18 November 1915, which suspended the possibility of Cassation appeals against the judgements and decisions of the military courts for the duration of the war[95]. When Jean Masui and his associates, who were officials of the supply base of the Belgian army in England, were prosecuted for fraud, misappropriation of public funds, extortion and the acceptance of bribes[96], they invoked that the decree-law of 18 November 1915 could not be applied to their case because it had been established independently by the King, in contravention of article 26 of the Constitution. The court-martial rejected this remedy by pointing out that the King's right to establish laws tallied with all principles of reasonability in the circumstance that the legislative chambers could no longer meet, if the King was the only operative branch of the legislature and if these laws were necessary to meet the urgent needs of the moment. According to the court-martial, the decree-law of 18 November 1915 indisputably met the purpose of meeting such an urgent need, because this decree-law once again enabled a decent military administration of justice. Before the decree-law, the filing of Cassation appeals had prevented the execution of some judgements of the court-martials and decisions of the Court of Military Appeals during the war.[97] Masui and his associates appealed against this judgement, but the Court of Military Appeals rejected this appeal on 13 September 1917 because the King, being the only remaining branch of the legislature, had the right to independently draw up all laws that were necessary for the defence of the country or the safeguarding of its vital interests[98]. Shortly afterwards, in a decision of 14 November 1917, the Court of Military Appeal repeated the same standpoint[99].

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95 *Pasinomie*, 1915, 33. Abolished by a decree-law of 16 November 1918, *Pasinomie*, 1918, p. 93-94.

96 Articles 240, 243, 245, 246, 252 and 496 of the criminal code.

97 Court-martial of the supply base of the Belgian army Calais 26 May 1917 concerning Jean Masui and his associates in Brussels, State Archive 2, *Military prosecutors and drumhead courts martials 1914-1919*, 1445, judgement 594-599.

98 Court of Military Appeal 13 September 1917, *Pasicrisie*, II, 1919, p. 125.

99 C. De Jongh en V. Yseux, *Le droit*, I, 1917, p. 712-715.

In the meantime, the court-martial of the third Army Division had already used the classical theory of emergency powers legislation to justify the force of law of a decree-law, namely the decree-law of 16 June 1916 which granted an unlimited territorial jurisdiction to the drumhead court-martials[100]. The court-martial did this in the criminal case against private Fernand Thierry from Saint Gilles near Brussels, who was prosecuted for insubordination (article 28 of the military criminal code). Thierry invoked that, being a member of a transportation corps that operated independently from the different divisions of the Belgian army, he should not appear before the court-martial of the Third Army Division, but before the court-martial of the Grand Headquarters. He based his argument on the Royal Decree of 17 October 1914 which established the court-martial of the Grand Headquarters. This Royal Decree was itself a decree implementing article 61 of the law of 15 June 1899 concerning title 1 of the Code of military criminal procedure which allowed the King to establish drumhead court-martials for the different divisions of the army. In application of articles 8, 26, 67 and 107 of the Constitution, the King could, according to Thierry, not impair this legal regulation by means of a decree. In addition, because this matter was legally regulated, he could not appeal to a 'contrainte d'une impérieuse nécessité de sauvegarder l'existence même de la Nation' or 'la loi suprême du salut public' either in order to promulgate such an unconstitutional decree. The decree-law of 16 June 1916, which granted unlimited territorial jurisdiction to the drumhead court-martials[101] could therefore not impair the regime of personal jurisdiction of the court-martials which had been introduced by article 61 the law of 15 June 1899. The decree-law could, consequently, not be applied to Thierry[102].

The court-martial of the Third Army Division rejected this objection of incompetence by pointing out that the decree-law of 16 June 1916 was a fully-fledged law which the King had established independently after it had turned out that it was impossible for the legislative chambers to meet. In addition, this decree-law met an urgent need, namely the safeguarding of the smooth functioning of the military administration of justice which was jeopardised because the scattering of soldiers and services had made it practically impossible to determine the personal jurisdiction of each

100 Decree-law of 16 June 1916 with a report to the King, *Pasinomie*, 1916, p. 21-22.
101 Decree-law of 16 June 1916 with a report to the King, *Pasinomie*, 1916, p. 21-22.
102 'Conclusions pour Thiérry, prévenu contre l'auditeur militaire' in Brussels, State Archive 2, *Court of Military Appeals Files 1915-1954*, box 137, file 160.

court-martial[103]. The Court of Military Appeals confirmed this judgement on 27 February 1919[104].

In the meantime, the Court of Appeal of Katanga had ruled positively on the force of law of the decree-laws on 2 September 1916, albeit partly on the basis of a different argument. The two points of departure of its ruling were the following: (1) the Belgian constitutional legislator had not provided a regulation for cases in which one or two branches of the legislation became inoperative because of extraordinary circumstances; and (2) the conclusion that the constitutional legislator would certainly not have wanted that the legislative power, which was an essential part of the national sovereignty, would no longer be exercised in such circumstances - as this would lead to a situation in which the existing laws could no longer be applied because the circumstances had changed, because the levying taxes, state expenditure and recruitment for the army had become impossible[105]. On the basis of these two elements, the Court of Appeal of Katanga stated that the constitutional legislator had made a very conscious choice when he had decided not to determine an exceptional regime for exceptional circumstances. The reason for this was that the constitutional legislator had realised that it was impossible to design a regulation for such circumstances beforehand. Therefore, the creation of a regulation had to be left to those who had the actual power, freedom and responsibility to take the measures that were necessary in order to meet the needs of the moment. According the Court of Appeal, for example, it was possible in Belgium despite article 130 of the Constitution to declare the state of siege when a city was under siege or the enemy invaded the country. According to the same Court, it was also possible, despite articles 8 and 94 of the Constitution, for the military courts to take over the jurisdiction of the civil courts in circumstances of war when the civil courts were no longer able to function. Although the judgements of the military courts contravened the Constitution in such circumstances, they were still legitimised by the country being in distress. According to the court, the consequence of all this was that the Constitution did not desire that the extraordinary circumstances of a war or revolution were dealt with by means of laws that had been established for normal times, but

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103 Court martial of the Third Army Division 10 October 1917 in State Archive 2, *Court of Military Appeals Files 1915-1954*, box 137, file 160.

104 Court of Military Appeal 27 February 1919, *Ibidem*.

105 According to the Constitution, all of these had to be determined by law every year.

that these circumstances were dealt with by means of laws that had been inspired by the needs of the moment.

The Belgian Constitution had granted the sovereignty of the Belgian state to the Nation in an enduring manner. Under normal circumstances, the Nation had this sovereignty exercised by the organs and in the manner appointed by the Constitution. The reasonable consequence thereof was that when force majeure caused this regulation to collapse, the sovereignty returned to the Nation, which could then have it exercised by the body or bodies which actually held power and had the support of the entire Nation or the majority thereof. In application of this reasoning, it was very reasonable that the King, being the only remaining branch of the legislature, exercised the legislative powers independently if the legislature was crippled because two of its branches, namely the Chamber of Representatives and the Senate, were inoperative since it was impossible for them to meet. According to the court-martial this was not only based on the idea that a solution had to be found for the needs of the moment, but also on the spirit of the Constitution and the constitutional principles derived from it. On the basis of the general principles of the constitutional law, a number of historical examples[106] and the general permission of the entire Nation or the majority thereof, the courts could safely conclude that the decree-laws which the King had promulgated under the pressure of the contemporary, violent and extraordinary circumstances had the force of law[107].

In order to give the force of law to the decree-laws, the Court of Appeal of Katanga not only based itself on the classical theory of emergency powers legislation[108], but also a theory that is now called the theory of the permanence of national sovereignty[109]. This theory first and foremost entails that the Belgian Constitution granted the sovereignty of the country to the Nation in a durable manner (article 25 of the Constitution) and that this national sovereignty consequently continues to exist even when most of

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106 The judgement referred to the Roman law which appointed a dictator in such circumstances, to the decisions of the French National Convention which were labelled as provisional laws by a law of 17 July 1793, the decrees of Napoleon which contravened the legislation, the decree-laws of 1814 of the Dutch King, the acts of the National Congress in 1830 which all had their legal basis in the necessity of action in the given circumstances, and, finally, to the adage 'Salus rei publicae suprema lex esto'.

107 Court of Appeals of Katanga 2 September 1916, *Pasicrisie*, 1916, II, p. 23-24.

108 The judgement mentions contraventions of the Constitution *qui sont legitimées par la nécessité* several times, as well as extraordinary circumstances which had to be regulated *par les nécessités du moment*, *des évènements de force majeure,* measures *en cas d'absolue nécessité* and a regulation *qui est légitimée par la nécessité inéluctable*.

109 *Transversale bepalingen*, p. 63.

the country is occupied by an enemy. The court of Katanga linked this idea of the permanence of national sovereignty with the idea that the legislative authority was an essential part of this national sovereignty (no sovereignty without legislative authority!) and was therefore permanent as well[110] . In addition, the court of Katanga also connected the permanence of sovereignty with the idea that the King, being one of the most important representatives of the Nation, could only exercise this legislative power when the other two branches of the legislature could no longer meet in a legally valid manner.

This theory of the permanence of national sovereignty had the same result as the classical theory of emergency powers legislation: it justified the force of law of the decree-laws that had been enacted between 13 February 1915 and 16 November 1918. As will be indicated below, under point 2, it had the additional benefit that according to this theory the King did not have to demonstrate that the measures which he had taken in the given circumstances were absolutely necessary.[111]

On 2 September 1916 the idea of the permanence of national sovereignty was not new at all: it was already implicitly contained in judgements of the Court of Cassation of 26 April 1915[112] and 20 May 1916[113] which also derived this permanence from article 43 of the Hague Convention of 18 October 1907 respecting the Laws and Customs of War[114]. This article determined that when the legislative competence had fallen into the hands of the occupying regime, this regime had to respect the laws that were in force in the country before its occupation, except in the case of force majeure. The Court of Cassation confirmed this idea explicitly in its judgement of 5 June 1917[115]. At the same time the Court forcefully rejected the (tradition-

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110 See the preliminary findings of attorney generalTerlinden in the judgement of the Court of Cassation of 11 February 1919, in which the attorney generalsummarised this theory into three points: 1° The sovereignty of Belgium never ceased to exist (during the war), 2° A nation cannot exist without a government and 3° a government cannot exist without laws: *Pasicrisie*, 1919, I, p. 11.

111 E. Remy, *De la validité originelle*, col. 897-900.

112 Court of Cassation 26 April 1915, *Pasicrisie*, 1915-1916, I, p. 129-131.

113 Court of Cassation 20 May 1916, with preliminary findings of chief public prosecutor Terlinden, *Pasicrisie*, 1915-1916, I p. 417 and *La Belgique judiciaire*, 1919, col. 148-173.

114 Convention that was ratified by an assenting act of 25 May -8 August 1910.

115 Court of Cassation 5 July 1917, with preliminary findings of Advocate General Janssens, *Pasicrisie*, 1917, I, p. 275-281 and *La Belgique judiciaire*, 1919, col. 296-311. According to Raymond De Ryckere this theory was also implicitly contained in a judgement of the Correctional Tribunalof Brussels of 8 May 1917 (*Journal des tribunaux*, 1919, col. 133) and a judgement of the Court of Appeals of Brussels of 7 February 1918 (*Journal des tribunaux*, 1918, col. 947-948): R. De Ryckere, *Les attentats et les complots sous le régime de l'occupation,* Revue de droit pénal et de criminologie, 10 (1920), p. 394-397.

al) theory that the sovereignty of a certain state was lost when its territory was occupied by an enemy state and was transferred to this occupying government[116] and the (very recent) theory that posited that during the occupation, sovereignty was divided between the original lawful authorities and the occupying government.[117]

It was only on 11 February 1919, in the Geubelle case, that the Court of Cassation linked the idea of the permanence of national sovereignty despite the occupation of the country with the idea of the permanence of the legislative power and the idea that the King can exercise the legislative power independently when the two other branches of the legislature are unable to function. Geubelle had appealed in Cassation against a judgement of the chamber of indictment of Liège, which, on the ground of article 7 of the decree-law of 11 October 1916 concerning the state of war and the state of siege, had declared itself incompetent to pronounce a judgement about the economic collaboration with which Geubelle was charged. Geubelle invoked that the decree-law of 11 October 1916 did not apply to his case because this decree-law contravened article 26 of the Constitution. The Court of Cassation dismissed this appeal first and foremost on the ground that article 43 of the Hague Convention of 1908 clearly showed that the Belgian national sovereignty had continued to exist integrally despite the German occupation of the largest part of the Belgian territory. Secondly, articles 79-80 of the Constitution, which determined that the legislative chambers could exercise the legislative power independently in the case of the King's demise or minority or if the throne remained vacant, clearly showed according to the Court that when one of the branches of the legislature ceased to function, the remaining branches could continue to exercise this legislative power as long as the Nation itself continued to exist. The fact that the King, being the only functioning branch of the legislative power, had established the decree-law of 11 October 1916 to take the measures that were necessary for the defence of the country and the safeguarding of its vital interests was consequently entirely in keeping with

116 More information about the authors (among others Alexandre Mérignhac and A. Pillet) who defended this theory can be found in A. Jonckx, *Beligica juris*, p. 4-9. This theory was still fiercely defended up to the level of Cassation - albeit in vain - by advocate G. de Mortier in the criminal case against Gustave Derbaudringhien: Brussels, State Archive 2, case files of the Court of Military Appeals 1915-1945, box 137, file 154/1919 and *Journal des tribunaux*, 1919, col. 243-248.

117 This theory was defended before the Court of Cassation by Edmond Picard (*Pasicrisie,* 1917, I, p. 275). Later, he also included such a defence in his preface to the 110th volume of the Pandectes Belges: E. Picard, *La législation, la juridiction, la contrainte dans le droit de la guerre,* Pandectes Belges, 110 (1919), p. XXIV-XXVIII.

the constitutional principles. According to the Court, the decree-law of 11 October 1916 therefore had the force of law. The chamber of indictment of Liège had rightly declared itself incompetent with regard to the offence against the safety of the State with which Geubelle had been charged[118].

Despite this judgement, the force of law of the decree-laws of 11 October 1916 and 8 April 1917 concerning the crimes and misdemeanours against the safety of the State was still being contested[119]. The Court of Cassation therefore repeated its standpoint clearly in the judgement of 4 June 1919 in the criminal case against Guillaume Van Dieren, who had already been prosecuted before the court-martial of Brabant on 31 January 1919 on account of Activism and malicious informing to the enemy (infringements of articles 118*bis* and 121*bis* which had been inserted into the Criminal Code of Belgium by a decree-law of 8 April 1917). On that occasion, his advocate had invoked that the decree-laws of 11 October 1917 and 8 April 1917 could not be applied because they contravened article 26 of the Constitution[120]. The military public prosecution office of Brabant realised that an important precedent hung in the balance and submitted an extensive defence[121]. Many of the arguments of this defence were taken over almost verbatim in the judgement that the court-martial of Brabant pronounced on 31 January 1919[122]. Referring to the above-mentioned article 43 of the Hague Convention and the above-mentioned judgements of the Court of Cassation of 20 may 1916 and 5 June 1917, the court-martial first established that the sovereignty of the Belgian state had continued to exist integrally during the war, both in the occupied and in the unoccupied territory[123]. Referring to the judgement of the Court of Katanga of 2 September 1916, the court-martial then pointed out that this national sovereignty essentially entailed the permanent authority

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118 Court of Cassation 11 February 1919 with preliminary findings of chief public prosecutor Terlinden, *Pasicrisie*, 1919, I, p. 9-16.

119 For example: on 7 February 1919 in the criminal case against the political collaborators Jules Vanden Bussche and Raymond Jonckx (*Pasicrisie*, 1919, III, p. 74-75), on 10 April 1919 in the criminal case against the political collaborator Joseph De Belie (Brussels, State Archive 2. Depot J. Cuvelier, *Military prosecutors and drumhead courts martials 1914-1919*, 1272, judgement 67) and on 18 April 1919 in the criminal case against the political collaborator Louis Craeybeckx (*Ibidem*, judgement 81).

120 'Conclusions pour Van Dieren prévenu contre le Ministère public' in Brussels, State Archive 2, *Court of Military Appeals Files 1915-1954*, box 137, file 155.

121 'Affaire van Dieren. Conclusions de Mr. L'Auditeur militaire' (29 January 1919), Brussels State Archive 2, *Court of Military Appeals Files 1915-1954*, box 137, file 155.

122 Court-martial of Brabant 31 January 1919, *Pasicrisie*, 1919, III, p. 1-8.

123 The sovereignty of the Belgian state had, in other words, not passed to the German occupier, as the German General Governorate claimed: advice of the General Governorate of 4 January 1915 which is cited verbatim in the judgement: *Pasicrisie*, 1919, III, p. 2-3.

to legislate for both the occupied and the unoccupied territory. This meant that if one or several branches of the legislature could no longer function, the remaining, functioning branches had the right to exercise this legislative power independently. As a result, the King could take legislative actions independently after he had found that the legislative chambers could no longer meet. The decree-laws which the King enacted therefore had the force of law. According to the court-martial, this force of law was not based on the so-called emergency powers legislation, which had been appealed to in the past too often to justify flagrant infringements of the law, but on the principle of the permanence of national sovereignty which could not entail that this sovereignty was no longer practised when one of the bodies which normally practised it was no longer able to. This principle therefore also entailed that, if one of these bodies stopped functioning, the exercise of sovereignty passed by operation of law to the most suitable body. Such a transfer of competences did not therefore entail a suspension or infringement of the Constitution. It was merely an application of the Constitution to a case that the constitutional legislator had not anticipated[124].

Van Dieren appealed against this judgement and his advocate repeated all of the arguments which he had already used at first instance. He added that the last reasoning of the Court of Military Appeal in its judgement against Georges Belloy - namely that if the constitutional legislator had anticipated the war, he would without a doubt have granted the legislative power to the King - was a mere assumption that did not provide a legal basis for the decree-laws that the King had enacted independently. On the contrary, this assertion only confirmed that the Constitution did not allow the King to legislate independently. Given the circumstances of war, it was perhaps necessary that the King took certain measures, but this did not mean that these measures were 'laws' in the formal sense of the word and that courts had to comply with them as if they were fully-fledged laws. Suggesting otherwise amounted to claiming the Constitution could be infringed![125]

In its judgement of 15 February 1919, the Court of Military Appeals rejected Van Dieren's appeal because the fact that the King had legislated independently could be justified on the basis of the rule *Salus populi suprema lex esto* and the necessity to save the country by means of urgent legislative

[124] Court-martial of Brabant 31 January 1919, *Pasicrisie,* 1919, III, p. 1-8. Van Dieren was sentenced to five years' imprisonment and a fine of 1,000 francs.

[125] 'Conclusions pour Van Dieren' in Brussels, State Archive 2, *Court of Military Appeals Files 1915-1954,* box 137, file 155.

measures. According to the Court, the Nation had even given the King a tacit mandate to that end[126].

Van Dieren filed an appeal in Cassation against this judgement and was assisted by Louis André, a famous barrister at the Court of Appeal of Brussels, who vehemently contested the legislative power of the decree-laws in an extensive statement. According to André, the King had rightfully taken a number of measures during the war which, given the state of emergency at that time, were necessary to maintain public order and defend the country. On the basis of article 67 of the Constitution, these measures had a generally binding character, but as decisions of the executive power rather than as decisions of the legislative power. If articles 25, 26, 67, 78 and 130 of the Constitution were taken into account, these decisions could at most fill a couple of gaps in the legislation. They could certainly not amend or abolish existing laws. In addition, they were subject to article 107 of the Constitution which allowed courts to test their legality and constitutionality[127].

In its judgement of 4 June 1919 the Court of Cassation briefly repeated that the national sovereignty had been fully preserved during the occupation of most of the country's territory, that the legislative power was an essential part of this national sovereignty and that the King could exercise this legislative power independently and could take all measures which he deemed necessary for the defence of the country and the safeguarding of its vital interests when the other branches of the legislature no longer functioned. According to the Court of Cassation, there was no difference between the laws which were established jointly by the King, the Chamber of Representatives and the Senate in times of peace and the laws that the King established independently in times of war. The decree-laws that had been enacted during the war therefore had the force of law and in application thereof Van Dieren could be sentenced to a fine and a prison sentence by the court-martial of Brabant[128].

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126 Court of Military Appeals 15 February 1919, Brussels, State Archive 2, *Court of Military Appeals Files 1915-1954*, box 137, file 155. Original of the judgement in Brussels, State Archive 2, *Court of Military Appeals Judgements,* 116, judgement 155. Part of the judgement was published in the findings of chief public prosecutor Terlinden in the Van Dieren case before the Court of Cassation, *Pasicrisie*, 1919, I, p. 99-99 and *La Belgique judiciaire*, 77 (1919), col. 1270-1271.

127 'Mémoire pour G. Van Dieren, demandeur en cassation d'un arrêt rendu par la Cour Militaire, le 15 février 1919, en sa cause contre le Ministère public, submitted to the registry of the Court of Cassation on 3 April 1919.

128 Court of Cassation 4 June 1919 concerning Guillaume Van Dieren, with preliminary findings of chief public prosecutor Terlinden, *Pasicirisie*, 1919, I, p. 97-100.

Judicial control of the absolute necessity of the decree-laws?

The classical theory of emergency powers legislation stated that, in exceptional circumstances such as a war or internal uprisings, the highest authority of the state had the right to take measures which could contravene the fundamental rights and freedoms when these measures were absolutely necessary for the continued existence of the state or the safeguarding of its vital interests. The decree-law of 11 October 1916 granted a number of special competences to the military authorities who allowed them to infringe constitutional rights and freedoms in so far as this was in the interest of the defence of the country and the safety of the army. This caused some judges to ask whether they, also being a manifestation of the national sovereignty, had the duty to check whether the measures which the King took in a decree-law were absolutely necessary to safeguard the existence of the state of Belgium or its vital interests. Besides, they wondered what the sanction was when these criteria were not respected.

In its judgement of 2 September 1916 the Court of Appeal of Katanga - which, as has been demonstrated above, combined the classical theory of emergency powers legislation with the theory of the permanence of national sovereignty - gave a twofold answer to this question. In so far as the decree-law of 15 September 1915 had the force and the value of a law enacted by the legislature, the Court deemed that the judge did not have the right to assess the motifs or reasons of necessity that justified the decree-law (application of the classical case-law of the Court of Cassation since 23 July 1849). The reason for this was that the judge - in application of article 107 of the Constitution - did not have the right to assess the appropriateness (and the constitutionality) of a law. However, when the decree-law concerned the exercise of an extraordinary competence that contravened the Constitution and that could only be justified by an absolute necessity, it was the duty of the judge to concretely assess the absolute necessity of the decree-law. That being said, in the given circumstances and because of his role, the judge could only contest this absolute necessity when the legislator was apparently abusing the extraordinary circumstance that the legislative chambers could not meet and the fact that he had been granted the entire legislative power. According to the Court, this was not the case for the decree-law of 15 September 1915[129].

[129] Court of Appeal of Katanga 2 September 1916, *Pasicrisie*, 1916, II, p. 23-24.

In its judgements of 9 September 1916[130], 13 September 1917[131] and 14 November 1917[132] the Court of Military Appeal only based itself, as has been explained above, on the classical theory of emergency powers legislation in order to justify the decree-laws. The Court therefore indicated each time that it was determined to acknowledge the validity of the decree-laws and to apply them in so far as they had been inspired by the necessity of maintaining the public order, the defence of the country and the vital interests of the country. The Court always concluded that the decree-laws were inspired by these motifs, but it never provided a concrete justification. The court-martial of the Belgian supply base in Calais and the court-marital of Le Havre did provide such a justification when they granted the force of law to the decree-laws of 18 November 1915 and 16 June 1916 on 26 May 1917[133] and 10 October 1917[134]. According to these court-martials, both of these decree-laws answered an urgent need, namely the safeguarding of the smooth functioning of military justice which was jeopardised by the circumstances of war.

In an article called 'La constitutionalité et la rétroactivité des lois', which appeared in the authoritative series 'Le droit et la guerre' in 1918, the famous lawyerVictor Yseux radically turned against these judgements pronounced by the Court of Military Appeal. He alleged that they wrongfully arrogated themselves the right to assess not only the appropriateness, but also the constitutionality of the decree-laws. Referring to the classical treatises on public law such as A. Girron and P. Errera[135] and the consistent case-law of the Court of Cassation since 23 July 1849[136], Yseux vehemently pleaded for these military courts to stop engaging in judicial control of the absolute necessity of the decree-laws and to refrain from any testing of decree-laws against the constitution or criteria of appropriateness out

130 Court of Military Appeal 9 September 1916 about Georges Belloy, *Pasicrisie*, 1919, II, p. 88.

131 Judgement of 13 September 1917 concerning Jean Masui and his associates, *Pasicrisie*, II, 1919, p. 125 and C. De Jongh and V. Yseux, *Le droit*, I, 1917, p. 571.

132 C. De Jongh and V. Yseux, *Le droit*, I, 1917, p. 712-715.

133 Court-martial of the supply base of the Belgian army, Calais, 26 May 1917, Brussels, State Archive 2, *Military prosecutors and drumhead courts martials 1914-1919*, 1445, judgement 594-599.

134 Court-martial of the third army division 10 October 1917, State Archive 2, *Court of Military Appeals Files 1915-1945*, box 137, file 160.

135 A. Giron, *Dictionnaire de droit administratif et de droit public,* s.l. 1895-1896; P. Errera, *Traité de droit public belge. Droit constitutionnel. Droit administratif,* Brussels 1918.

136 Court of Cassation 23 July 1849, *Pasicrisie*, 1849, I, p. 443. More information can be found in R. Van Caenegem, *The 'Rechtsstaat'*, p. 188, who refers to *Pasicrisie*, 1849, I, p. 443 and M. Barzin, *La constitutionalité des lois*, *Académie royale de Belgique. Bulletin de la Classe des Lettres*, 52 (1966), p. 335-350.

of respect for the principle of the separation of powers and the traditional ascendancy of the legislature over the two other powers[137].

After the liberation of the country, the court-martial of Brabant, which, as has been mentioned above, was the first court that only used the theory of the permanence of national sovereignty to justify the decree-laws, was also the first court to side with Yseux. In answer to the claims of Van Dieren's advocate that the decree-law of 8 April 1917 had not been necessary because it only punished acts for which appropriate punishments were already provided by the criminal code of 1867, the court-martial very clearly stated in its judgement of 31 January 1919 that judges were allowed to check whether the legislative power was exercised by a body that had received legislative competences on the basis of the Constitution or, as in this case, the Constitution and the principles of national sovereignty. However, the court-martial also stated that judges encroached on the privileges of the legislature and the principle of the separation of powers if they arrogated themselves the right to assess whether this legislature (including the King who had to act independently in times of war) had acted out of an absolute necessity or not. For the same reasons, the court-martial was of the opinion that the judge was not allowed to assess whether a decree-law contravened the Constitution[138].

Eight days later, the court-martial of the Grand Headquarters took the same standpoint during the criminal proceedings against the political collaborators Jules Vandenbussche and Raymond Jonckx. In its judgement of 7 February 1919 it stated 'que les tribunaux ont pour mission d'appliquer les lois et que du principe de la séparation des lois ils ne peuvent, sans sortir des limites de leur compétence, juger de la constitutionalité ou de l'opportunité des lois.'[139] A little over two months later, the same court-martial repeated this standpoint in the lawsuits against the political collaborators Joseph De Belie[140] and Louis Craeybeckx[141]. In the criminal case against Gustave

137 V. Yseux, *La constitutionalité et la rétroactivité des lois,* C. De Jongh and V. Yseux (ed.), *Le droit*, 2, p. 17-29.

138 Court-martial of Brabant 31 January 1919, *Pasicrisie*, 1919, III, p. 6.

139 Court-martial of the Grand Headquarters 7 February 1919, *Pasicrisie,* 1919, III, p. 74-75 and *Journal des tribunaux*, 1919, col. 148-150. Confirmed by the Court of Military Appeals on 5 April 1919, Brussels, State Archive 2, *Court of Military Appeals Judgements 1849-1940*, register 126, judgement 242-243.

140 Court-martial of the Grand Headquarters 10 April 1919, Brussels, State Archive 2, *Military prosecutors and drumhead courts martials*, 1272, judgement 67: 'Aangezien de rechtbanken enkel belast zijn met de wetten toe te passen en dat het hun geenszins is toegelaten de wettelijkheid eener wet te vorschen.' [Since the courts are only charged with the application of the laws and are by no means permitted to assess the legality of a law.]

141 Court-martial of the Grand Headquarters 18 April 1919 concerning Louis Craeybeckx, Brussels, State Archive 2, *Military prosecutors and drumhead courts martials 1914-1919*, 1272, judgement 81.

Derbaudringhien, however, in the same period the Court of Military Appeal decided that the decree-law of 8 April 1917 was a real law which the courts had to apply 'sans qu'il leur soit permis de le juger'[142].

In his findings in the criminal case against Van Dieren before the Court of Cassation, Louis André made a last attempt at having the judicial control of the absolute necessity of decree-laws acknowledged. In his statement of 3 April 1919 he therefore claimed that, even when it was assumed that the decree-laws were fully-fledged laws, they were only justified in so far as they were absolutely necessary to meet a public need and that this absolute necessity was lacking when the decree-law regulated certain matters which had been properly regulated in an earlier law. The latter was the case, according to André, for the decree-law of 11 October 1916 which gave the military courts the competence to prosecute offences against the safety of the State when they had been committed by ordinary citizens because articles 8, 94 and 98 of the Constitution and article 20 of the law of 15 June 1899 had already granted this competence in a very clear manner to the ordinary courts. The decree-law of 8 April 1917 as well was entirely superfluous according to André: the matter which was regulated in article 121*bis* of the criminal law (malicious informing to the enemy) had already been regulated properly in articles 445 and following of the Belgian criminal code which punished the filing of defamatory reports. Moreover, the Court of Cassation had already decided on 29 November 1915[143] that this included defamatory reports to the German enemy.[144]

In its judgement of 4 June 1919, the Court of Cassation refuted this standpoint by pointing out that the King - in his capacity as the only remaining branch of the legislature - was competent to take the measures which he deemed necessary for the defence of the country and the safeguarding of its vital interests in the decree-laws of 11 October 1916 and 8 April 1917. In addition, the Court stated that, contrary to what André alleged, there was no difference between ordinary laws and decree-laws.[145] With the latter statement, the Court meant to say that the judge could assess neither the appropriateness nor the constitutionality of the decree-law. In other words,

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142 *Journal des tribunaux*, 34 (1919), col. 248.

143 Court of Cassation 29 November 1915, *Pasicrisie*, 1915-1916, I, p. 207.

144 'Mémoire pour G. Van Dieren, demandeur en cassation d'un arrêt rendu par la Cour militaire, le 15 février 1919, en sa cause contre le Ministère public', submitted to the registry of the Court of Cassation on 3 April 1919, p. 6-7 in the file of Guillaume Van Dieren.

145 Court of Cassation 4 June 1919 concerning Guillaume Van Dieren, with preliminary findings of attorney generalTerlinden, *Pasicrisie*, 1919, I, p. 97-110.

the Court once again took the standpoint which it had taken with regard to the principle of the separation of powers nearly seventy years ago, on 23 July 1849[146].

This meant that the Court of Cassation did not seize upon the circumstances of war to define the relations between the judicial and the legislative powers more clearly. It did not argue, like article 15.1 of the ECHR and article 4.1 of the ICCPR currently prescribe, that exceptional derogating measures that contravene the constitution are only possible when they are absolutely necessary (Fr. *strictement nécessaire,* Eng. s*trictly required*). This would have enabled a judicial control of the proportionality of such derogating measures[147] and would have been a new step in the development of a more perfect rule of law in Belgium[148].

The immediate effect of the decree-laws

Between 1915 and 1918 the decree-laws were established by the Belgian government in Le Havre, passed and promulgated by the King, and published in the Belgian Official Journal, which was printed in Le Havre and delivered to the authorities in the unoccupied territory. The Germans already forbade the distribution of the Official Journal in the occupied area on 15 October 1914[149] so that the issues of the Official Journal that contained the decree-laws were no longer delivered to the courts, municipal and other authorities in the occupied territory. Exceptionally, some copies were clandestinely smuggled into the country or the substance of some

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146 Court of Cassation 23 July 1840, *Pasicrisie*, 1849, I, p. 443. Additional information can be found in R. Van Caenegem, *The 'Rechtsstaat*', p. 188, who also refers to *Pasicrisie,* 1849*,* I, p. 443 and M. Barzin, *La constitutionalité des lois, Académie royale de Belgique. Bulletin de la Classe des Lettres*, 52 (1966), p. 335-350.

147 *Transversale bepalingen*, p. 89.

148 The principle of the inviolability of the law was set aside for the first time in the Franco-Suisse Le Ski judgement, through the priority of international law. In 1988 the Court of arbitration was given the competence to check whether laws were in contravention of article 24 of the Constitution (freedom of education) and articles 10 (principle of equality) and 11 (principle of non-discrimination) and 24 of the Constitution. On 21 April 2003 the Constitutional court was given the competence to test all laws against all constitutional rights and freedoms in title II of the Constitution, as well as against articles 170, 172 and 191 of the Constitution: A. Alen and K. Muyle, *Handboek van het Belgisch Staatsrecht*, Antwerp, 2011, p. 43, 496-501 and 521-528.

149 *Bulletin officiel des lois et arrêtés du gouvernement allemand pour le territoire belge occupé*, nr. 8 of 15 October 1914; *La Belgique judiciaire*, 77 (1919), col. 301.

decree-laws became public via Dutch or Belgian Activist newspapers[150], but in general no one in the occupied territory had knowledge of these decree-laws. Therefore, they were not even applied by the Belgian administrative and judicial authorities who were familiar with them. After some Senators and representatives complained about Pieter Tack, August Borms, Jacob Lambrichts and other political collaborators of the Council of Flanders, the Court of Appeal of Brussels, for example, only based itself on articles 104 and 115 subsection 5 of the Belgian Criminal Code and not on the more suitable article 118*bis* of the criminal law, which had been introduced by a decree-law of 8 April 1917, to charge the attorney generalof Brabant with the criminal prosecution of these political collaborators[151].

In the occupied territory many ordinary courts[152], as well as the Courts of Appeal of Ghent[153], Brussels[154] and Liège[155] decided several times that the (ordinary) Royal Decrees which had been established and published in the Official Journal in the unoccupied territory did not have binding power for the inhabitants of the occupied territory because the dissemination of the Official Journal in which they had appeared was at best very limited in the occupied territory and the inhabitants had therefore not been able to acquaint themselves properly with the new laws. The Court of Appeal of Liège even declared several times that the application of legal provisions with which citizens could not acquaint themselves, was tyrannical and despotic[156].

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150 In his findings in the Van Dieren case, the military prosecutor of Brabant referred to an article in the *Nieuwe Rotterdamsche Courant* of 14 April 1917 and an article in *La Belgique* of 8 May 1917 - copied from *La Gazette de Cologne* of 6 May 1917, which described the decree-laws of 8 April 1917. (Brussels, State Archive 2, *Court of Military Appeals . Files 1915-1945*, box 135, file 155). The court-martial of Brabant adopted it in its judgement of 31 January 1919, *Pasicrisie*, 1919, III, p. 7.

151 L. André, *La publication des arrêtés-lois*, Journal des tribunaux, 1919, col. 314 and *Pasicrisie*, 1919, I, p. 101; *Une page de gloire de la magistrature belge*, Journal des tribunaux, 1919, col. 946-952; A. Jonckx, *Belgica juris*, p. 15-17.

152 For example Hasselt 19 January 1916, *Pasicrisie*, 1915-1916, II, p. 366-367; district court of Brussels, 29 July 1916, *Pasicrisie*, 1919, III, p. 28. A reference to other judgements can be found in A. Jonckx, *Belgica juris*, p. 9-14.

153 Ghent 1 February 1916, *Pasicrisie,* 1915-1916, II, p. 207-209; Ghent 7 February 1916, *Pasicrisie*, 1915-1916, II, p. 220-221.

154 Brussels 27 July 1916, *Pasicrisie,* 1915-1916, II, p. 309-311; Brussels 26 March 1916, *Pasicrisie*, 1917, II, p. 167.

155 Liège 29 December 1915, *Pasicrisie,* 1915-1916, II, p. 246-248; Liège 5 January 1916, *Pasicrisie,* 1915-1916, II, p. 181-183; Liège 23 February 1916*, Pasicrisie*, 1915-1916, II, p. 213-214; Liège 15 July 1916, *Pasicrisie,* 1917, II, p. 182-183; Liège 28 June 1917 *Pasicrisie*, 1917, II, p. 22-24.

156 Liège 5 january 1916, *Pasicrisie*, 1915-1916, II, p. 182; Liège 23 February 1916, *Pasicrisie*, 1915-1916, II, p. 214; Liège 28 July 1917, *Pasicrisie*, 1917, II, p. 22-24.

This administration of justice followed the unanimous nineteenth-century Belgian legal doctrine[157] and the French doctrine and case-law[158] which derived this standpoint from article 1 of the 'Code Civil'. This article determined that the laws which had been promulgated by the emperor only had to be applied in each part of the empire from the moment that it was possible for people in that region to have knowledge of its promulgation (Fr. *'en pourra être connue'*). Different time periods after the expiry of which it was presumed 'juris et de jure' that citizens 'could' know the laws were introduced. According to the same doctrine and case-law, this (French) system entailed, among other things, that if a department was occupied by a foreign power or had been so ravaged by a flood or another disaster that communication between the department's principal town and Paris was no longer possible, the laws which had been published in the Official Journal did not have binding power in that department for the duration of the occupation or the disaster[159].

During the occupation of Belgium, the Court of Cassation shared this view and determined, for example in a judgement of 30 October 1916, that the fact that interested parties had not been notified of a Royal Decree or that this decree had not been published in a certain municipality allowed a judge on the merits to deduce that this Royal Decree had not amended an earlier legal measure[160]. In a judgement of 13 November 1916 the same Court decided, on the basis of a conclusion to that effect of Advocate General Paul Leclerq, that the irrefutable presumption that everyone is expected to know the law applied in times of peace, in an unoccupied country where communication between the different authorities was possible and where there were no problems with the dissemination of the Official Journal, but not in a country that was in a state of war and which was occupied by an enemy. In the latter case, the judge on the merits was allowed to assess whether the proclamation of the Royal Decree that was invoked had happened in a regular manner and was of such a nature that citizens were able to acquaint themselves with it[161]. Finally, in a third judgement of 5 July 1917 the Court

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157 L. André, *La publication*, col. 283-284, who refers to J. Thonissen, *Constitution belge annotée, offrant sous chaque article, l'état de la doctrine, de la jurisprudence et de la législation,* Hasselt, Millis, 1844, art. 69, nr. 312, F. Laurent, *Principes de droit civil,* Brussels, 1887, I, nr 17); E. Arntz, *Cour de droit civil Français*, Paris, 1863, I, nr. 35; Schiks, *Revue pratique du Notariat*, 1919, p. 17 and Thiry, *Cours de droit civil*, nr. 9.

158 P. Laband, *Le droit public de l'Empire allemand*, Paris, 1901, p. 372.

159 *Ibidem*, p. 372.

160 Court of Cassation 13 October 1916, *Pasicrisie*, 1917, I, p. 291-292.

161 Court of Cassation 13 November 1916, *Pasicrisie*, 1917, I, p. 54-55; *La Belgique judiciaire*, 77 (1919, col. 293-295). Also see Cassation 30 October 1916, *Pasicrisie,* 1915-1916, I, p. 291-293.

of Cassation determined that the publication of a Royal Decree in the Belgian Official Journal and the expiry of a certain time period resulted in an irrefutable presumption that citizens had been able to acquaint themselves with this decree, unless it was proved that force majeure had made it impossible for these citizens to familiarise themselves with the decree[162]. In his preliminary findings, Advocate General Janssens pointed out that on 15 October 1914 the Germans prohibited the distribution of printed matter without their permission in the occupied area. This prohibition resulted in an insurmountable obstacle that prevented the regular dissemination of the Belgian Official Journal. Consequently, it had to be presumed that the citizens in the occupied territory no longer had knowledge of the decrees enacted by the King in the unoccupied territory[163].

After the liberation of the country (October-November 1918), the advocates of those who were criminally prosecuted for an offence against the safety of the State[164] which had been committed in the occupied territory before the liberation, of course eagerly invoked this case-law to ask for their clients' acquittal. These lawyers argued that the decree-laws, and in particular the decree-law of 11 October 1916 concerning the state of war and the state of siege, the decree-law of 11 October 1916 concerning misdemeanours and crimes against the safety of the State and the decree-law of 8 April 1917 concerning offences against the external safety of the State, could not be applied to their clients because the issues of the Official Journal in which these penal decree-laws had been published had not - or only to a limited extent - been distributed in the occupied territory. Pursuant to article 129 of the Constitution[165], these decree-laws were therefore not binding for their clients[166].

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162 *La Belgique judiciaire*, 77 (1919), col. 301.

163 *La Belgique judiciaire*, 77 (1919), col. 301. Additional information about these judgements can be found in the findings of attorney general Terlinden that preceded the judgement of the Court of Cassation of 7 February 1919 in the Geubelle case*, Pasicrisie,* 1919, I, p. 14-15 and the findings of attorney generalr Terlinden preceding the Cassation judgement of 4 June 1919 concerning Guillaume Van Dieren, *La Belgique judiciaire*, 1919, I, col. 1274-1276.

164 On the basis of articles 104 (Activism), 115 paragraph 4 (economic collaboration), 115 paragraph 5 (Activism), 116 (espionage), 118*bis* (Activism) or 121*bis* (malicious informing to the enemy) of the Belgian criminal code.

165 This article of the Constitution determined that no law, decree or regulation of a general, provincial or municipal authority was binding unless it had been promulgated in the manner determined by the law.

166 For example the findings of the advocate Jean Vanparys in the criminal case against the political collaborator Robert De Wael (Brussels, State Archive 2, *Court of Military Appeals . Files 1915-1945*, box 155 B, file 700/1919), the conclusions of the advocate Lebon in the criminal case against the political collaborator Hyppolite Manssens (*Ibidem*, box 149, file 516/1919), the findings of the advocate de Mortier in the criminal case against the informer Gustave Derbaudringhien (*Ibidem*, box 137, file 154/1919), the findings of the advocate Van Eecke and the statement of the advocate Louis André in the criminal case against the informer Guillaume Van Dieren (*Ibidem*, box 137, file 155/1919).

The Belgian government in Le Havre had anticipated this defence and had therefore laid down in article 2 of the decree-law of 8 April 1917, which determined the effect of the measures taken by the German and the Belgian government, that 'the decree-laws which had appeared in the Official Journal during the war, were binding in the entire Kingdom (i.e. in the unoccupied as well as in the occupied territory) and that the administrative and judicial authorities had to apply the decree-laws as soon the territory was liberated and without a new publication of the decree-law being necessary'[167]. It was only from the government's report to the King that preceded this decree-law that one could derive the intention behind this decree-law, which was that the Belgian judicial authorities had to apply the decree-laws to offences which had been committed in the occupied territory after the entry into force of these decree-laws[168]. The decree-law of 8 April 1917 concerning the crimes and misdemeanours against the safety of the State, for example, which inserted articles 118*bis* (political collaboration) and 121*bis* (malicious informing to the enemy) into the Belgian Criminal Code, had to be applied to all cases of political collaboration and malicious informing that had occurred since 13 April 1917. This was so because the decree-law of 8 April 1917 had appeared in the Belgian Official Journal of 13 April 1917 and its third article determined that it entered into force on the day of its publication in the Official Journal[169].

The defence lawyers of the prosecuted people raised the following objections against this government report. (1) The report did not have any legal value. (2) Their clients had only been able to acquaint themselves with the decree-law of 8 April 1917 which determined the effect of the government decisions after the liberation and this decree-law therefore only became binding for their clients after the liberation. (3) The literal text of this decree-law of 8 April 1917 (without the commentary in the report to the King) allowed the decree-law to be interpreted in the previous sense. (4) If one applied the penal decree-laws of 11 October 1916 and 8 April 1917 concerning crimes and misdemeanours against the safety of the State to crimes and misdemeanours which had been committed before the liberation of the country, these penal decree-laws were applied retroactively to behaviour with regard to which the defendants could not have known that

167 *Pasinomie*, 1917, p. 14.
168 *Pasinomie*, 1917, footnote on p. 1415.
169 *Pasinomie*, 1919, p. 14.

it was punishable. This amounted to a contravention of the general legal principle of the non-retroactivity of the criminal law[170].

The public prosecutors' offices, led by attorney generalTerlinden of the Court of Cassation realised very well that the continued application of the wartime case-law concerning the binding character of laws would have as a consequence that the majority of those who were guilty of economic, political or intellectual collaboration with the Germans would not be punished. This could have severe consequences: so shortly after the war, the population was bent on revenge. The politicians, who wanted to oblige the population, feverishly sought for a different solution and found it in a new interpretation of article 4 of the law of 18 April 1989, which was a verbatim citation of article 2 of the law of 28 February 1845 which determined: '*Les lois, immédiatement après leur promulgation, seront insérées au Moniteur qui remplacera, pour sa publication, le Bulletin des lois. Elles seront obligatoires dans tout le royaume, le 10e jour après leur publication à moins que la loi n'ait pas fixé un autre delai*'[171].

According to this new interpretation, which was defended in two anonymous footnotes in *Pasicrisie*[172] and *La Belgique judiciaire*[173], the law of 1848 was a radical breach with the (democratic!) French system that determined that laws were only binding after citizens had been able to acquaint themselves with them. According to this interpretation the only requirement for force of law had been since the law of 1848 that the law in question was inserted (*insérée*) into the Official Journal and that a certain term (10 days or less) had expired. The nation-wide dissemination of the Official Journal in which the law had been printed was a third condition which was no longer in the law. In other words: according to this new interpretation, the publication of the law happened when it was inserted into the Official Journal. Henceforth, the only objective of this insertion was to give the law an authentic character, not to familiarise the public

[170] See for example L. André, *La publication des arrêtés-lois*, Journal des tribunaux, 1919, col. 283-286, 302-304 and 312-318, which cite the (second) statement that André submitted to the Court of Cassation on 29 April 1919 in the criminal case against Guillaume Van Dieren.

[171] *Pasinomie*, 1845, p. 25-34. Translation: 'Immediately after their promulgation, the laws will be inserted in the Official Journal, which will replace the Collection of Laws and Decrees of Belgium. They will be binding throughout the Kingdom the tenth day after their publication unless the law itself has determined another term.'

[172] Footnote after a judgement of the Court of Appeals of Liège 26 February 1917, *Pasicrisie*, 1919, II, p. 182-187.

[173] 'Observations' after a judgement of the Court of Cassation 5 July 1917, *La Belgique judiciaire*, 77 (1919), col. 303-312. According to A. Jonckx, these anonymous footnotes were written by attorney generalTerlinden or one of his close associates: A Jonckx, *Belgica juris*, p. 29.

with it[174]. Even if a law was printed in the Official Journal and all of the copies containing that law had been left in a cupboard in the administrative department, the law in question was binding for citizens after the expiry of the period of ten days or less determined by the law. When a part of the territory of the Kingdom was occupied by an enemy or was inaccessible because of force majeure, the law was nevertheless binding for all of the inhabitants of that territory, even if it had been impossible for them to get acquainted with it[175]! According to its proponents, this (authoritarian or dictatorial) interpretation was based on a literal interpretation of article 2 of the laws of 1845 and 1898 - although no one had reinterpreted these laws in this manner before 1919[176] - and on the Prussian system of promulgating laws as determined in article II of the Constitution of the German Empire of 1871 that was described extensively by Paul Laband in his *Le droit public de l'Empire allemand*, Paris, 1901[177].

The court-martials and the Court of Military Appeal were all too pleased to blindly follow this interpretation after the liberation of the country. Sometimes they added sarcastically that they were not allowed to assess the appropriateness and constitutionality of the decree-law of 8 April 1917 which determined the effect of government decisions.

The court-martial of the Headquarters of the Army was the first to do this, namely on 23 January 1919 in the criminal case against Robert De Waele, the very first person to be prosecuted on account of political collaboration (infringement of articles 104, 115 subsection 5 and 118*bis* of the criminal law). His advocate contested the force of law of the decree-laws of 8 April 1917 and 11 October 1916 because the inhabitants of the occupied territory had not been able to consult the Official Journal to familiarise themselves with the decree-laws that were promulgated in the unoccupied territory. The court-martial pointed out in its judgement of 23 January 1919 that according to article 4 of the law of 18 April 1898 it sufficed that a law was inserted into the Official Journal (the French text next the Dutch text) in order for this law to become binding for the entire Kingdom of Belgium on the tenth day after its publication or at an earlier date when the law so determined. According to article 4 of the law of 18 April 1898, as soon as

174 Footnote in *Pasicrisie*, 1919, II, p. 184.
175 L. André, *La publication*, col. 284; P. Laband, *Droit public*, p. 373-374.
176 L. André, *La publication*, col. 304.
177 P. Laband, *Droit public*, p. 338 and 373-374; Findings of attorney generalTerlinden preceding the judgement of the Court of Cassation of 4 June 1919 in the Van Dieren case, *La Belgique judiciaire*, 77 (1919), col. 1278; L. André, *La publication,* col. 311-312.

the law was published in the Official Journal there was therefore a presumption 'juris et de jure' that everyone knew the law[178].

The court-martial of Brabant endorsed this position in its judgement of 31 January 1919 in the criminal case against Guillaume Van Dieren. Following the example of the Court of Appeal of Liège - which had loudly proclaimed on 28 July 1917 that it was despotic and tyrannical to subject citizens to legal provisions that they could not know, but radically changed its opinion on this matter on 24 December 1918[179] - the court-martial of Brabant also pointed out that according to article 2 of the decree-law of 8 April 1917, the mere inclusion of a decree-law in the Official Journal (which was only disseminated in the unoccupied territory) was enough to make this decree-law binding in the occupied territory. According to the court-martial, this article 2, being an indispensable corollary of the practice of national sovereignty in the legislative field, neither impaired the Constitution nor entailed a suspension of this Constitution. It merely rendered the regular rules of publication for laws temporarily ineffective because of extraordinary circumstances[180].

It was only in its judgement of 11 February 1919 in the criminal case against Geubelle that the Court of Cassation also changed its opinion and began to support the (authoritarian) Prussian interpretation of article 2 of the law of 28 February 1845 and article 4 of the law of 18 April 1898 by proclaiming (without any motivation!) that the inclusion (Fr. *L'insertion*) of a law in the Belgian Official Journal was not meant to familiarise citizens with the law, but only to give it an authentic character so that, from that moment on, it could be assumed that everyone knew it[181]. Under the influence of attorney generalTerlinden, the Court repeated this view in its judgement of 4 June 1919 in the criminal case against Van Dieren. Basing itself on the fact that the laws of 28 February 1845 and 18 April 1899 did not determine that the law had to be disseminated among the citizens, the Court

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178 *Pasicrisie*, 1919, III, p. 33. This argument was repeated on 7 February 1919 in a judgement against Jules Van den Bussche and Raymond Jonckx (*Journal des tribunaux*, 74 (1919), col. 148-150) and on 18 April 1919 in a judgement against Louis Craeybeckx (Brussels, State Archive 2*, Military prosecutors and drumhead courts martials 1914-1919*, 1272, judgement 81). The latter was confirmed by the Court of Cassation on 27 April 1920*, Pasicrisie*, 1920, I, p. 124-125.

179 Chamber of indictment of Liège 30 December 1919 concerning Ory, *Pasicrisie*, 1919, III, p. 15-16. More complete text in *Jurisprudence de la Cour de Liège*, 1919, p. 90-93. Also see Chamber of indictment of Liège 18 January 1919 concerning Cerfontaine and his associates, *Pasicrisie*, 1919, II, p. 41-42.

180 Court-martial of Brabant 31 January 1919, *Pasicrisie*, 1919, III, p. 7.

181 Court of Cassation 11 February 1919 with preliminary findings by attorney generalTerlinden, *Pasicrisie,* 1919, I, p. 15.

determined, contrary to its three above-mentioned wartime judgements, that the inclusion of a decree-law in the official Journal and the expiry of a certain term sufficed to make a decree-law binding in both the occupied and the unoccupied territory. The immediate consequence was that the penal decree-laws, such as the decree-law of 11 October 1916 concerning the misdemeanours and crimes concerning the external safety of the State and the decree-law of 8 April 1917 concerning the crimes and misdemeanours against the safety of the State could be applied to an entire series of citizens who had committed a number of offences that answered to the description of the crimes and misdemeanours described in these decree-laws.

For purely political reasons[182], the Court of Cassation chucked out the entire nineteenth-century Belgian legal doctrine, as well as its own settled case-law concerning the binding character of laws. Pressurised by the attorney general, who was in his turn pressurised by the politicians and the public opinion, the Court of Cassation laconically opted for the authoritarian German system concerning the binding character of laws in order to punish the Belgians who had collaborated with the Germans. Shortly afterwards, the office of the attorney general at the Court of Cassation (Terlinden) gleefully published the judgement of 4 June 1919 in *Pasicrisie*[183] and in *La Belgique judiciaire*[184]. In a very cynical note, it added that the Belgian citizens could count themselves lucky because in the allegedly super-democratic England a law was already binding when the Parliament had taken cognizance of the fact that the King had passed the law. It did not need to be published in an official journal[185]! The magistracy had showed that it was prepared to make radical juridical changes … but at what ethical cost?

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182 More about this in A. Jonckx, *Belgica juris*, p. 30-35, who, being directly involved as an political collaborator, is of course exaggerating somewhat.

183 Court of Cassation 4 June 1919, *Pasicrisie*, 1919, I, p. 109-110.

184 Court of Cassation 4 June 1919, *La Belgique judiciaire*, 1919, I, col. 1269-1284.

185 *Ibidem*, col. 1284.

Laudatio Danny Segers

Dirk Ryckbosch

The Sarton medal is given to individuals active in the field of history of science. Today's medalist is prof.Danny Segers who is fortunately not yet part of that history, but he nevertheless already has some history behind him. He was born on August 15, 1951 in Tollembeek, close to Brussels. Until well into the '80s he would call this home, before permanently moving to Ghent. In the '60s we find him as a pupil at the Royal Atheneum of Herne and Halle. In 1969 the real student life begins at the -then- Ghent State University. In 1973 he earned the degree of Master of Science, Physics. The subject of his master's thesis was "Lifetime Measurements of positrons in annealed Be, Pt, Cd, Cu, Sn, Au, Ni and Si", and the theme is set for the first part of the academic career of prof.Segers: Nuclear methods (in this case, positron-annihilation) used in the study of materials.

He immediately started as researcher of the "IIKW", an associated fund of the FWO which has since disappeared. Prof.Robbrecht on that occasion wrote in his letter of reference: "He is a born experimenter with a sense of planning and precise work ... He has the talent and the gift of insistence (typical of an experimenter)." Prof. Robbrecht was quite right, because these are qualities that we'll see again and again in the career of our laureate.

In 1978, Danny Segers became "dr.Segers" with a work on the "Influence of temperature on positron annihilation equilibrium measurements", and in 1983 he became "Geaggregeerde voor het Hoger Onderwijs" with a dissertation on "Positron annihilation in metals". The next 2 years then see prof.Segers working in Delft and Leuven, before returning to Ghent in 1985. At this time he obtains a tenured position as logistics researcher with

the IIKW in the former Laboratory of Nuclear Physics. The subject of his research remains faithfully the use of positron annihilation in materials.

From 1997 he was first a visiting professor at Ghent University, and at the same time Director of Research at the FWO Research Foundation. In 2000 he joined with the other FWO researchers the ranks of the Ghent University ZAP as associate professor. In 2003 he became full professor, and in 2008 senior full professor.

Meanwhile, the big change was started in his study area. Prof.Segers had always worked closely with colleagues Maurice Dorikens in the "nuclear physics" part of his life. And in that same branch of the department of Subatomic and Radiation Physics we find also emeriti Christine Yserentant and Jos Uyttenhove. The interest these colleagues showed in the history of science also clearly resonated with Danny Segers. It is therefore not at all surprising that when Jos Uyttenhove became Director of the Museum of the History of Science, succeeding Maurice Dorikens, Danny Segers would become his Deputy Director (in 2005). He subsequently became Director of the Museum in 2007.

With youthful enthusiasm Danny Segers then went to work in what had now become "his" museum. A whole range of temporary exhibitions are organised: in 2007 around Bakelite and Baeckeland, in 2008 "Oog en Blik'' around optical illusions (a first collaboration with the art world), in 2009 "Micro, macro, mega" on the occasion of a large donation of microscopes, and another one about the impending demise of the lightbulb; in 2010 we see exhibitions on Minerals and on Gastronomy and in 2011 it is all about Geomatics. And this continues with the present exhibition on crystallography. Being reminded of Danny's love for the kitchen I can imagine what topics are among his most preferred.

In addition to temporary exhibitions, and changes in the permanent collection, there is also a continuous stream of shorter activities, often offered to school classes. Stimulating our future scientists with beautiful things from the past is a clear mandate for the museum. We see this also in a different area: for several years, students of Physics and Astronomy have chosen a bachelor project under the guidance of prof.Segers. We hear about the anorthoscope of Plateau, the cinemadisk of Duboscq, a historic solar telescope, discharge tubes, etc. Also students from other disciplines come to the museum for their master's or bachelor project. All this sometimes cul-

minates in official A1 publications about the historic scientific instruments. “A born experimenter with a sense of planning and precise work?” That was indeed a true prediction!

There was also external recognition for the operation of the museum: in 2007 the Museum for the History of Sciences received the prize of the public associated with the Flemish Museum Prize.

Modern museums do not escape the need for networking. Together with his collaborators Danny Segers has also been very active in this aspect. He is one of the founders of the Center for Technical, Scientific and Industrial Heritage (ETWIE), and he is co-founder of the Interuniversity Platform for Academic Heritage, a partnership of several Flemish universities. Within Ghent University, he coordinates the creation of the Ghent University Museums, where the collections of all university museums are brought together.

In short, someone with a broad knowledge of the field and with a tremendous commitment to our heritage in the form of scientific patrimony. It is therefore that prof.Danny Segers is a most worthy laureate of the 2014 Sarton Medal.

Aspects of the history of physics using old scientific instruments. Different stories behind one instrument

Danny Segers

I. Introduction

In 1815, the Northern and the Southern Netherlands together with Luxembourg were united in the United Kingdom of the Netherlands, Willem I being the king of this United Kingdom. It was under his regime that in 1817[1] the Latin speaking Ghent State University was inaugurated. After the independence of Belgium in 1830, French became the official academic language.

At the foundation of Ghent University, it was stipulated by law, that didactic collections had to be started up and used for teaching. These didactic collections form the basis of most of our museums at Ghent University.

Ghent University nowadays has seven museums. They are: the Archeological Museum, the Ethnographic Collections, the Museum for the History of Medicine, the Museum for Morphology, the Zoology Museum, the Botanical Garden and the Museum for the History of Sciences. The collections of the museums are actively managed so preservation and safeguarding is guaranteed.

Besides these collections, there are a large number of demonstration and research collections, spread all over the university, where no durable safeguarding is guaranteed.

[1] For more information see the following link (1st December 2014): https://www.ugent.be/nl/univgent/feiten

The museum collections can be divided in two groups: i) the actively used collections and ii) the heritage collections.
The core business of a university is teaching and research. It is logical that collections have to link up more with those core duties.
For the actively used collections, there is no problem: they are already actively used for teaching and/or research. Examples from the museum collections are: the Botanical Garden[2], the Zoology Museum and the Museum for Morphology.
It is not always expected that heritage collections can also contribute to teaching and research. However, in recent years, it has been proven that those heritage collections indeed contribute to teaching and research[3]. Bachelor projects, master dissertations, PhD research, … are often carried out with objects of those collections. It is of course clear that our very rich heritage collections are not sufficiently exploited for teaching and research, the reason being the teaching staff of the university is not sufficiently aware of the important potential those collections can offer.
However, in Flanders the academic collections of Ghent University hold a unique position. In a recent study on academic heritage in Flanders[4] it was demonstrated that Ghent University has the largest magnitude of academic collections: 82% of the academic heritage items in Flanders are present at Ghent University. All the more reason why it has to be stimulated that academic teaching should more actively use the museum collections.

The museum for the History of Sciences contains an important amount of instruments in connection with physics. In the teaching in exact sciences, physics has always been an important general subject taught in different curricula.
One of the major sub-collections is the Physics Cabinet of Joseph Plateau. The important role of Joseph Plateau in the timeline of Ghent University will be explained in the next paragraph. The work of Joseph Plateau will also be summarized.

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2 For example the Botanical Garden is actively used for fundamental research in the discipline of botany.

3 "Gentse Universitaire Musea: positionering, personeel en werkingsmiddelen"; Danny Segers, Willem Dedobbeleer; Supplement for the document for the Executive Board BC26/06/2014 ALG/3 of the 15th of April 2014.

4 G.Vanpaemel, I.Rotthier, T.Noordermeer, F.Scheelings, N.Proot, S.Leenknegt, "Balans en perspectief. Academisch Erfgoed in Vlaanderen", Interuniversitair Platform voor Academisch Erfgoed, ISBN 9789057284311, (2013), 54 pages

The main objective of this article is to show that old scientific instruments can be used to illustrate aspects of the history of physics. History of physics can be seen as consecutive evolutions in physics within a certain timeframe.
The Cabinet of Physics and the content of the physics course notes of Joseph Plateau will be used to illustrate aspects of the history of physics. Some case studies will be worked out (see paragraph III. We will also demonstrate those historic instruments can nowadays still be used for didactic demonstrations in the framework of contemporary courses in general physics. It has also been mentioned before that those historic instruments can also be deployed for bachelor projects, master dissertations and PhD research.

II. Joseph Plateau (1801 – 1883), his life and work in a nutshell

Joseph Antoine Ferdinand Plateau (figure 1) was an important physicist of Ghent University. He was born in Brussels on the 15th of October 1801 and died in Gent on the 15th of September 1883. The most complete survey of the life and work of Joseph Plateau can be found in the book by M.Dorikens[5].

a) His life, his studies and his work

Joseph Plateau became an orphan at very young age: he lost his mother at the age of 13 and shortly afterwards his father at the age of 14. Joseph, together with is two sisters Joséphine (1809 - 1894) and Nathalie (1803 - 1867), were placed under the guardianship of their uncle who was a layer. From 1817 till 1822 Joseph Plateau studied at the "Atheneum" in Brussels. From 1819 till 1822 Plateau is a pupil of Adolphe Quetelet[6] (1796 – 1874). The contacts with Quetelet will profoundly influence the life and work of Plateau. In 1822 his uncle guardian forces Plateau to enroll in the Philosophy Faculty of the University of Liège to start his studies of Law. Plateau obtains his candidate diplomas at that faculty[7].

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5 M.Dorikens, "Joseph Plateau 1801 – 1883, Living between Art and Science", (2001), ISBN 90-76686-06-8, 277 Pages

6 A.Quetelet obtained his doctorate in mathematics at Ghent university in 1819. He was a well-known Belgian astronomer, mathematician, statistician and sociologist. He founded and directed the Brussels Observatory in 1828.

7 On the 30th of July 1823 the diploma of "Candidate of Arts" and on the 31st of July 1824 the diploma of "Candidate of Law".

However Plateau was very much fascinated by science and three months after his law-degree he obtains the diploma of "Candidate in Physical and Mathematical Sciences" on the 26th of October 1824.

In 1827 Plateau becomes a mathematics teacher at the Atheneum in Liège. In the meantime Plateau does fundamental physics research on his own, without external guidance by a university supervisor. This will result in a doctoral thesis[8] in physical and mathematical sciences. On 12 March 1829 he sends his manuscript to Quetelet for his advice. He submits his thesis to the University of Liège where on the 9th of June 1829 he is admitted to the defense of his work. His thesis was the first doctoral thesis of the University of Liège which was written in French and not in the common Latin. The thesis contains the first results of research into the impression of colors on the retina (duration, intensity and color), the research into the combination of moving mathematical curves (locus), the observation of the deformation of moving figures and the reconstruction of deformed images (anorthoscopes). In his work he actually measured the persistence of visual impressions to be on average 0,34 seconds.

In 1830, due to health problems, Plateau has to resign from his teaching duties at the Atheneum in Liège. However he continues doing experiments.

In 1832 Plateau publishes an article[9] describing the construction and the action of a disc with 16 slits at the rim of the disc and 16 intermediate sectors[10]. If in the 16 sectors an identical figure is drawn, then one sees one stationary image, when looking through the slits at the revolving disk in a mirror. It was the brilliant contribution of Plateau, to draw not 16 identical figures in the sectors, but 16 figures each a little different from the other. If one now looks through the slits at the revolving disk in a mirror, the images now succeed one another very rapidly and they fade together due to the effect he described in his doctoral thesis: the persistence of visual impressions. In this way the effect of movement is created. He in fact produced the first animation film. This is maybe one of the inventions for which he is best known.

In the period 1833-1834 he lives in Brussels. Thanks to the intervention of Quetelet, Plateau is appointed as a physics teacher in the renowned "Institut Gaggia" in Brussels.

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8 J.Plateau, "Dissertation sur quelques propriétes des impressions produits par la lumière sur l'organe de la vue", 35 pages, Edited Dessain Liège (1829)

9 J.Plateau, "Sur un nouveau genre d'illusions d'optique", Corr. Math. et Phys. VII, p. 365 (1832)

10 Those disks were later on called phenakistiscope disks.

Figure 1: Photograph of Josep Plateau.

In 1835 he becomes professor at Ghent University. It is again Quetelet who has hand in this appointment.

The two predecessors of Plateau were Jean-Charles Hauff (1766 – 1846) and Charles Morren (1807 – 1858). They respectively taught physics and chemistry from 1817 till 1835[11]. The Cabinet de Physique, before Plateau, did not amount to anything. So Plateau decided to acquire an important collection of demonstration instruments. He managed to obtain special funds from the Belgian government and the administrator-inspector from Ghent University to build up a Cabinet de Physique. He often traveled abroad to order instruments from the best instrument makers of that time. He travelled to Paris, London and Berlin.

Following his numerous travels Plateau writes (see reference 11) on the 27nd of June 1843 to minister J.B.Nothomb[12] (1805 – 1881):

> *"... grâce aux subsides que le gouvernement m'a libéralement accordés, et aux dons que M.D'hane a bien voulu y joindre, le cabinet de physique de l'Université de Gand est maintenant l'un des plus remarquables de ceux qui existent. Je puis avancer cela avec connaisance de cause, car j'ai visité les collections scientifiques de la France et de l'Allemagne. ..."*

The curator of the Cabinet de Physiques is the instrument maker Jacques Bernaert (– 1850). In 1840 he accidently drops a small amount of oil into a mixture of water and alcohol. To his surprise, Plateau sees that spherical oil masses are formed. This is the onset for a new set of experiments and numerous articles[13]. He wonders which forces generate the spherical form. After numerous experiments he comes to the conclusion that it are forces

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11 A.M.Simon-Van der Meersch, "De academische loopbaan van Prof. Dr. J. Plateau", Uit het verleden van de RUG, 35, Editor K.De Clerck, Archive RUG, (1993)

12 Jean-Baptiste Nothomb was an important Belgian statesman and diplomat. He played an important role in the foundation of the Belgian state.

13 See ref. 5, p. 186

that act in a thin layer at the interface between the oil masses and the surrounding fluid. They are called "surface tension". Those studies belong to the great scientific achievements of Joseph Plateau.

In summary Joseph Plateau is well known for three reasons:

1. Due to his study of the persistence of the visual impressions and the construction of the phenakistiscope disk, he justifiably is called the father of film (rather the animation film).
2. For Ghent University he is the one who built up the famous Cabinet de Physique.
3. His great scientific achievement at Ghent University was the study of surface tension, a phenomenon that nowadays is still very important and which bears very important practical applications.

b) Plateau's Cabinet de Physique and his course notes at Ghent University

As mentioned in the foregoing paragraph, Joseph Plateau gathered an impressive collection of physics demonstration instruments. We now can say with certainty that those demonstration instruments were intensively used during the lectures of Plateau. Three student handwritten manuscripts are preserved in Ghent University library. These are the lecture notes of Emmanuel Boudin (academic year 1837-1838), César Alexandre Frédéricq (academic year 1839-1840) and Paul Voituron (academic year 1841-1842)[14]. In figure 2 a small section from the student lecture notes is illustrated.

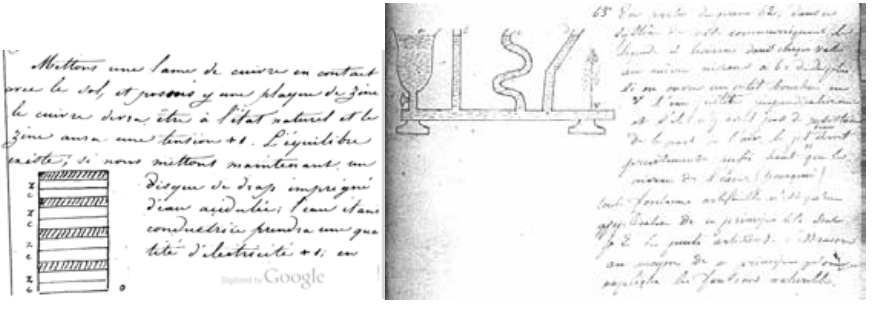

Figure 2: An excerpt from student course notes of respectively of P. Voituron (left) and C. Frédéricq (right)..

[14] The manuscripts can be found respectively under the numbers Hs 4142, Hs 27796 and Hs 11782.

As can be seen from the figure, the notes are handwritten in French. It is not always easy to decipher. However the general conclusion that can be drawn from the examination of the student lecture notes is that drawings of instruments of the Cabinet de Physique are present. A large number of the instruments depicted in the manuscripts are still present in the Plateau collection in the Museum for the History of Sciences.

III Some case studies related to the Cabinet of Physics and the lecture notes of Plateau

One should wonder if the Cabinet de Physique of Joseph Plateau can be used to illustrate aspects of the history of physics?
In what follows we will indeed illustrate that the Plateau collection and the student notes are an ideal starting point to communicate aspects of the history of physics. However we will have to limit us to some case studies.

In the aspect of science communication of the Museum for the History of Sciences, the Plateau collection can be explored on three levels: *i) the more general level*, where the Cabinet de Physique and its content is only mentioned as part of the main achievements of Plateau without profoundly illustrating the underlying physics aspects. *ii) the physics history level* where the Cabinet de Physique and the course notes are used to illustrate a number of physics principles and the evolution of the achievements in physics by different scientists. *iii) the level social relevance of science*. Here the Cabinet de Physique and the notes can be used to illustrate where important discoveries in physics still have applications in daily live.

The fact that instruments can be used to communicate science on different levels is what is meant by the subtitle “Different stories behind one instrument”.
In the case studies that follow a combination of physics history *and* social relevance of physics will be illustrated.

a) Air pressure and the barometer

In the following figure 3 a copy of three drawings from the lecture notes of C.Frédéricq (see ref. 14) is represented. These objects are still present in the collection of Plateau.

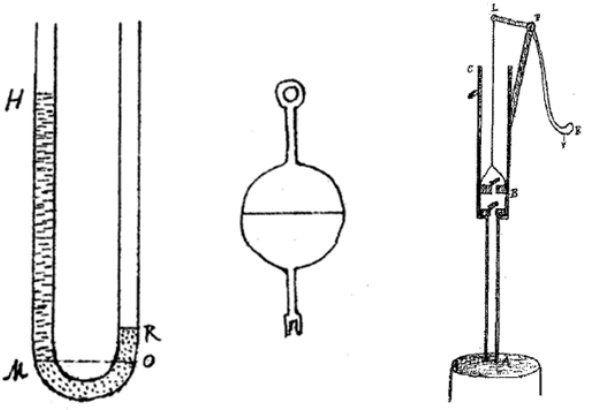

**Figure 3: drawings from the course notes of C.Frédéricq.
From left to right: illustration of equilibrium between different fluids,
Magdeburg hemispheres, the suction pump.**

The objects represented in figure 3 are connected with physics developments of the 17th century. The 17th century is known for the invention of six instruments that have had an enormous impact on the experimental science. Many of those instruments also have influenced practical applications in our daily live. The six instruments are represented in table 1.

The barometer and the vacuum pump have to do with the 17th century research on air pressure and the existence of a vacuum.

Research that led to the discovery of the barometer.

The 17th century was still dominated by Aristotle (384 – 322 B.C.) doctrine[15] on the horror vacui or the abhorrence of the void.
Giovanni Battista Baliani (1582 – 1666) was an Italian mathematician, physicist and astronomer who maintained an intense correspondence with Galileo Galilei (1564 – 1642). On July 27, 1630 he wrote a letter to Galilei about the explanation of an experiment he had made in which a siphon, led over a hill about twenty-one meter high, failed to work[16].
Also around 1635 it was clear that a water suction pump could not pull water beyond a certain height of about 18 Florentine yards[17]. The con-

[15] Science Teaching, The contribution of history and philosophy of science, Michael R. Matthews, 2nd edition 2014, printed by Routledge New York, ISBN 978-415-5193-5, 478 pages
[16] Anne Rooney, "The history of physics", The Rosen Publishing Group, ISBN 978-1-4488-7229-9, (2012) 208 pages, p.77
[17] René Dugas (1988). A history of mechanics, Courier Dover Publications. p. 144, ISBN 978-0-486-65632-8.

Table 1: List of six instruments invented in the 17th century.		
Instrument	*Related to*	*Invention attributed to*
1) Pendulum clock	Galileo Galilei (pendulum)	1656 Christiaan Huyghens
2) Telescope	Hans Lippershey (?) Zacharias Janssen (?)	1609 Galileo Galilei
3) Microscope	Hans Lippershey (?) Zacharias Janssen (?)	1625 Galilei Galileo ~1650 Antoni Van Leeuwenhoek
4) Thermometer	~1592 Galileo Galilei (thermoscope)	1610 Galileo Galilei (alcohol thermometer) 1612 Santorio Santorio (thermometer with reading scale)
5) Barometer		~1643 Evangelista Torricelli
6) Vacuum pump		~1640 Otto von Guericke

version to meters is uncertain. It is estimated that it should be around 10 meter.
Both effects formed a problem for the mining industry, construction of fountains, irrigation projects etc.. This is schematically illustrated in the figure 4.

In the same period, the duke of Tuscany planned landscaping work. They observed that the suction pumps were unable to pump water from great depths. The duke commissioned Galilei to investigate the problem[18]. Galilei provided an explanation based on the horror vacui. He suggested that at the top of a suction pump a (temporary) vacuum was created that pulled up the water. However if the height of the water column was too high, it simply collapsed. Galilei's ideas were summarized in his final book the "*Discourses and Mathematical Demonstrations Relating to Two New Sciences"* (*Discorsi e dimostrazioni matematiche, intorno à due nuove scienze*), published in 1638. This book covered much of his work in physics over the preceding thirty years.

[18] http://en.wikipedia.org/wiki/Vacuum_pump#CITEREFCalvert2000 (19/12/2014)

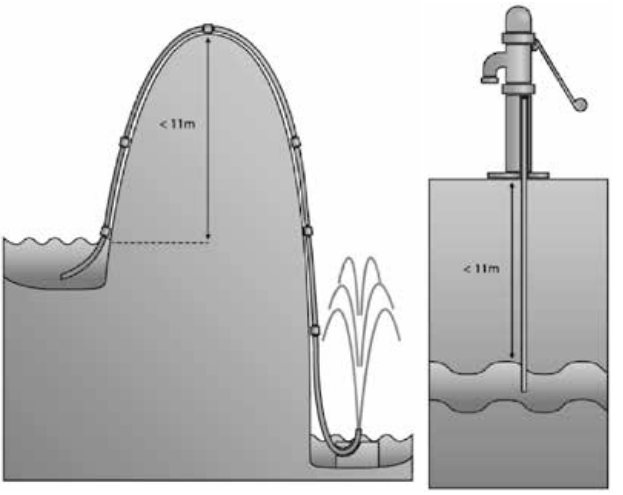

Figure 4: There is a limitation to the height of the water column for the working of the siphon or a suction pump.

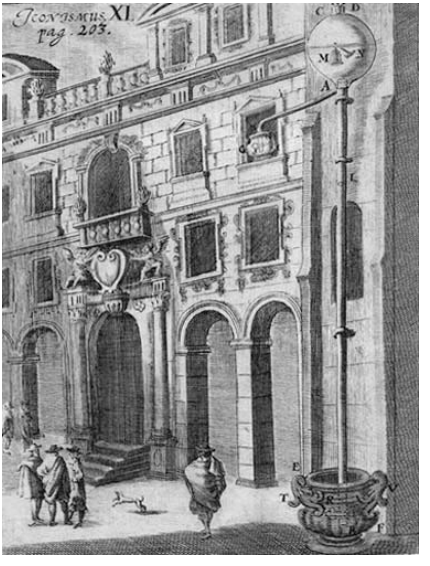

Figure 5: Drawing of the experiment of Gasparo Berti.

Figure 6: Drawing illustrating that the size and volume above the mercury does not influence the height of the mercury column.

Gasparo Berti (ca. 1600 – 1643) was an Italian mathematician, astronomer and physicist. He studied Galilei's book, the Discorsi. Together with another Italian mathematician, astronomer and physicist, Raffaello Magiotti (1597 – 1656) he designed in the period between 1640 and 1643 an experiment to test the existence of a vacuum. They filled an eleven meter long lead tube, filled it with water and sealed both ends. They submerged one end in a water bath and unsealed it. Some water flowed out, but much of it remained, filling about 10 meter of the tube. They claimed that the space above was a vacuum[19]. This is illustrated in the figure[20] 5.

Evangelista Torricelli (1608 – 1647) was an Italian mathematician and physicist. In 1641, during the three remaining months of Galilei's life, he was his amanuensis. In 1643 he repeated the experiment of Berti and Magiotti, but used instead of water, the much heavier liquid mercury. A tube sealed at one end was filled with mercury and then inverted into a mercury bath. A mercury column with a height of about 76 cm was left in the sealed tube. This instrument was later on called a barometer.

From this experiment, Torricelli concluded that i) nature did not abhor the void, and ii) air had weight[21].

It was also remarked that the size and the volume of the space above the mercury level was of no importance. This is illustrated in figure 6 (see reference 20).

The idea that the space above the mercury column was a vacuum, was however not generally accepted. Some believed that the mercury gave off vapor, filling the space above the liquid column, and so pushing the mercury column downwards.

Blaise Pascal (1623 – 1662) , French mathematician and physicist, heard from the Torricelli experiment by Marin Mersenne (1588 – 1648).

Mersenne was a French priest and scientist. He played an important role in the dissemination of mathematical and scientific knowledge. He visited Torricelli toward the end of 1644 and witnessed the Torricelli experiment[22].

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19 See http://catalogue.museogalileo.it/biography/GasparoBerti.html (19/12/2014).

20 From *Technica curiosa, sive, Mirabilia artis* by Gaspar Schott, published in 1664

21 See webpage of Institute and Museum of History of Science, Florence, Italy: http://www.imss.fi.it/vuoto/eesper2.html (19/12/2014).

22 See W.E.K.Middelton, The History of the Barometer, John Hopkins University Press (2002) ISBN 978-0801871542, 511 pages

Pascal devised an experiment to test the proposition that it was vapor from the liquid that filled the space in a barometer. In the proposed experiment he compared water and wine, and since the latter was considered more 'spirituous' it was expected that the wine should stand lower than water[23].

Early 1647, Pascal did the experiment in his hometown Rouen, which was the location of the best glass manufacture of France of that time. Some of the experiments were done in public, with citizens of Rouen as interested witnesses. The comparison of the water and wine experiment showed that the wine column in the glass tube was higher than the water column, in contrast with the expectation. The mechanical explanation[24] could account for the result. It was supposed that it was the weight of the (external) air which was pushing on the basin and prevented the liquid to further flow out of the glass tube. In fact Torricelli came earlier to the same conclusion (see reference 21). Now wine being less dense than water could explain the higher wine column[25].

Pascal was convinced that the pressure of the air kept the fluids from pouring out of the tubes, but he wanted more proof. He realized that if it was the weight of the air which was the driving force in all those experiments, the air pressure should be lower the higher the place where the experiment is performed, since then the layer of air above is thinner. So the column of mercury in the Torricelli experiment should be the lower, the higher the place where the experiment is done. In the late 1647 he wrote a letter to his brother in law, Florin Périer (1605-1672) living in Clermont-Ferrand near the Puy de Dôme. Pascal proposed to do two measurements[26], one in Clermont-Ferrand and one on top of the Puy de Dôme, where there is an altitude difference of about 1000 m. On Saturday, September 19, 1648, Florin Périer, together with some friends started the experiment. They measured the height of the mercury column in two Torricelli experiments. One at the low-lying place in town, in the "Jardin des Minimes", a monastery garden in Clermont-Ferrand. The reading was 711 mm. One instrument was left there and it was observed during the day by a monk. The other instrument

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23 More vapor would mean more pushing against the liquid column.

24 See R.S.Westfall, The Construction of Modern Science. Mechanisms and Mechanics, Cambridge University Press (1978), ISBN 0-521-29295-6 , 190 pages

25 In fact the pressure p exerted by a fluid column of an height h is given by: , where ρ is the density of the fluid and g is the free fall acceleration.

26 There is a debate among historians of science about who had suggested first to conduct the Torricelli experiment on a mountaintop. Some argue that it was René Descarte' (1596-1650) idea, some assign priority to Pascal.

was carried to the top of the Puy de Dôme, some 1000 m higher. To their big surprise the reading there was much lower: 627 mm. They repeated the measurements several times. They also did several measurements during the descent of the Puy de Dôme. The height of the mercury column climbed up in the glass tube. Back in the monastery, it was again 711 mm, the same height the stationary control instrument indicated there during the whole day[27].

Other instruments in the Plateau collection connected with Blaise Pascal

Pascal's law

This is also called the principle of transmission of fluid-pressure. It is a principle in fluid mechanics, that states that pressure exerted anywhere in a confined incompressible fluid is transmitted equally in all directions throughout the fluid such that the pressure variations remain the same. Plateau illustrated this principle with an instrument as shown in figure 7.

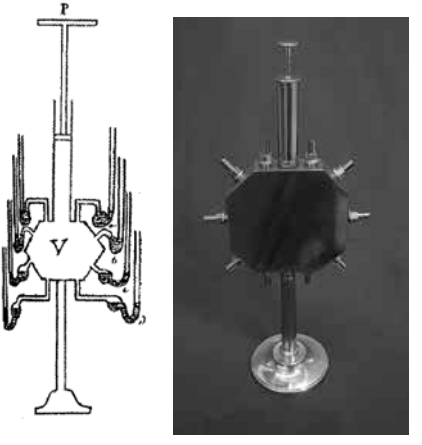


**Figure 7: Instrument illustrating Pascal's law.
On the left is a copy of a drawing from the course notes of C. Frédéricq.
On the right is a photograph of the instrument from the Cabinet de Physique.**

Pascal's vases

The functioning of Pascal's vases is based on the hydrostatic paradox. In fact the hydrostatic paradox was first formulated by Simon Stevin (1548 –

[27] See http://backreaction.blogspot.be/2007/11/blaise-pascal-florin-p-and-puy-de-d.html (22/12/2014).

**Figure 8: Instrument to illustrate the hydrostatic paradox.
On the left is a drawing from the course notes of C. Frédéricq.
The photograph in the middle and to the right are pictures of the actual instrument
from the Cabinet de Physique.**

1620) in 1587. It states that the pressure, exerted by a liquid at the bottom of a vessel, depends only on the height of the liquid column and not of its volume. In the Cabinet de Physique, Plateau illustrated this principle with an instrument as represented in figure 8.

Pascal re-invented the principle of the hydrostatic paradox and built the so called Pascal's vases.

This liquid level vase has several liquid-filled tubes connected to the same reservoir, and the liquid rises to the same level in all of the tubes. This is illustrated in figure 9.

Research on air pressure and the invention of the vacuum pump – the Magdeburg hemispheres

Otto von Guericke (1602 – 1686) was a German physicist, inventor and politician. He was the mayor of Magdeburg in the period between 1646 and 1681. He is well known for three achievements: i) he is the inventor of the first really working vacuum pump, ii) he demonstrated the existence of a vacuum with the help of the famous Magdeburg hemispheres and iii) he also invented the first electrostatic generator (see later).

Von Guericke started his experiments with air pumps around the 1640's[28]. In one of his first experiments he tried to make a vacuum in a large copper

[28] P.A.Redheaed, "History of vacuum devices" in "CAS - CERN Accelerator School : Vacuum Technology", Snekersten, Denmark, 28 May - 3 June 1999, pp.281-290; 10.5170/CERN-1999-005.281

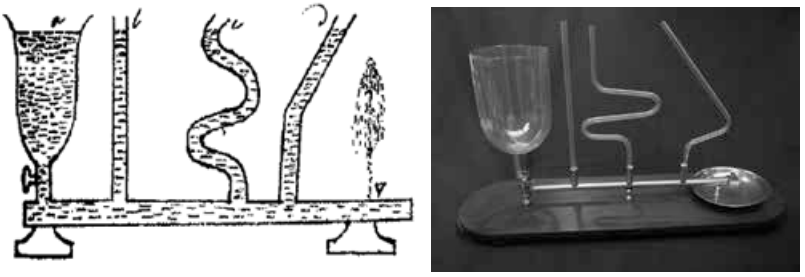


Figure 9: Pascal's vases.
On the left is a drawing from the course notes of C. Frédéricq.
On the right is a photograph of the actual instrument from the Cabinet de Physique.

sphere. When most of the air was removed out of the sphere, it collapsed with a loud noise. Von Guericke realized it being caused by atmospheric pressure. A more precise spherical vessel was made and then the experiment was successful.

He twice publically demonstrated the existence of a vacuum. Two copper hemispheres with a diameter of about 30 cm were put together and the air was pumped out. The sphere was mounted between two horse yokes. In 1654 he did the experiment in Regensburg using 30 horses (2 times 15 horses). In 1657 he repeated the experiment in Magdeburg with 16 horses (2 times 8 horses). In both experiments the horses could not pull apart the evacuated copper sphere.

In the collection of the Cabinet de Physique two sets of Magdeburg hemispheres are still present. One set is represented in figure 10.

Figure 10: Photograph of a set of Magdeburg hemispheres from the Cabinet de Physique.

Bernoulli's law and the working of the syphon

Due to the understanding of air pressure, the limitation for the maximum depth for pumping up water with a suction pump was well understood. The working of the syphon was also well understood from around 1738.

Daniel Bernoulli (1700 – 1782) was a Swiss mathematician and physicist. He is best known for the law of Bernoulli. In 1738 he published his impor-

tant book on hydrodynamics. There he published his equation[29] which describes the fluid dynamics. This equation is in fact based on the principle of energy conservation. Applying the Bernoulli equation to the working of the syphon it can be proven that the maximum height (h_{max}) for the working of the syphon is given by: $h_{max} = \frac{p_{atm}}{\rho\, g}$. Here p_{atm} is the atmospheric pressure, ρ is the density and g is the free fall acceleration. For water the maximum height is then 10,3 m.

Timeline

In figure 11, for the most important scientists mentioned in the above sections, the lifespan is represented on a timeline. The lifespan of Plateau is also indicated, in order to compare the realized research with where we have to situated the Cabinet de Physique.

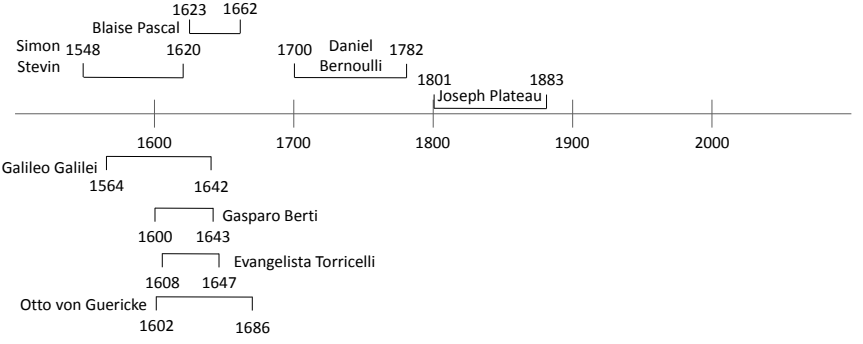


Figure 11: Timeline showing the most important scientists mentioned in the above section.

b) History of electricity

Subjects on electricity are well treated in the lecture notes of Plateau. Drawings of several demonstration instruments can be found in the student notes.

In the evolution of the study of electricity several milestones can be detected: i) the generation of static electricity by friction, ii) the construction of electrostatic generators, iii) storing of electrical charges, iv) the flow of charges, v) the invention of the galvanic element, vi) relation between electricity and magnetism, the electromagnetic theory, vii) applications.

[29] Bernoulli equation states that . Here p is the pressure, ρ is the density, v is the velocity, g is the free fall acceleration and y is height.

Plateau lived in the 19th century and this is the century of the electromagnetism. It is interesting to look more closely which of the 19th century subjects were and were not treated in the course notes of Plateau.

Static electricity, the first electrostatic generator, electrical conduction, storing charges

Already in ancient years, Thales of Miletus (624 – 545 B.C.) showed that by rubbing amber, it could attract light objects. However in the following 2000 years nothing impressive in the evolution of electricity happened.

The start of further progress in the study of electricity was in 1600 with the publication of a book "De Magnete, Magneticisque Corporibus, et de Magno Magnete Tellure" (On the magnet and Magnetic Bodies, and on That Great Magnet the Earth) by William Gilbert (1544 – 1603). He was an English physician, physicist and natural philosopher. His book summarized the knowledge of electricity and magnetism of that time.

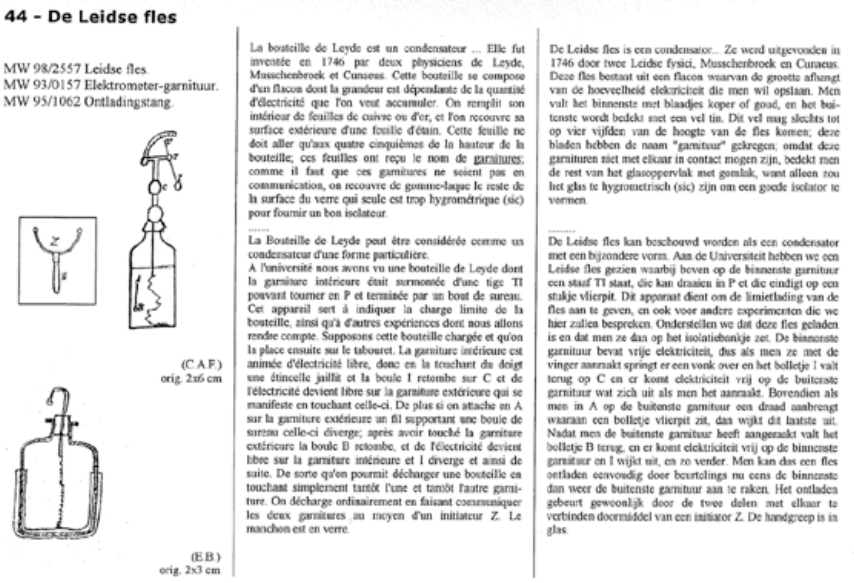
Otto von Guericke constructed the first electrostatic generator in 1660. It was a sulfur sphere that could be turned around. The sphere was charged by touching it by hand.

Stephen Gray (1666 – 1736) was an English scientist and astronomer. He was the first to systematically experiment with electrical conduction, rather than the simple generation of static charges and investigations of the static phenomena. He discovered that some materials could conduct electricity. He was the first to make a distinction between conductors and insulators.

Charles François de Cisternay de Fay (1698 – 1739) was a French chemist. Its main contribution to the study of electricity was that he discovered the existence of two types of electricity and he named them "vitreous" and "resinous". They were later known respectively as positive and negative charges. The vitreous electricity was obtained by rubbing glass, quartz or gem stones. The resinous electricity was obtained by rubbing amber, resins or lacquers. He also discovered that alike-charged objects would repel each other and that unlike-charged objects attract each other.

Here we have to remark that in the lecture notes of Plateau the expressions "électricité vitrée" and "électricité résineuse" are used instead of positive and negative charges.

Pieter van Musschenbroeck (1692 – 1761) was a Dutch physician, mathematician, physicist and astronomer.



44 - De Leidse fles

MW 98/2557 Leidse fles.
MW 93/0157 Elektrometer-garnituur.
MW 95/1062 Ontladingstang.

(C.A.F.)
orig. 2x6 cm

(E.B.)
orig. 2x3 cm

La bouteille de Leyde est un condensateur ... Elle fut inventée en 1746 par deux physiciens de Leyde, Musschenbroek et Cunaeus. Cette bouteille se compose d'un flacon dont la grandeur est dépendante de la quantité d'électricité que l'on veut accumuler. On remplit son intérieur de feuilles de cuivre ou d'or, et l'on recouvre sa surface extérieure d'une feuille d'étain. Cette feuille ne doit aller qu'aux quatre cinquièmes de la hauteur de la bouteille; ces feuilles ont reçu le nom de garnitures; comme il faut que ces garnitures ne soient pas en communication, on recouvre de gomme-laque le reste de la surface du verre qui seule est trop hygrométrique (sic) pour fournir un bon isolateur.

.....

La Bouteille de Leyde peut être considérée comme un condensateur d'une forme particulière.
A l'université nous avons vu une bouteille de Leyde dont la garniture intérieure était surmontée d'une tige TI pouvant tourner en P et terminée par un bout de sureau. Cet appareil sert à indiquer la charge limite de la bouteille, ainsi qu'à d'autres expériences dont nous allons rendre compte. Supposons cette bouteille chargée et qu'on la place ensuite sur le tabouret. La garniture intérieure est animée d'électricité libre, donc en la touchant du doigt une étincelle jaillit et la boule I retombe sur C et de l'électricité devient libre sur la garniture extérieure qui se manifeste en touchant celle-ci. De plus si on attache en A sur la garniture extérieure un fil supportant une boule de sureau celle-ci diverge; après avoir touché la garniture extérieure la boule B retombe, et de l'électricité devient libre sur la garniture intérieure et I diverge et ainsi de suite. De sorte qu'on pourrait décharger une bouteille en touchant simplement tantôt l'une et tantôt l'autre garniture. On décharge ordinairement en faisant communiquer les deux garnitures au moyen d'un initiateur Z. Le manchon est en verre.

De Leidse fles is een condensator... Ze werd uitgevonden in 1746 door twee Leidse fysici, Musschenbroek en Cunaeus. Deze fles bestaat uit een flacon waarvan de grootte afhangt van de hoeveelheid elektriciteit die men wil opslaan. Men vult het binnenste met blaadjes koper of goud, en het buitenste wordt bedekt met een vel tin. Dit vel mag slechts tot op vier vijfden van de hoogte van de fles komen; deze bladen hebben de naam "garnituur" gekregen; omdat deze garnituren niet met elkaar in contact mogen zijn, bedekt men de rest van het glasoppervlak met gomlak, want alleen zou het glas te hygrometrisch (sic) zijn om een goede isolator te vormen.

.....

De Leidse fles kan beschouwd worden als een condensator met een bijzondere vorm. Aan de Universiteit hebben we een Leidse fles gezien waarbij boven op de binnenste garnituur een staaf TI staat, die kan draaien in P et die eindigt op een stukje vlierpit. Dit apparaat dient om de limietlading van de fles aan te geven, en ook voor andere experimenten die we hier zullen bespreken. Onderstellen we dat deze fles geladen is en dat men ze dan op het isolatiebonkje zet. De binnenste garnituur bevat vrije elektriciteit, dus als men ze met de vinger aanraakt springt er een vonk over en het bolletje I valt terug op C en er komt elektriciteit vrij op de buitenste garnituur wat zich uit als men het aanraakt. Bovendien als men in A op de buitenste garnituur een draad aanbrengt waaraan een bolletje vlierpit zit, dan wijkt dit laatste uit. Nadat men de buitenste garnituur heeft aangeraakt valt het bolletje B terug, en er komt elektriciteit vrij op de binnenste garnituur en I wijkt uit, en zo verder. Men kan dus een fles ontladen eenvoudig door beurtelings nu eens de binnenste dan weer de buitenste garnituur aan te raken. Het ontladen gebeurt gewoonlijk door de twee delen met elkaar te verbinden doormiddel van een initiator Z. De handgreep is in glas.

Figure 12: Extract on Leyden jars taken from the catalogue mentioned in reference 30.

Ewald Georg von Kleist (1700 – 1748) was a German jurist and physicist.

They both invented around the same period between 1745 and 1746 a device to store electrical charges. This device was later on named the "Leyden Jars" and is in fact the precursor of the capacitor.

In his lectures Plateau discussed in detail the functioning of the Leyden Jar. (figure12[30]). In the Plateau collection several Leyden Jars are still present.

Joseph Plateau also purchased two electrostatic generators: a Ramsden and a Van Marum Generator.

Jesse Ramsden (1735 – 1800) was an English instrument maker. He is well known for the construction of astronomical instruments. The electrical generator he built was also used for medical purposes. The generator, we still have in the Plateau collection, consists of a large circular glass plate which could be rotated and which is rubbed by an animal fur. It generated positive charges.

30 Catalogue of an exposition on the Cabinet de Physique of Joseph Plateau, organized by the Museum for the History of Sciences in 2001. "Het 'Cabinet de Physique' van Joseph Plateau, L.Dorikens-Vanpraet, M.Dorikens (2001), D/2001/0376/1.

Martinus van Marum (1750 – 1837) was a Dutch physician, naturalist and chemist. He also was the first director of the famous Teylers museum in Harlem, the Netherlands. This museum was founded in 1778. He built an electric generator which was capable of producing the two kinds of charges. In his course notes, Plateau described the ingenious mechanism that makes it possible to reconvert the machine to generate positive and negative charges.

Both electrical generators, as there are still in our collection, are represented in the following figure 13.

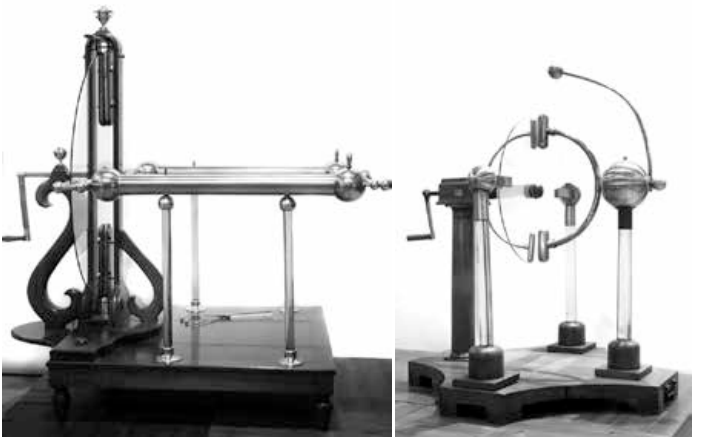


Figure 13: The electrical generator of Ramsden (left) and Van Marum (right) from the Cabinet de Physique of Joseph Plateau.

The 18th century

The 18th century is known as the century of "La physique amusante". For the general public, a lot of demonstrations were organized mostly around electrostatics. The electrostatic generator was the central instrument during those demonstrations.

An important scientist who contributed in those demonstrations was Jean-Antoine Nollet (1700 – 1770). Nollet was a French clergymen and physicist. It is because he was a clergyman that he is often referred to as Abbé Nollet.

He also gave the name of "Leyden jar" to the instrument invented by van Musschenbroeck and von Kleist (see earlier) for storing charges.

In 1746 he did a demonstration for king Louis XV where he discharged a Leyden jar through a chain of 180 of his soldiers. They all together jumped up, much to the amusement of the public.

He is also the inventor of the electroscope. This instrument was also described in the course notes of Plateau.

Besides amusement demonstrations, also serious scientific research was done in that period. Charles-Augustin de Coulomb (1736 – 1806) was a French physicist who studied the forces between charges. For his study he invented a special torsion balance to measure the electrostatic forces. In the course notes of Plateau a graph of such a demonstration torsion balance is found, but the instrument is not present anymore in the Plateau collection.

The 19th century

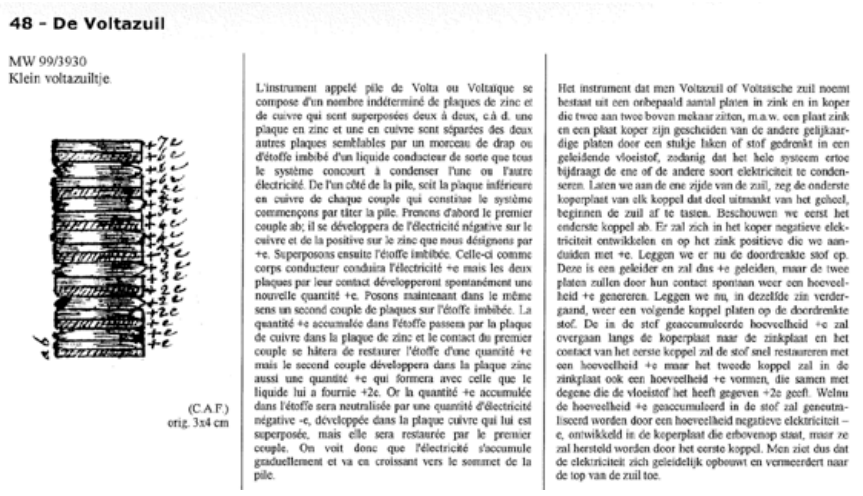
The 19th century is the century of electromagnetism. A number of fundamental experiments were carried out and the theory of electromagnetism was formulated.

It all began in 1800 with the invention of the battery by Alessandro Volta (1745 – 1827). He was an Italian physicist who invented the voltaic pile, which is an electrochemical cell. It is an early electric battery producing a steady electric current.

In the course notes of Plateau the voltaic pile is described. This is illustrated in the following figure 14. The pile as depicted in that figure is still present in the Plateau collection.

Before the invention of the voltaic pile, electrostatic generators produced charges, which were stored in Leyden jars, and so discharges (electric pulses) could be generated. With the help of the voltaic pile new experiments could be designed.

The first striking new results were obtained by Hans Christian Oersted (1777 – 1851). He was a Danish physicist and chemist. In 1820 he noticed that a steady current through a wire caused a deviation of a magnet needle placed in the direct neighborhood of the wire. This illustrated that a steady flow of charges generated a magnetic effect. In the course notes of Plateau, which dates from 1839, there is mention of the effect in a paragraph entitled “Electro-magnetique”. No drawings of demonstration equipment are present, but the experiment of Oersted is precisely described.



48 - De Voltazuil

MW 99/3930
Klein voltazuiltje

(C.A.F.)
orig. 3x4 cm

L'instrument appelé pile de Volta ou Voltaïque se compose d'un nombre indéterminé de plaques de zinc et de cuivre qui sont superposées deux à deux, c.à d. une plaque en zinc et une en cuivre sont séparées des deux autres plaques semblables par un morceau de drap ou d'étoffe imbibé d'un liquide conducteur de sorte que tous le système concourt à condenser l'une ou l'autre électricité. De l'un côté de la pile, soit la plaque inférieure en cuivre de chaque couple qui constitue le système commençons par tâter la pile. Prenons d'abord le premier couple ab; il se développera de l'électricité négative sur le cuivre et de la positive sur le zinc que nous désignons par +e. Superposons ensuite l'étoffe imbibée. Celle-ci comme corps conducteur conduira l'électricité +e mais les deux plaques par leur contact développeront spontanément une nouvelle quantité +e. Posons maintenant dans le même sens un second couple de plaques sur l'étoffe imbibée. La quantité +e accumulée dans l'étoffe passera par la plaque de cuivre dans la plaque de zinc et le contact du premier couple se hâtera de restaurer l'étoffe d'une quantité +e mais le second couple développera dans la plaque zinc aussi une quantité +e qui formera avec celle que le liquide lui a fournie +2e. Or la quantité +e accumulée dans l'étoffe sera neutralisée par une quantité d'électricité négative -e, développée dans la plaque cuivre qui lui est superposée, mais elle sera restaurée par le premier couple. On voit donc que l'électricité s'accumule graduellement et va en croissant vers le sommet de la pile.

Het instrument dat men Voltazuil of Voltaïsche zuil noemt bestaat uit een onbepaald aantal platen in zink en in koper die twee aan twee boven mekaar zitten, m.a.w. een plaat zink en een plaat koper zijn geschieden van de andere gelijkaardige platen door een stukje laken of stof gedrenkt in een geleidende vloeistof, zodanig dat het hele systeem ertoe bijdraagt de ene of de andere soort elektriciteit te condenseren. Laten we aan de ene zijde van de zuil, zeg de onderste koperplaat van elk koppel dat deel uitmaakt van het geheel, beginnen de zuil af te tasten. Beschouwen we eerst het onderste koppel ab. Er zal zich in het koper negatieve elektriciteit ontwikkelen en op het zink positieve die we aanduiden met +e. Leggen we er nu de doordrenkte stof op. Deze is een geleider en zal dus +e geleiden, maar de twee platen zullen door hun contact spontaan weer een hoeveelheid +e genereren. Leggen we nu, in dezelfde zin verdergaand, weer een volgende koppel platen op de doordrenkte stof. De in de stof geaccumuleerde hoeveelheid +e zal overgaan langs de koperplaat naar de zinkplaat en het contact van het eerste koppel zal de stof snel restaureren met een hoeveelheid +e maar het tweede koppel zal in de zinkplaat ook een hoeveelheid +e vormen, die samen met degene die de vloeistof het heeft gegeven +2e geeft. Welnu de hoeveelheid +e geaccumuleerd in de stof zal geneutraliseerd worden door een hoeveelheid negatieve elektriciteit – e, ontwikkeld in de koperplaat die erbovenop staat, maar ze zal hersteld worden door het eerste koppel. Men ziet dus dat de elektriciteit zich geleidelijk opbouwt en vermeerdert naar de top van de zuil toe.

Figure 14: Extract on the voltaic pile taken from the catalogue mentioned in reference 30. The instrument is still present in the collection of Plateau.

The following important experimental progress was obtained by Michael Faraday (1791 – 1867). He was an English scientist who contributed in the field of electromagnetism and electrochemistry. In 1831 he discovered the principle of electromagnetic induction: a changing magnetic flux induces electric currents.

Eight years later, in 1839, Plateau described this effect in his course notes in a paragraph entitled “Courants électrique par induction ou influence”. Again no drawings of demonstration instruments were present.

The principle of electromagnetic induction generated a lot of practical applications. Nicholas Callan (1799 – 1864), an Irish priest and scientist, invented the induction coil. Heinrich Daniel Ruhmkorff (1803 – 1877), a German instrument maker, improved this induction coil and nowadays the instrument is still known as a Ruhmkorff coil.

The principle of electromagnetic induction is also the basic principle for electric generator and the electric motor.

Those practical applications are not treated in the course notes of Plateau, what is probably comprehensible since they were quite new and recent developments.

Timeline

In figure 15, for the most important scientist mentioned in the above sections, their lifespan is represented on a timeline. The lifespan of Plateau is also indicated, in order to compare the realized research with where we have to situated the Cabinet de Physique.

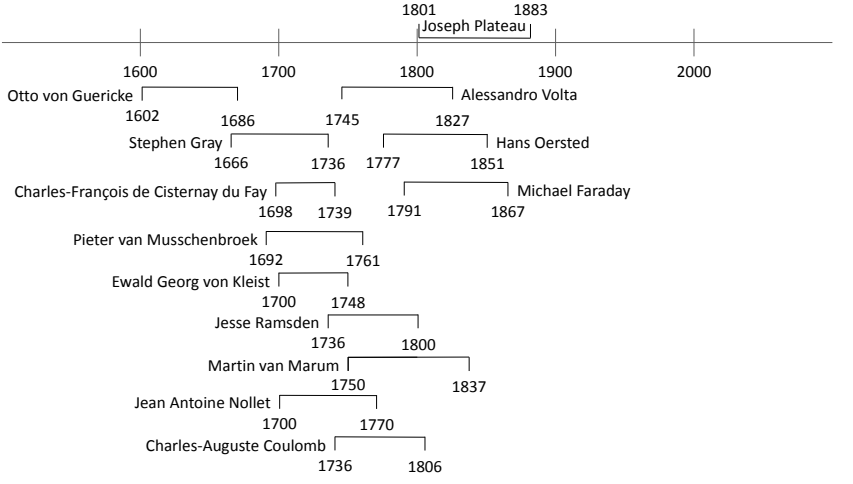


Figure 15: Timeline showing the most important scientists mentioned in the above section.

Conclusion

We can conclude that the lecture notes of Plateau treat very well the physics principles known at that time. Even the new discoveries of the 19th century are treated in the lessons of Plateau. He illustrated his course with demonstrations. A lot of those demonstration instruments are still preserved and can still be used to illustrate basic principles pf physics.

Laudatio Marta Catarino Lourenço

Danny Segers

Marta Catarino Lourenço began working in museums in 1998. Initially she worked on museum education and exhibitions, and later she was active in the areas of collections and research.

Earlier, in 1992, she had completed a degree in Physics from the University of Lisbon. In 2000 she obtained a Master-degree in Anthropology and Museology from the New University of Lisbon. In 2005 she obtained her PhD degree in Paris at the "*Conservatoire des Arts et Métiers"*. It was a PhD in Epistemology and History of Technology. The title of her thesis was: "Between two worlds: The distinct nature and contemporary significance of university museums and collections in Europe". In the framework of her PhD research, she visited and studied more than 300 university museums and collections in Europe.

Presently, Marta Lourenço is a full time researcher. She is Chief Curator of the Historical Collections of the Museums of the University of Lisbon and the National Museum of Natural History and Science. She has the supervision of: the scientific instruments, the art collections, collections of drawings, the historical archives and libraries and also the Museum's constructed heritage such as two Astronomical Observatories and one Chemistry Laboratory. This is all scientific heritage from the 19th century.

Since 2014 she is also Deputy Director of the Museum.

She coordinates *PRISC, the Portuguese Research Infrastructure of Scientific Collections*. *PRISC* is an infrastructure that dates from 2014. It was included in the "Portuguese Roadmap of Strategic Research Infrastructures" and involves the survey, preservation and accessibility of scientific collections at a national Portuguese level.

Marta Lourenço is affiliated with two research centres: i) the "Interuniversity Centre for the History of Science and Technology" of the University of Lisbon and ii) the "Centre d'histoire des techniques et de l'environement" of the "Conservatoire National des Arts et Métiers, l'Ecole des Hautes Etudes en Sciences Sociales" in Paris.

She teaches a semester course on the material culture of science at the Masters and PhD programmes in History and Philosophy of Science at the Faculty of Sciences of the University of Lisbon. This course is entitled: "*Museums, Collections and History of Science"*.

She also supervises post-graduate students in History of Science and Museology, as well as post-docs, from several Portuguese and Brazilian universities.

She has given workshops, courses and seminars for historians of science and museum professionals in Portugal, the UK, France, Italy and Brazil.

Last year, she was awarded the Vital Brazil Medal for her work in raising awareness for the promotion of scientific heritage.

She has coordinated several national, EU and international research projects. The most elaborated project, that lasted for a quite long period between 2006 and 2011, was the development of the online tool "*The thesaurus of scientific instruments in Portuguese"*. The work was developed in collaboration with the Museum of Astronomy in Rio de Janeiro, along with a network of about 20 institutions from Portugal and Brazil.

She is currently coordinating the survey of cultural heritage of the University of Lisbon.

In terms of international networks, she is presently Vice-President of the European Network of Academic Heritage (this is the well-known UNIVERSEUM). She is also a member of the boards of a) the History of Physics Group of the European Physical Society and b) the Scientific Instruments Commission (which is a constituent organization of the International Union for the History and Philosophy of Science).

She is also a member of the Advisory Board of the Centre for the History of Science of the Royal Swedish Academy of Sciences in Stockholm.

As a member of these boards and in the framework of her scientific work at the Museum in Lisbon, she has organized several scientific conferences, discussion panels, and debates.

In Portugal and abroad she is a member of Prize Committees, Advisory Boards of Museums, the Editorial Board of several Journals and Research Evaluation Panels. She has evaluated museum and research projects for funding agencies in Portugal, Brazil and Italy. She has also done consulting work on museums and collections for universities, research laboratories and schools in Europe and Brazil.

Her research, teaching and consulting has always addressed the importance of scientific museums, collections and heritage – including archives, laboratories, observatories and botanical gardens – in contemporary society, particularly those preserved by European universities.

Recently, she has been actively engaged in promoting the use of collections as primary sources for research in the arts and humanities, and particularly in the history of science. She has also been increasingly interested in the history of scientific collections, such as the cabinets of physics.

In the past 10 years, she has published 10 books as author or editor and about 50 scientific articles and chapters in books. She gave 92 talks at scientific conferences, among which 11 keynote talks.

To conclude: This year it is for the first time that Ghent University Museums award a Sarton medal. As follows from the curriculum vitae of Marta Catarino Lourenço, she really is an expert on university collections and museums. She has a thorough knowledge of those particular collections all over Europe but also out of Europe. We consider her as a very valuable candidate for the medal awarded and we are very happy to have her here to deliver a paper about "Scientific Collections, Museums and Heritage: Creating connections and engaging society through History".

Scientific collections, museums and heritage: Creating connections and engaging society through history

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National Museum of Natural History and Science, University of Lisbon (MUHNAC)
Research Unit for the History of Science and Technology, University of Lisbon (CIUHCT)

Introduction

Museums are places of intersections. They remove objects from cycles of use, exchange, trade, and abandonment so that they can be preserved forever. They do that because these objects have great stories to tell about our human strive for truth and beauty. Museums are therefore at the intersection of the past – history and memory – and the future – permanence and perpetuity. The present is important – it is where we are now and when choices about objects are made – but it is the tension between past and future, between transient and eternal, that drives museums, ultimately making them places of imagination, inspiration and learning.

Apart from being at the intersection of the past and the future, museums are also at the intersection of different communities – collectors, researchers, students, politicians, donors, first nation peoples, artists, traders, historians, and so on. Throughout time, these communities and their cultures have shaped what museums are and do, resulting in their sheer number and extraordinary diversity today.

In this paper, I will use my experience as a museum professional to analyse the implications of these intersections and tensions on the role played by contemporary museums in interpreting and engaging broad audiences

with the past. I work in a museum of science – the National Museum of Natural History and Science, University of Lisbon (fig 1)[1] – therefore my discussion will naturally focus on museums of science. The latter requires definition, as there is no such thing as *the* museum of science. The definition provided by the International Council of Museums (ICOM) is broad,[2] comprising museums of the history of science (such as the Museum of the History of Science in Gent, the Museum of the History of Science in Oxford, the Whipple Museum in Cambridge, and many others), science and technology national museums (e.g. the Science Museum in London, the Deutsches Museum in Munich, the *Conservatoire National des Arts et Métiers* in Paris), but also small and large industrial and engineering museums, natural history museums, eco-museums, medicine and health museums, astronomical observatories, *aquaria*, *planetaria*, botanical gardens and science centres. The typology is complex, fragmented and intricate. Missions, purposes, scopes, collections and audiences vary considerably. For the purpose of this paper, I will restrict the discussion to museums with collections of scientific instruments, although I may also comment occasionally on natural history museums.

Which are the main communities that drive science museum policies, missions and programmes? If we exclude local, regional and national governments, we are left with three broad types of stakeholders. On the one hand, we have the 'generators' of objects and collections. These are scientists, researchers, professors, and students. They acquire, build, adapt, use and re-use scientific instruments, machines, tools, models. On the other hand, we have the 'keepers', who are typically museum professionals. Finally, we have the 'users', a broad category that encompasses everyone who uses museums – from researchers in the sciences, arts and humanities to general audiences and the general public. Ultimately, the better we understand these three communities – generators, keepers and users – the better research and the more meaningful exhibitions and educational programmes museums deliver. The problem is that generators, keepers and users have

[1] Created in 2012, the National Museum of Natural History and Science (MUHNAC) resulted from the fusion of two museums – the National Museum of Natural History and the Museum of Science. It holds c. 800,000 items (natural history specimens, scientific instruments, manuscripts, books, herbaria, illustrations and paintings, memorabilia, photographs, and many others objects). MUHNAC also comprises the Lisbon Botanical Garden (founded 1878), two nineteenth century astronomical observatories and the recently restored Laboratorio Chimico (dating from the 1890s) (fig. 2). See more at MUHNAC's website http://museus.ulisboa.pt, accessed 7 June 2015.

[2] See the ICOM museum definition in http://icom.museum/the-vision/museum-definition/, accessed 7 June 2015.

Fig. 1. The National Museum of Natural History and Science (MUHNAC), University of Lisbon (photo J. Perico, MUHNAC Archives).

Fig. 2. The 19th century Laboratorio Chimico at MUHNAC (photo P. Cintra, MUHNAC Archives).

different cultures, agendas and practices. They have different time dynamics too – focus on the past, focus on the present or the future.

I will first examine the relation between keepers and users (historians) and then the relation between keepers and generators (scientists). I will highlight three challenges that in my view should strategically guide museums in the near future: the challenge of history, the challenge of science and the challenge of the recent past. First, however, I will outline an important broader challenge that cannot be ignored: the preservation of scientific heritage in contemporary societies.

The 'dark matter'

In recent years, an increased sense that a lot has already been lost, combined with other social, cultural and scientific factors, has resulted in a growing awareness at social, political and scientific echelons towards the importance of scientific heritage. There has been significant public and private investment in major museums of science and natural history across Europe (e.g. London, Berlin, Florence, Trento, Barcelona, Leiden, Turin, Manchester, Copenhagen) and several new projects are currently being developed (e.g. Gent, Glasgow, Madrid).

Perhaps more significantly, scientific heritage and collections are increasingly being considered scientific infrastructures, in other words they are being recognised as invaluable and irreplaceable resources for the national and international scientific systems in a wide range of cross-disciplinary fields. The association between the terms 'scientific collections' and 'infrastructure' first appeared at high political level in a report commissioned by the White House in 2009[3]. Since then, the association has been regularly adopted, including in policy documents at the highest scientific and political levels in Europe[4]. Moreover, two European countries – Estonia and

[3] *Scientific Collections: Mission-Critical Infrastructure for Federal Science Agencies. A Report of the Interagency Working Group on Scientific Collections* (IWGSC), Washington DC. See https://www.whitehouse.gov/sites/default/files/sci-collections-report-2009-rev2.pdf, accessed 5 July 2015. This was followed by a White House Memorandum on Scientific Collections, see https://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp-2010-scientific-collections.pdf, accessed 5 July 2015.

[4] OECD Global Science Forum Report (2008), the ESFRI Strategy Report (2010) and the German Research Council initiative on Scientific Collections as Research Infrastructures (2011).

Portugal – have already included infrastructures of scientific collections in their national strategic research roadmaps[5].

However, the sustainable preservation of scientific heritage, in other words the preservation of the material evidence of science research, teaching and dissemination, is still one of the greatest cultural challenges of contemporary societies.[6] It involves a broad spectrum of agents, from museums to universities, secondary schools to academic hospitals, and people – scientists, historians, anthropologists and sociologists of science, politicians, and many others. Several factors contribute to the complexity of the task.

First, scientific heritage is difficult to define in the context of cultural heritage. It is diverse and volatile, assuming a wide range of forms, from collections (e.g. herbaria, scientific and medical instruments, fossils, minerals, DNA and seed banks, models, drawings, documents, books), single objects (e.g. nuclear reactors) to botanical gardens and buildings (e.g. astronomical observatories, chemistry and physics laboratories, anatomical theatres). Moreover, the relation between scientific heritage and identity is problematic – contrary to other types of cultural heritage, such as artistic heritage, or archaeological heritage.

Second, contrary to, for example, natural heritage, the preservation of which has mobilised biologists and geologists worldwide, scientific heritage does not have a clear and well-defined professional voice to promote it politically and socially. It is not by chance that scientific heritage does not have an international Charter, Declaration, or Recommendation, contrary to archaeological heritage or industrial heritage – or indeed university heritage, which unanimously mobilised the Council of Europe around a dedicated Recommendation in 2005.[7]

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5 PRISC (Portuguese Research Infrastructure of Scientific Collections) and eIFL (Estonian e-Repository and Conservation of Collections). The latter is an e-infrastructure and only covers biology and geology collections. The former encompasses all scientific collections (digital and material), using the following as working definition of 'scientific collections': scientific collections are *organised* assemblages of *selected* material evidence of the natural environment or scientific human activity, accompanied by the necessary *associated information* that makes them sources for research, teaching and science communication in a wide range of cross-disciplinary fields (PRISC, 2014).

6 Präet M. V. Heritage and scientific culture: the intangible in science museums in France. Museum International 2004; 56 (1-2): 113-121; Lourenço M. C., Wilson L. Scientific heritage: Reflections on its nature and new approaches to preservation, study and access. Studies in History and Philosophy of Science 2013; 44 (4): 744-753.

7 Rec. 2005 (13) of the Council of Europe on the Governance and Management of University Heritage. See also Soubiran S., Lourenço M.C., Wittje R., Talas S., Bremer T. Initiatives européennes et patrimoine universitaire. La Lettre de l'OCIM [Université de Bourgogne] 2009; 123: 5-14.

Third, the real dimension and distribution of scientific heritage are unknown. It is being created constantly at an astonishing pace. Every day new materials are generated as a result of research, teaching and innovation activities. Many are trashed without any selection policy or criteria, or remain inaccessible in offices, attics and basements for decades. I will get back to this further on. The available mechanisms to prevent this irreversible path, or – at least – select or document some materials, are inexistent or clearly insufficient. Scientific heritage is the invisible 'dark matter' of the cultural heritage universe.[8] We know it is out there, yet we are powerless to identify, measure, or describe it, let alone preserve it in a balanced and sustained way. Scientific heritage is vulnerable and disappearing without us even having known it existed.

Finally fourth, although most European countries include the preservation of scientific heritage in their cultural heritage legislation, in practice this heritage is twice an orphan. It is an orphan in its own generator institutions – universities, schools, research laboratories, academic hospitals – because these lack the vocation, dedicated funds, qualified staff or internal policies. Preservation tends to be left to the arbitrariness and good will of heritage-concerned individuals. Secondly, it is an orphan in regards to cultural institutions – e.g. culture ministries, cultural divisions in local governments – which tend to be sympathetic but feel that the preservation of scientific heritage is someone else's responsibility.

Although awareness has been growing, it is against this unfavourable background scenario that we should examine the challenges faced by museums of science today: the challenge of history, the challenge of science and the challenge of the recent past.

The challenge of history

Undoubtedly museums of science need to integrate more history of science in their collections practices, exhibitions and public programmes[9]. Curators and historians would mutually benefit from increased collaborations. Collections are a challenge for historians and history is a challenge for curators. In this section, I will briefly explain why, arguing that the challenge is easier for historians.

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8 Lourenço M. C., Wilson L. 2013, *op. cit*.

9 Lourenço M. C., Gessner S. Documenting collections: Cornerstones for more history of science in museums. Science & Education 2012; 23 (4): 727-45.

Since the seminal works of George Sarton (1884-1956), history of science has expanded and become more interdisciplinary. Recently, an increased interest for collections, objects and material culture as primary sources has become more prominent, a movement that is commonly designated the 'material turn'.

For the most part of the twentieth-century, the majority of history of science narratives were linear and triumphal tales, focused on heroic discoveries that were supposed to culminate in the present state of the sciences. In the 1960s and 1970s this discourse of steady linear progression began to change. There is extensive literature on the subject[10], and I will merely highlight factors that have converged towards the increased use of objects, collections and heritage as primary sources by historians.

Basically three simultaneous forces pulled the history of science from its solid linearity. First, there was the introduction of discontinuity (e.g. Kuhn, Bachelard), which repositioned the role of the historian towards reconstructing and retrieving 'secondary', 'inferior' and 'lost' practices. Second, there was the social turn, which recognised that the activities of the sciences are inextricably associated with the worlds of everyday life, culture and politics. Last but not least, there was the culture turn, which introduced the notion of cross-cultural exchanges in science and replaced the idea of knowledge transmission from 'advanced' to 'primitive' peripheral nations with the idea of multiple local sites of expertise where practices, skills and knowledge circulate and are mediated, appropriated and tailor-made.[11]

These three forces combined have shaped recent history of science historiography and narratives. The 'local' began to matter. What happened in peripheral countries, such as Norway, Lithuania, Iberia, Mexico, India did matter. Technicians in laboratories, workshops and astronomical observatories mattered. Spaces mattered. Women mattered. How students learned mattered. And objects mattered. The 'material turn' is not so much a spontaneous and isolated movement of historians towards objects, collections, spaces and museums, but it is deeply embedded in, and a consequence of, these three forces.

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[10] Recently, the Cambridge historian Nick Jardine performed a comprehensive revision of the literature in an issue of the journal Studies in History and Philosophy of Science devoted to recent heritage of science. See Jardine, N. Reflections on the preservation of recent scientific heritage in dispersed university collections, Studies in History and Philosophy of Science 2013; 44 (4): 539-754.

[11] It should be noted that these are not exclusive to the history of science. They are included in a broader movement of new approaches to historical studies.

In the grand diachronic narrative of science, objects practically had no significant role to play (only iconic objects from great scientists, e.g. the telescope of Galileo), but in this multiple complex local-global narrative they can be central, especially if well-documented and rich with information. We want to know who used them, how they circulated, how they were adapted in laboratories by scientists and technicians, we want to know if it was possible to reach certain conclusions with them, we want to know their biographies and how they encapsulate research and teaching practices, theoretical speculation, experimental inquiry, technical application and innovation; we want to understand the interactions between instrument-makers, traders, laboratory staff, scientists and the industry, as well as controversies, and even broader historical, social and political contexts.

So, history of science is now better prepared than it was 40 years ago for an increased use of objects and collections. Is it really happening? Interest and use have increased, but we cannot say that museums have been flooded with requests for access to collections by historians. For this to happen, historians need to consider material sources on a more equal basis with documental sources and this is not happening yet. It requires a shift in historiographical approach: from objects as illustrations and representations to objects as primary sources of historical analysis. In other words, objects more often earlier, and not *only* at the end of historical narratives. This shift, which is cultural as much as historiographic, requires training and takes time. As William Kingery indicated, "learning from things requires rather more attention than reading texts and the grammar of things is related to, but more complex and difficult to decipher than, the grammar of words"[12]. Complementary training of young historians in the material culture of science is paramount and while a considerable body of literature has already been published, reference materials are still scarce and material culture studies have only marginally penetrated graduate and post-graduate history of science courses in Europe.

However, just when historians of science were approaching objects, museums of science were moving away from objects. What has happened in the museum sector? On the one hand, collection activities – both curatorial and research – represent today a much smaller percentage of all museum activities than it did in the past. Since the 1960s, there has been a decline

[12] Kingery W. D. (ed.) Learning from things. Method and theory of material culture studies. Washington DC: Smithsonian Institution Press; 1996, p. 1.

Fig. 3. Students from the Masters in History and Philosophy of Science of the University of Lisbon working with the material culture of science (photo by the author).

in the role of collections and research in museums, a decrease in curatorial careers and collection funding, combined with a low regard for collections *vis à vis* other museum areas, such as education, marketing and management[13]. The portrait applies to every museum – not just science and natural history museums. For natural history museums and collections, the impact has often been devastating, particularly in universities[14].

On the other hand, the 1980s and 1990s was the time of the science centres' boom and public understanding of the science movement, along with

[13] There is an extensive literature on the topic. For a comprehensive overview of museum research in recent years (focus on the UK), I suggest Anderson R. G. W. To thrive or survive? The state and status of research in museums. Museum Management and Curatorship 2005; 20 (4): 297-311. For the impact of collections-based research and teaching on European university collections, I suggest Lourenço M. C. Between two worlds: The distinct nature and contemporary significance of university museums and collections in Europe. Paris: CNAM; 2005 (PhD tesis), particularly Chapter 5 (http://webpages.fc.ul.pt/~mclourenco/, accessed 5 July 2015).

[14] Lourenço M. C. 2005, *idem*.

a vogue of politically motivated ideas such as 'scientific culture' being essential to informed citizenship. This period – which still continues, although perhaps more intensely in the Americas than in in Europe – was all about 'the science', 'the content, the concepts of science' (energy, optics, climate, and so on) and little about history.

Probably, museums of science have always been about 'the science', as Jim Bennett has convincingly argued[15]. According to him, museums of science were not created to pursue the history of science – they were created with the aim of educating their audiences, which could be students, professionals and artisans, or the general public. This strong didactic component has driven museums of science since the first modern ones until today's science centers. Many have combined the science education agenda with a national or regional identity agenda, particularly since the emergence of world exhibitions and national museums in the 19th century. Since it opened in 1794, the *Conservatoire National des Arts et Métiers* in Paris had operational models and accessible drawings aimed at training artisans from all over France. The *Urania* – the first institution with hands-on experiments – was created in Berlin in 1898. The Deutsches Museum in Munich introduced interactive experiments and demonstrations illustrating scientific and technological concepts since its creation in 1925. The Science Museum in London had an interactive Children's Gallery as early as 1933. A similar movement has taken place in natural history museums. Although natural history museums have an even more problematic relation with history[16], their public interpretation and exhibitions have a strong educational focus on timeless concepts (the tree of life, where extinct and extant species are displayed, and evolution, behaviour, ecosystems). These more recent educational movements have merely reinforced and accentuated what was already a very strong science education agenda in museums.

The combination of the science education agenda with the decline in collections-based activities has not been favourable for objects. Objects are problematic and they are presented to illustrate, support and explain mainstream science education narratives.

A galvanometer, for example, is collected and documented with limited concern for pre-museum data because its 'value' is not in (its) history, life cycle, biography or past uses, but in the representativeness of its function.

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15 Bennett J. Museums and the history of science. Practitioner's postscript. Isis 2005; 96: 602–608.

16 'Human' history, that is, not natural history.

That is what is considered important for the science education agenda. Once in the museum, the galvanometer is reduced to its functional, elemental, operational principle. It materialises, and supposedly explains, purified, almost vestal scientific concepts, laws, and phenomena, supposedly easier to communicate to broader audiences, in an exhibition about energy transformation, for example. The galvanometer is educational wallpaper[17].

In this perspective, all galvanometers of the same period are alike – any would serve – and so are all astrolabes and vacuum pumps. We are not dealing with individual objects with singular life cycles; we are dealing with archetypes of objects whose life cycles are not only irrelevant, but incompatible with a de-contextualized presentation of 'the science'. Life cycles and past uses are too local, too loaded with complexity and contingency – which is precisely what is interesting to the 'new' history of science, apart from being, ironically, what brings uniqueness and meaning to individual objects. Introducing more history and historians into practices and public activities is probably the most important challenge museums of science face today.

The challenge of science (scientists and scientific practices)

Scientific heritage mirrors the state of the art, practices, ideas, policies and values of science in a given period. That is why collecting and preserving is important to document science through time. While in use, objects go through different life cycles where control and decision-making is made by *generators* – scientists, engineers, technicians, researchers and students. These processes are complex and still poorly understood by museums. I draw my reflections (fig. 4 on next page) from direct observation and countless informal interviews with scientists.

First, objects are manufactured, acquired or developed. Then they are used for the purposes they were made for. Once primary use discontinues – due to obsolescence, inadequacy, or the availability of better, more precise or more efficient instruments – objects can simply be trashed. Alternatively, they can enter a second life cycle, which may entail adaptation/innovation, cannibalisation, down-graded use – for example from research to teaching, often in a different institution – and storage for spare parts (fig. 5)[18].

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17 Elsewhere I have examined in detail how perceptions of 'object wallpaper' often drive collecting and documentation practices in museums of science. Cf. Lourenço & Gessner 2012, *op. cit*.

18 Schaffer S. Easily cracked: Scientific instruments in states of disrepair. Isis 2011; 102: 706–717.

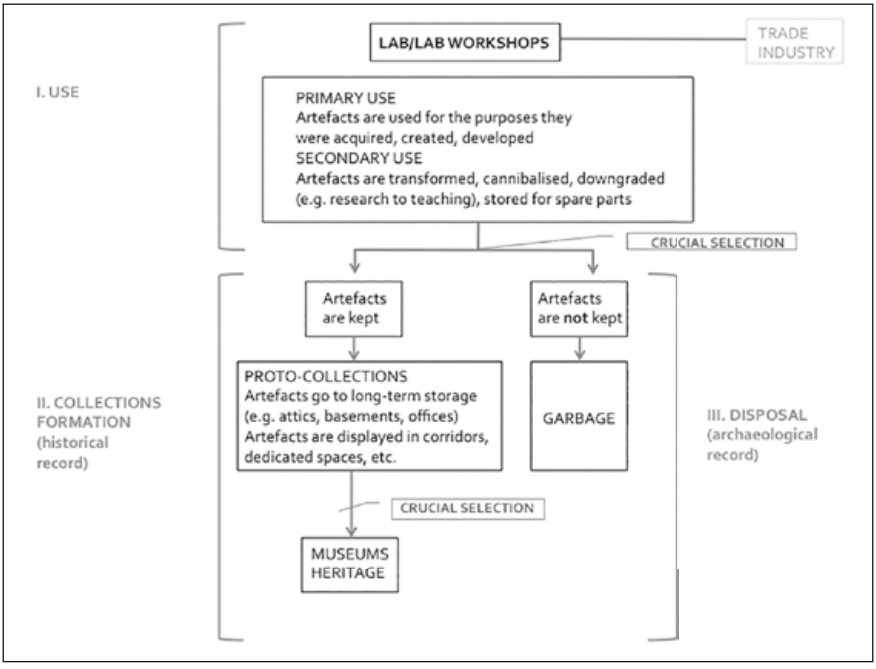

Fig. 4 – General scheme of objects' life cycles: patterns of use from manufacturer to garbage or museum.

All museum professionals have seen material evidence of multiple life cycles in objects. My favourite example is the Cassini-D'Arturo globe at the *Museo La Specola*, University of Bologna. In the early 1920s, Guido Horn-d'Arturo, a professor of Astronomy, was studying the distribution of nebulae in the sky. He was using a written source – the 1888 *New General Catalogue of Nebulae and Clusters of Stars* – but because his research required the examination of space distribution, he marked with red *confetti* the nebulae he was studying on the surface of a 1792 Cassini celestial globe. The globe is still there in Bologna, splendid despite the *confetti* – or rather, *because* of the confetti[19].

The end of the second life cycle – which may last for decades – is crucial. Most artefacts are trashed at the end of the second life cycle. Broadly speaking, when they are not trashed one of two things may happen.

[19] Clercq S. W. de; Lourenço M. C. A globe is just another tool: understanding the role of objects in university collections. ICOM Study Series 2003; 11: 4-6; Lourenço M. C. University collections, museums and heritage in Europe: Notes on significance and contemporary role. In Proceedings of the Congreso Internacional de Museos Universitários. Madrid: Universidad Complutense de Madrid, in press.

Fig. 5. Scientific instruments on display at the *Escuela Técnica Superior de Ingenieros Industriales, Universidad Politecnica de Madrid* (photo by the author).

Objects may be selected and put on display in corridors, classrooms and halls. These displays are usually organised by scientists and they have a strong disciplinary and departmental focus. They target young scientists, students and visitors. Labels are minimal and reduced to the instruments' names, if existent at all (fig. 5). The motivation behind these showcases requires further research although recent studies seem to suggest that individual scientists and technicians often demonstrate emotional and aesthetical attachment to objects, prolonging their life cycles and preserving them until they enter a museum.[20]

Alternatively, objects may be moved to spaces increasingly distant from core research and teaching activities: offices, attics, basements, general warehouses, off-site storages. They subsequently become increasingly detached from the scientists and technicians who have operated them. Moreover, in

[20] Wilson L. Intangible histories and the invisible technician. UMACJ 2012; 5: 17–22; Wilson L. A typology of dispersed collections: Collaborating with scientists and technicians. Transactions of the Royal Norwegian Society of Sciences and Letters 2013; 3: 137-151; Boudia S. Communautés savantes et ambivalences patrimoniales. In Boudia S., Rasmussen A., Soubiran S. (eds.), Patrimoine et communautés savants (pp. 61–76). Rennes: Presses Universitaires de Rennes; 2009.

Fig. 6. University warehouse with obsolete equipment, books and documents from different periods (photo by the author).

these spaces, artefacts get mixed with other non-scientific objects – e.g. old furniture, old teaching equipment, out-of-fashion decorative elements, and so on (fig. 6). Eventually, all these objects are selected too. Many may be trashed, but a local museum may also be called. In any case, decision-making no longer pertains to scientists and technicians – typically administrators and logistics officers decide on the fate of objects at this stage.

To a large extent, I suspect these patterns of use and re-use are invariable through time, in other words they could probably be already identified in 18th and 19th century science practices (or even earlier), although this requires further research. In any case, generators – scientists, technicians, researchers, students, administrators – make all the choices through every moment of objects life cycles, including the ultimate one: the garbage or the museum. Museums are at the end of a complex, dynamic and contingent decision-making process – they collect from what generators decide to leave behind.

Museums understand these dynamics poorly, yet they are essential to document pre-museum object biographies that could later inform research in history and other humanities, as well as public engagement. Moreover, these dynamics have an impact on the 'representativeness' of objects museums collect (what 'science' do they encapsulate?). Museums need to get proactively involved with generators at much earlier stages.

More research is crucial, drawing from previous studies and using methods and approaches derived from anthropology, sociology and archaeology[21]. For example, we need to understand why some objects are immediately trashed while others are not, why an instrument is downgraded from a research laboratory to a teaching classroom. We need to study what is trashed. We need to understand the duration of each cycle and the variables at play when these are prolonged.

The challenge of recent heritage

Apart from the challenges of history and practices of science in their relation with objects, perhaps the most important challenge facing museums today is the preservation of the so-called recent heritage of science, roughly corresponding to instruments with life cycles after WWII (fig. 7 on next page). In the past five years, there has been a growing interest in the topic and the associated literature is already considerable[22].

Few museums other than large national ones are consistently collecting recent heritage of science. The collection, study, storage, preservation and public interpretation of instruments of the recent past is significantly more difficult and expensive than earlier instruments. Six factors contribute to this.

First, the size of recent instruments – much larger than earlier instruments, they are often modular and occupy entire laboratories. Second, the very concept of instrument is challenged: what is an instrument today? One module that performs one function? The whole system? The entire lab? Moreover, part of one experiment may take place in Oxford, the other in Gent and the other in São Paulo. In practice, how can collecting and documentation be done? Who is responsible? How do you preserve fragmented, dispersed and highly dematerialised narratives?

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21 For instance, Latour B. Science in action: How to follow scientists and engineers through society. Milton Keynes: Open University Press; 1987; Latour B. Reassembling the social: An introduction to actor-network theory. Oxford: Oxford University Press; 2005; Rathje W., Murphy C. Rubbish! The archaeolology of garbage. Tucson: University of Arizona Press; 2001.

22 See a recent whole issue of the journal Studies in History and Philosophy of Science, edited by Nick Jardine and published in 2013 (Vol. 44, No. 4). See also Doel R. E., Söderqvist T. (eds.). The historiography of contemporary science, technology and medicine: Writing recent science. London: Routledge; 2006; Cuenca C., Thomas Y., Ballé C. Le patrimoine scientifique et technique contemporain: Un programme de sauvegarde en Pays de la Loire. Paris: L'Harmattan; 2005.

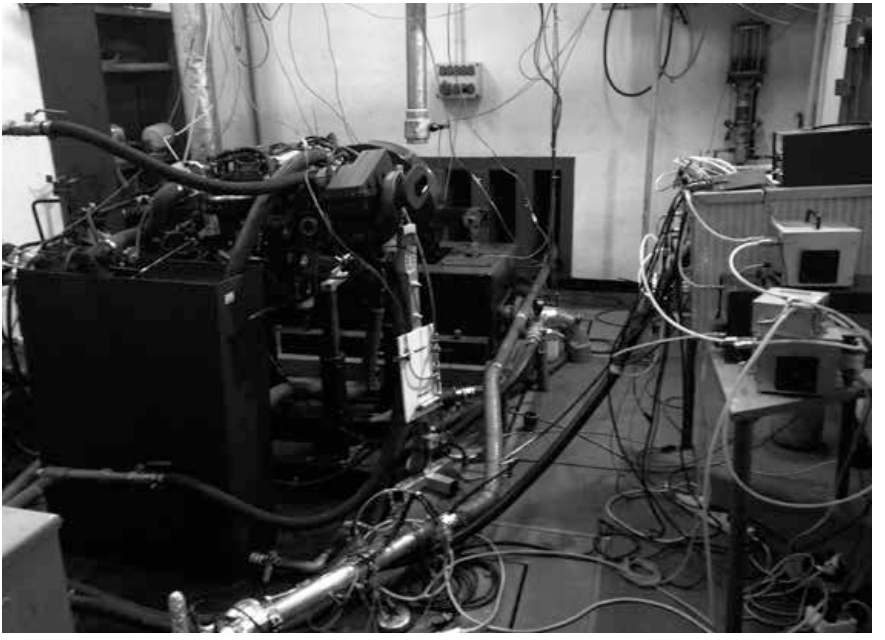

Fig. 7. Recent heritage of science in situ (photo by the author).

Third, the so-called 'black box' phenomenon: many instruments produced after WWII no longer have clear designs in terms of articulation between form and function. Everyone recognises a late 19th or early 20th century thermometer and barometer. This no longer applies to instruments of the recent past. Instruments are all similar, and often the computer is the instrument. Fourth, many instruments of the recent past are contaminated with new (and old) hazardous materials.

Finally, as argued earlier, it is important to collect and preserve not only the material objects, but the associated documentation as well – and this poses yet another challenge. Until the late 1980s, scientists and technicians wrote their research notes and correspondence on paper. Since then, and just like all of us, they have increasingly used digital formats (email, apps). The volatility of these formats, combined with the absence of clear institutional archival policies, makes it very difficult to document the use and re-use of instruments.

Clearly a pragmatic approach is needed, involving scientists, historians, archivists, conservators and museum professionals. Some tools are already

available. Archives associations have developed a wide variety of resources for the preservation of digital documentation. Oral history tools can be used, contrary to earlier collections. The *in situ* character of recent heritage of science requires survey and preservation tools that can be adapted from industrial archaeology. Theses addressing the topic are becoming more regular. Moreover, there are examples of good practices in some European countries (e.g. the PATSTEC Programme in France[23], the ASTUT, *Archivio Scientifico e Tecnologico* at the University of Turin[24], the Science Heritage Programme at the University of Cambridge). UNIVERSEUM, the European Academic Heritage Network, has a Working Group on Recent Heritage of Science since 2012. It has produced two reference documents: *Selection Criteria for Recent Material Heritage of Science at Universities* and the *Minimum Requirements for Preservation and Access of Recent Heritage of Science*[25].

Conclusions

In this paper, I have summarised what I think are the three main challenges museums of science face today: the challenge of history, the challenge of science and the challenge of the recent past. These challenges have one thing in common: addressing them signifies more and better collections documentation, which in turn signifies working closely with the communities of users (particularly historians) and generators (scientists and technicians). Insight was drawn from my professional and research experience with scientific collections and heritage in Europe. I have also identified the areas that require further development and research.

In recent decades, the history of science has substantially changed and it will continue to embrace new complexities, new perspectives, and new sources. Until now, actual use of objects and collections in museums as sources is sporadic, but in my view this tends to develop as material culture studies become increasingly included in historians' graduate and post-graduate training. Historians are naturally interested in diversifying sources, and they are avid museum visitors.

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23 See www.patstec.fr, accessed 5 July 2015.

24 See http://www.unito.it/ateneo/strutture-e-sedi/musei-e-archivi/archivio-scientifico-e-tecnologico, accessed 5 July 2015.

25 The UNIVERSEUM Working Group is chaired by Roland Wittje. See aims and resources in http://universeum.it/working_group_urhs.html, accessed 5 July 2015.

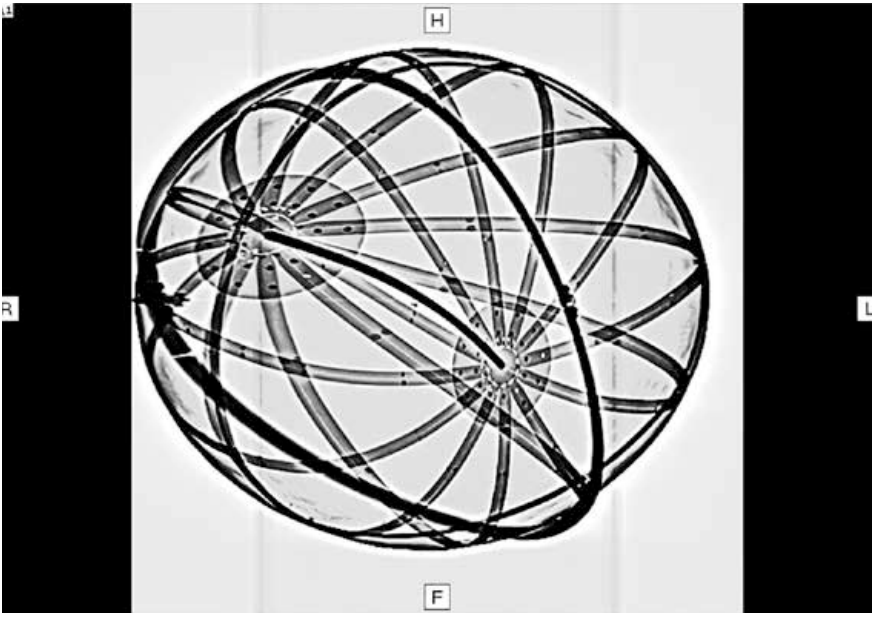

Fig. 8. A CT-scan of a 16th century Schissler celestial globe, presently at the National Palace of Sintra, Portugal (photo courtesy of Instituto Português de Oncologia, Lisbon).

For museums, the challenge of history is more difficult. They are still poorly prepared to adequately respond to the needs of historians. As Jim Bennett succinctly wrote, "history of science has no divine right to rule just because the objects in the museum are old"[26]. Collections in museums can contribute to historical studies but this requires major changes in museums' perception of objects and museum practice, particularly documentation and research. The timing is, however, right, as the 'material turn' provides extraordinary opportunities for active collaborations.

Science has also changed significantly in the twentieth century, particularly after WWII. The research questions, the institutions, the practices, the objects are noticeably different from those of previous periods. Practices and objects collected by museums need to change accordingly. Museums need to engage more substantially and proactively with generators (scientists and technicians) earlier in object life cycles and not merely at the 'end of the line'. Too often, museums are passively waiting. Being more proactive means four things: i) first, a better understanding of decision-making processes during object life cycles and subsequently better understanding

[26] Bennett J. 2005, *op. cit.* p. 606.

Fig. 9. Chemistry Open Storage, MUHNAC (photo C. Teixeira, MUHNAC Archives).

of the role played by objects in science teaching and research practices; ii) a better understanding of what is adapted, trashed and why; iii) increased awareness towards contemporary research questions being addressed by local, regional and national researchers, and iv) 'wish lists' of contemporary items to collect[27].

None of this is easy. Museums are already strained because of a chronic lack of resources and have trouble dealing with what they already have, let alone opening new collecting and research fronts. However, these challenges are more strategic than action-based. They are about being aware, deliberate and open to collaborations.

Together – users, generators and keepers – we will be more capable of unveiling the 'dark matter': hundreds and hundreds of objects thick with material and immaterial marks of their complex biographies that lay dormant in university departments and museum storages, research them and ultimately present their unique stories to audiences of all ages and

[27] This was suggested to me by David Pantalony, Curator at the Canadian Science and Technology Museum, Ottawa (pers. comm, Nov. 2014). How many museum curators have a wish list, I wonder.

backgrounds. Unique stories that are loaded with human, social and political contingencies, apart from errors, mistakes, doubts and open questions. Both are still poorly represented in our museums of today, yet they are intrinsic to our human strive for truth, beauty and knowledge.

Acknowledgements

Throughout the years, I have had the privilege of discussing these issues with countless friends and colleagues to whom I express my gratitude. More recently and specifically regarding the challenges mentioned here, I am grateful to Jim Bennett, Peter Heering, Roland Wittje, Rich Kremer, Marcus Granato, David Pantalony, Lydia Wilson, Sébastien Soubiran and Cornelis Hazevoet. I am grateful to the Portuguese Foundation for Science and Technology (FCT) and Gulbenkian Foundation for supporting my research on scientific collections and university heritage. I also thank the institutions that allowed me to use the pictures included in this paper. Finally, I am deeply grateful to the Sarton Committee of Gent University, particularly Professor Robert Rubens and Professor Danny Segers, for awarding me with the honour of the Sarton Medal 2014.

Laudatio Paul WYLOCK

Yves Van Nieuwenhove

Paul Wylock was born in Ghent on December 7th 1945. In 1963, he finished the "retorica" at the Royal Atheneum in "de Voskenslaan" in Ghent, and decided to study medecine at the Ghent University. Only 7 years later, in June 1970, Paul graduated as doctor in Medicine, Surgery and Obstetrics.

As was custom in those times, young male physicians fulfilled their military duty, and Paul Wylock was stationed as general practitioner in Germany from August 1970 till October 1971. During this period he chose to start a training to become surgeon, from November 1971 till June 1975 at the St Joseph Hospital in Venlo (Holland) which was affiliated with the Radboud University Nijmegen, followed by a specialised training for plastic and reconstructive surgery back in the Ghent University Hospital from July 1975 untill December 1978. Under the supervision of Prof. Dr G. Matton this resulted in his board certification as a Plastic Surgeon in september 1978.

Only a few months later, in January 1979 Paul was asked to be the founder of the new Unit of Plastic Surgery at the brand new University Hospital of the Vrije Universiteit Brussel.

A fruitfull carreer followed; in March 1982 he received the National Award of the Belgian Hand Group with a clinical study on Dupuytren's disease, since September 1986 he was appointed Teacher in Plastic Surgery, and from September 1990 Teacher in Plastic, Reconstructive and Hand Surgery in the "Collegium Chirurgicum Plasticum Belgicum". From 1997 till 2005 Paul Wylock was elected as National Secretary of the Belgian Society of Plastic Surgery, from 2005 President of the Royal Belgian Society of Plastic Surgery, and untill 2012, he was Chairman of the national teaching courses of the Collegium Chirurgicum Plasticum.

A specific achievement was the organisation of the Lustrum Meeting of the 50th Anniversary of the Belgian Society of Plastic Surgery in May 2005 (1955-2005) in Brussels.

Due to his tremendous experience and international reputation in the field of hand surgery, Paul became a Full Member and later president of the Belgian Hand Group of the Royal Belgian Society of Plastic Surgery. Paul became also on 27 juni 2015 honorary member of the Belgian Hand Group.

His international achievements are numerous, with invitations as guest professor in 1988 in Kinshasa (Congo), 1998 Hue, Vietnam, in combination with the start-up of the first Belgian-Vietnamese Course of Plastic Surgery and a Course of Hand Surgery in Hue, in 2002, 2003 and 2005 an invitation by Prof. Thet Hta Way to Yangon, Myanmar, in 2007 an invitation by Prof. Mohamad Qattan and Prof. Abdullah Alnamlah to Riyath, Saoudi-Arabia, in 2007 to Antananarivo, Madagascar, and in 2013 and 2014, again to Yangon, Myanmar.

Meanwhile, on December 7th, 2010, Prof. Paul Wylock celebrated his retirement, and proudly handed over the chair of the department of Plastic and Reconstructive Surgery of the University Hospital Brussels over to Prof. M. Hamdi.

One of Paul's other passions, next to Surgery and traveling, however was the history of medecine. Shortly after his retirement, he received an Award of the Belgian Royal Academy of Medicine with his book, "The Life and Times of Guillaume Dupuytren", followed by an official proclamation during an Academic Session at the Royal Academy of Medicine, Brussels on November 19th 2011.

The life and times of Guillaume Dupuytren (1777-1835)

Paul Wylock

His life

At the time of Dupuytren's birth in 1777, France was still governed by an absolute monarch, Louis XVI. When Dupuytren died in 1835, he had lived through two revolutions (1789 and 1830), a republic, a 'Directoire', a consulate, an empire under Napoleon and another two royal restorations under Louis XVIII and Charles X.

Dupuytren (Fig.1) was always closely involved in these historic events as he was in direct contact with the leading figures from the different periods, both privately and professionally. He played an important role in the organisation and reorganisation of medical surgical education. As the "head surgeon" at the Hôtel-Dieu hospital, the largest hospital in France, he treated not only a large and highly varied number of surgical patients but also the victims of riots, insurrection, revolutions and wars, as well as victims of the cholera epidemic of 1832.

Fig. 1. Guillaume Dupuytren

His role in the development of modern surgery and surgical pathology was so overwhelming that the period during which he was "head surgeon", is called **the Dupuytren age** in the history of surgery in France.

His fame brought him into contact with the great and powerful. He was the surgeon to King Louis XVIII and Charles X; he became a friend of, amongst other nobility, Baron James de Rothschild and Baron Alexander von Humboldt.

Under Napoleon, Dupuytren became "Officier de la Légion d'Honneur", Louis XVIII elevated him to the aristocracy as a baron and Tsar Alexander I gave him the "Medal of the Order of St. Vladimir".

He became an honorary member of numerous academies and associations both in France and beyond.

In art, Romanticism developed as a reaction against the 18th century Rationalism. During his life, there was a resurgence of prose, poetry, opera, ballet and fine art in Paris. The French Revolution naturally caused a huge revival of creativity.

On February 8th, 1835 Dupuytren died at three o'clock in the morning in the presence of his beloved daughter Adeline and his son-in-law the count de Beaumont.

The autopsy was carried out according to the wishes of the deceased.

Dupuytren had once said: '*Que l'on examine mon cœur surtout, et l'on y trouvera le siège de ma maladie, la lésion produite par mes chagrins et mes tourments'* [That they may examine my heart especially and that they may find the seat of my disease, the lesion produced by my chagrin and torments]

On February 11th 1835 Dupuytren was buried.

His funeral was a great ceremony at which the political and academic government, as well as his plentiful students and a great mass of people attended.

When leaving the church the horses were unharnessed from the hearse and his students pulled the hearse themselves, helped by some men from the crowd, all the way to Père-Lachaise cemetery through an immense crowd. (Fig. 2)

The name Dupuytren has become immortal in medicine, not only in the contracture of the palm, which he described in extreme detail, but also in a specific fracture of the fibula. His name survives also in road names,

in the "Musée Dupuytren", the museum of pathological anatomy in the medical faculty in Paris, in the new university centre of Limoges, which is named after him and in an amphitheatre at the Parisian hospital Hôtel-Dieu.

The anniversary of his birth and death are also still commemorated in Pierre-Buffière where he was born and in Paris where he studied, worked, lived and died. A statue of him has been erected in the inner courtyard of the Hôtel-Dieu hospital in Paris and a memorial has been built in his place of birth.

Fig. 2. His tomb at Père-Lachaise, Paris

Dupuytren's working day and work

Dupuytren was 38 years old when he became "**chirurgien-en-chef**" of the Hôtel-Dieu (Fig. 3) on September 9, 1815.

Fig. 3. Hôtel-Dieu Hospital in Paris during Dupuytren's life

He was to hold this position, for which he had worked so hard, for the next 20 years.

His name was at the top of the French surgical world and the Hôtel-Dieu hospital itself was the most famous surgical teaching hospital at that time.

Dupuytren had a strict working schedule.

For the next 20 years Dupuytren's day-to-day programme remained practically unchanged. His working schedule was very strict.
Dupuytren's assistant was **Jean Nicolas Marjolin** (1780-1850).
Dupuytren expected him to step in should he ever be absent or sick. But he said "*Monsieur, vous avez été désigné pour me remplacer quand je m'absenterai ou quand je tomberai malade; je vous préviens que je ne m'absente jamais et que je ne suis jamais malade"*. [Sir, you were appointed to replace me when I am absent or if I should be sick; I should remind you that I am never absent and never sick].

He arrived at the hospital at 6 a.m. in the summer and one hour later in the winter, every day, including on Sundays and holidays.

The arrival of this illustrious man was announced by the ringing of a bell, everyone was waiting for him, "internes" [residents] and "externes" [non-residents], students, nurses, visitors and lower staff. A nurse, according to some "la mère supérieure" [the matron] took his coat and hat and gave him the well-known white apron, pulled up to under his armpits, which he would wear into the operating room.

Before beginning the ward rounds Dupuytren checked attendance and woe betide those who were absent without a valid excuse. Unjustified absence meant sacking from the service.

He occasionally received distinguished visitors, such as King Charles X in 1824. (Fig. 4)
Dupuytren had a soft voice. The impact he had on his patients was incredible. His words '*Allons mon brave, nous vous guérirons*' [Come on my man, we will cure you], had a magical affect on them.

Dupuytren became most famous for his description of finger contracture, previously wrongly named as a contracture of the tendons "*crispatura tendineum*" by Felix Platter in 1614.

Fig. 4. Visit of King Charles X at the Hôtel-Dieu Hospital

There is absolutely no doubt that this illness was first described in an exact manner by Dupuytren, who was also the first to make a differential diagnosis with other types of finger contracture, observe the same type of pathology in the sole of the foot and to describe an effective operation and make the diagnosis and treatment available to the entire world.

At 9 o'clock the lessons started in the amphitheatre of the Hôtel-Dieu hospital. He sat in his high backed green chair behind a table and in that way often addressed 500 people, coming from all over Europe and even from America.

Testimonies from visitors are known from this period. One of the most famous was John Collins Warren from Boston (1778-1856), the son of John Warren (1753-1815), the founder of the Harvard Medical School in Boston and first professor of anatomy and surgery at that school. J.C. Warren visited Paris at the beginning of Dupuytren's career. His son Jonathan Mason Warren (1811-1867) visited Paris at the end of Dupuytren's career.

Mostly Dupuytren lectured extensively on a few cases he had seen during ward rounds. He taught the case history and semiology; the differential diagnosis was also explained. He was well aware of when surgery could be helpful and when it could not. He was later (in early 1835) to refuse the

Fig. 5. Duputren's instruments case

operation for thoracic empyema for himself because he preferred to die of the illness rather than of the operation.

At around 10 o'clock, after a one hour lecture, the operation session began…without anaesthesia. This took place in the same hall. He operated at breakneck speed; he would amputate a thigh in a few minutes. He adapted instruments and had new instruments made. His beautiful instrument case contained instruments with ivory handles. (Fig. 5)

The operation session was an extension, a demonstration, of his clinical lectures.

He often spoke the following winged words: "***Je me suis trompé quelque fois, mais je crois m'être trompé moins que les autres.***" [I have made a few mistakes, but I believe I made fewer mistakes than the others]

The work of Dupuytren

He became most famous with his description of finger contracture (Dupuytren's Contracture), but also with the description of the fracture of the lower part of the fibula, with dislocation of the ankle (Dupuytren's Fracture).
He was also famous for cataract operations, lithotomie (thesis in 1812 !) and artificial anal reconstruction.
No field escaped Dupuytren's interest. Of course surgical pathology was his largest field of interest, but he was also experienced in internal medicine, physiology, neurology and anatomy.

After the operating session the "Consultation Générale et Gratuite" [General and Free Consultation] began.
Seated in his famous green chair Dupuytren received the patients who came to his free consultation.
Dupuytren's morning was spent in the Hôtel-Dieu hospital.

In the afternoon he concentrated on his private practice at his home on the "Place du Louvre".
When he arrived at his private consultation the waiting room was mostly already filled with waiting patients.
If his consultation for the poor and needy was always overcrowded, the same was also true of his consultations for his richer patients.
Patients came to him from all areas of France, Europe and Great Britain. Everyone received the same attention: the powerful, the middle class and also the poor and needy.
Through his private consultations Dupuytren amassed a fortune, though he does not seem to have been greedy or mean. He adjusted his fee to his patient's financial status.
He left millions of francs, not just the profits from his fees but also the result of investments that were very profitable. He had been advised about them by none other than the baron James de Rothschild, who had become a patient of Dupuytren's after having received a serious head injury when falling from his carriage. De Rothschild not only remained Dupuytren's patient but also became an intimate friend and financial advisor besides being the executor of Dupuytren's will.
After the private consultation Dupuytren made his way to the faculty, where countless professional obligations awaited him … examination

preparation, composing the panel of judges for theses, scientific sessions …
Sometimes he operated on a rich patient at their home. It would take a long time before well-off patients would allow themselves to be operated in hospital.

Every evening he returned to the Hôtel-Dieu hospital between 6 and 7 o'clock to check on the patients he had operated on in the morning and also to see new patients. He checked register of observations, which he corrected or supplemented. He also checked important bandages.
Then his social life would begin.

Belgian students and contemporaries of dupuytren

Ghent

Jozef Frans Kluyskens (1771-1843), of Ghent, was first a surgeon in the Austrian army (Fig. 6). During the Consulate he became a surgeon at Ghent's Bijloke Hospital. He lectured on surgery at the school for medicine in the "Pakhuis" when his colleague Verbeek (1779-1848) taught anatomy there.
He went to Paris on a study tour.
After the battle of Waterloo in 1815 he was responsible for the organization of all ambulances. He carried out three hundred amputations with a mortality rate of only 25%, a remarkable achievement at that time.
In Kluyskens' time there was stagnation in teaching created by the separation of the Empire from its neighbours. In 1808 he attempted, with other colleagues, to fill this deficiency by founding the '*Annales de Littérature Médicale Etrangère'*. Through these *'Annales'* he particularly hoped to make the medical literature smuggled in from England. This initiative got Kluyskens the nickname "*the Lieven Bauwens of medical literature*".
He was rector of Ghent University in 1830-1831 and 1839-1840.

Jacques Louis Kesteloot (1778-1852) (Fig. 7) had an important influence in Ghent's favour as a university town. He was born in Nieuwpoort, obtained his doctorate in Leiden and was based in The Hague. He also studied in Paris. He became a councilor to Willem I and was a friend of the later minister of public education. Kesteloot became the rector of Ghent University in 1825-1826. Due to his Orangist leanings he was no longer a part of the faculty but in 1834-1835 he became the rector again.

Fig. 6. Prof Kluyskens

Fig. 7. Prof Kesteloot

Fig. 8. Prof Verbeeck

Fig. 9. Prof Michaux

Frans Egidius Verbeeck (1779-1848) (Fig.8) obtained his degree in Paris in 1806.
He taught anatomy, physiology, surgery, botany, pharmacology and chemistry at the *'Ecole de Médecine'*.
At the university he was the great supporter of horticulture.
He was rector in 1821-1822, 1832-1833 and 1847-1848.

Louvain

Maximilien René Michaux (1808-1891) (Fig. 9) After having studied anatomy, he completed his education in Paris with Dupuytren, Roux and

Velpeau as well as in Heidelberg, where he attained his doctorate in medicine.
He then taught surgery in Louvain. This remarkable surgeon, with his perfect knowledge of anatomy operated with complete calm in a time when chloroform was not yet used and indescribable scenes could be seen in operation halls, especially during facial surgery. In 1840 Michaux removed a parotid gland and an entire upper jaw, but especially the great number of nasopharyngeal tumors that he removed from 1843 to 1867 by splitting the palate aroused the outside world's interest. As soon as chloroform began its triumphant march through Europe his technique became more popular. This apparently unmoved man rarely showed any deep emotions.

Brussels

In Brussels **Jean Baptiste Uytterhoeven** (1765-1844) (Fig. 10) head surgeon of Saint Jean Hospital in Brussels and forefather of several generations of leading Brussels surgeons. In 1788 he took his exams to become a 'maitre-chirurgien' and first settled in the country, to be taxed with the organization of the health service as 'chirurgien-major' during the Brabant's revolution.

Fig. 10. Prof Uyterhoeven

After receiving the title of 'chirurgien de la ville' in 1791, a promotion at that time, he decided to set up in Brussels, where he was tied to the city's "Burgerlijke Gasthuis" seven years later.

After being appointed prison doctor of Vilvoorde (1802) he frequently attended lectures in anatomy and 'clinique' given by leading names such as Desault, Broussais and Dupuytren. In 1817 he became the head surgeon in Saint Jean Hospital. After Napoleon's defeat at Waterloo Uytterhoeven was honoured with the position as surgeon to King Willem I of the Netherlands. *'Il fut pour le Brabant que fut Kluyskens pour les Flandres et Ansiaux pour la province de Liège*' [He did for Brabant what Kluyskens did for Flanders and Ansiaux for the province of Liege] could be read in *'La Belgique Médicale et Annales médicales Belges'* after his death on 14 January 1844.

Further reading

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Laudatio Helmut Staubmann

Raf Vanderstraeten

In 1913, George Sarton published the first issue of the journal *Isis*, which was itself one of the first journals explicitly devoted to the history of science. On the front cover of this issue, Sarton listed *Isis'* patrons, among whom the famous French sociologist Emile Durkheim. In his opening essay, Sarton put forward his view on the identity of a yet-to-be-established scientific specialization. He defined his specialization as a "psycho-sociological investigation". A former Ph.D. student of Sarton at Harvard University, named Robert King Merton, became Associate Editor of *Isis* in the late-1930s, first responsible for what was called "the social aspects of science" and, as of 1942, for "sociology". In 1952, only a few years before his death, George Sarton, who was by then generally respected as the dean among the historians of science, still referred to what he called "my sociology of science" (Sarton, 1952, p. 94).

These few facts are a few indications of the close historical affinities between the history and the sociology of science. I may add, as Prof. Rubens mentioned, too, that Robert Merton was in the academic year 1986/87 the first recipient of the Sarton Medal for the History of Science of Ghent University. And I may add that the Ph.D. dissertation of Robert Merton (titled *Science, Technology and Society in Seventeenth Century England*) was supervised by two Harvard Professors, George Sarton and Talcott Parsons.[1]

[1] In 1938, Sarton published Merton's Ph.D. dissertation as volume 4 of *Osiris* – which he had founded as *Isis'* supplement in order "to take charge of the longer memoirs" (Sarton, 1953, p. 238). It may be added that Robert Merton dedicated his influential collection of papers on *The Sociology of Science* (Merton, 1973) to five of his teachers: Pitirim Sorokin, Talcott Parsons, George Sarton, L.J. Henderson and A.N. Whitehead. In some reflections and recollections on the occasion of the centennial of Sarton's birthday, Merton (1985) also presented himself as an 'unruly apprentice' of Sarton.

These few facts also allow me to point to the importance of the work in the theory and history of sociology of Prof. Helmut Staubmann. Over the years, Prof. Staubmann has made a great number of pertinent contributions that deal with various themes in sociology. In 2013, for example, Prof. Staubmann published a book titled *The Rolling Stones – Sociological Perspectives* (Staubmann, 2013). Over several decades, however, he has also done pioneering work in the history of sociology, in particular by providing new entries to Georg Simmel's work on aesthetics (see, e.g., Simmel, 2005) and by working on the unpublished legacy of Talcott Parsons, which consists of unpublished manuscripts, unpublished working papers, administrative documents or reports, and professional correspondence (see, e.g., Staubmann & Wenzel, 2000; Staubmann, 2015).

When Parsons (1902-1979) fully retired from Harvard University in 1973, he was no longer the leading theorist of sociology he had been in the mid-twentieth century. In the 1960s and 1970s, it had rather become common currency to depict Parsons as an out-of-this-world theorist, whose work was void of empirical relevance. Various theoretical alternatives competed against 'Parsonian hegemony'. As Jeffrey Alexander, for example, noted a few years after Parsons' death about the relationship of sociological theory to Parsons: 'If sociology were to be free to develop, this [i.e. Parsons'] domination had to be overthrown. The attacks on Parsons, which spanned the three postwar decades of his life, were often significant. Anti-Parsonian attacks spawned every major movement of theoretical reform, each of which initially presented itself vis-à-vis some particular dimension of Parsons's work' (1984, p. 410). As a consequence of these 'attacks' and associated 'paradigm shifts', Parsons' writings have since the 1960s and 1970s never again received much attention within sociology. It became in fact very unfashionable and very unproductive (in terms of career prospects or reputation mechanisms) to devote serious attention to the work of Parsons. Negative comments about the Parsonian hegemony still abound.

Only in recent years, there has emerged some serious scholarly interest in Parsons' work. Prof. Staubmann is one of the leading figures in this regard; over many years, he has fought with much dedication against the tide. His work relies on extensive periods of study within The Harvard University Archives, to which Parsons' unpublished manuscripts, working papers and professional correspondence were bequeathed. Often in collaboration with Parsons' former student and assistant Victor Lidz, he has edited several

unpublished documents of Parsons, thereby facilitating discussions about and interpretations of Parsons' work within the academia. His efforts now make it possible to discuss the historicity of Parsons' work – instead of just dismissing a particular period of sociological theory as outdated, overruled, replaced by something better, etc. Within a few months, Sage will also publish his monograph on Parsons (Staubmann, 2015).

From personal experience, I may tell that usage of the Talcott Parsons Papers of The Harvard University Archives is very laborious and time-consuming – as there is as yet but minimal chronological and alphabetical ordering of the many bequeathed documents. It may also be added that Parsons was a compulsory writer of – often many-page – letters (and many-page means 5, 6, 7, 8, 9 or more densely printed pages).[2] For Parsons, as well as for many other mid-twentieth century academics, the letter to an esteemed colleague was more or less equal to a publication. Such correspondence was part of the communication system of the discipline. This practice is very different at the moment. In the current academic climate, very different expectations and imperatives exist regarding communication and publication within the scientific system. Much of the work, which Prof. Staubmann has devoted to Talcott Parsons and the Parsons Papers, goes uncounted and hence in important administrative regards unnoticed. But it constitutes a difference which really makes a difference for the history of sociology. For this work, we would like to honour Prof. Staubmann with the Sarton Medal for the History of Science.

[2] Parsons used to dictate his letters onto a Dictaphone and give the tapes to his secretary; his secretary frequently would not only type, but also sign these letters.

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Rise and Decline of Functionalism and Current Problems of Methodology in the Social Sciences[1]

Helmut Staubmann

Historical Starting Point

The rise and decline of functionalism is widely regarded as a sort of historical fact that we can observe from a temporal distance of about half a century. In the course of the preparation of my talk, I did what many students and scholars nowadays see as a kind of royal road to scientific knowledge, namely to check with google and Wikipedia respectively on the topic of inquiry. What we find there is the undoubted conviction – as shared by large parts of the scientific community – that sociological functionalism was a phenomenon of the forties and fifties, associated primarily with the work of Talcott Parsons. It came under attack because it allegedly could not deal adequately with social conflict and with societal change, it was held as politically conservative or affirmative towards established power structures; in short, the period of functionalism is depicted as an "embarrassment in … theoretical sociology" (1, p321) as one of the renowned exponents of functionalism Wilbert E. Moore had complained in a programmatic essay.

Some decades later, Jeffrey C. Alexander coined the term neo-functionalism but it remained a label for the promotion of a couple of books under this title (2,3) and soon thereafter the traces of neo-functionalism vanished. Jeffrey C. Alexander found new theoretical grounds in what he calls "the strong program of cultural sociology." (4)

[1] I want to thank Victor M. Lidz for helpful comments on an earlier version of this essay.

One of the most prominent students of Parsons, Niklas Luhmann, made use of the concept of function in a somewhat modified way. (5,6) Expressed in personal terms, he had declared it as one of his main goals to synthesize Parsons and Husserl, or expressed in conceptual terms, function and meaning. (7) With his typical irony he had predicted that his highly abstract social systems theory would need a while to trickle down to common sociology; instead, it occurs to me, that in recent years we can see his influence trickling away. The chapter of functionalism seems to be closed.

For the sociology of knowledge it is crucial to discern two approaches to the history of ideas. One consists in the explanation of historical currents of thought by recourse to social, cultural, ideological or political circumstances, their dependence on power and other social forces. The decline of functionalism is explained in this way by the socio-cultural transformations of the sixties with its concomitant rise of political movements, of Neo-Marxism and Critical Theory. Provided that this view is correct, all of these factors are in a way exterior to the respective systems of ideas themselves. In line with this, Luhmann once suspected that Parsonian action theory disappeared simply because his followers could not establish themselves sufficiently in academic institutions.[2]

The other approach for an understanding of the development of ideas involves the reconstruction of their inner logic and an understanding of their inherent meaning. The unfolding of ideas clearly requires exterior prerequisites of all sorts; however, it follows a logic of its own that is not determined by these factors.

A look into the history of ideas through the lenses of the two approaches soon makes clear that the promotion or obstruction of ideas through exterior factors is by no means sufficient for a historical understanding of their career, as it were, and even less for a judgment on the quality of the ideas themselves. This also holds true for functionalism. The undisputable simple fact of the short period of time in which functionalism was regarded as the dominating current of epistemological thought in the social sciences, and its nearly complete disappearance in contemporary social thought does not *per se* provide sufficient evidence for its shortcomings. The question

[2] Some of Parsons‘ students became highly influential figures in American and international sociology. But at some point they distanced themselves from their teacher and greatly understated their relation to his work. What Luhmann refers to is certainly true for those scholars who openly acknowledged their Parsonian background.

of whether or not functionalism still can be of help in resolving current problems in the methodology of the social sciences requires a substantial look into its basic assumptions and conclusions and certainly into the different forms it attained.

Metaphysical Prelude

In order to get attuned to some of the quite complex and tricky issues of functionalism, I want to start with two preliminary remarks. The first one is a sort of philosophical or metaphysical prelude with which I want to provide a basic orientation or framing for the following arguments, the second one will lead us to a detour on artistic creativity.

The Vienna Circle-philosopher Moritz Schlick noted in his book *Allgemeine Erkennntnislehre* (*General Theory of Knowledge)* that in whatever way the basic assumptions of an epistemology are to be construed, "they need to leave space for the truth that there is an infinite number of modes of qualities; for the world is not cold and monotonous but polymorphous and full of eternal change."[3] (8, p. 372) Polymorphous is a translation of the German word *vielgestaltig* which Schlick had used. The expression *Gestalt* had entered the English vocabulary through a psychological theory of perception. *Gestalt* in this context means the capability of perceiving things as a whole, as a totality, or in later terminology one could say as a system with emergent qualities, not reducible to the parts it consists of. On the contrary, the parts are only understandable within the frame of the whole, an idea famously formulated already in ancient Greek philosophy and associated with the name of Aristotle. Throughout the history of epistemology there is a line of thinking that – in historically different formulations – holds on to the very idea that the world can be conceived of as a configuration of qualitatively different totalities that at times emerge and disappear and that cannot be reduced to its parts or to one another.

We would not deal with human reasoning if there wouldn't be a counter position maintaining the complete opposite. And again, from the ancient search for elementary parts, the atoms, to the materialism of the 18th and 19th century and to strong contemporary positions in the philosophy of the social sciences, we find a more or less overt commitment to the metaphys-

[3] My own translation.

ical assumption that real knowledge is a deciphering of the multitude of phenomena as a mere appearance of an ultimate matter. In the humanities and social sciences this takes on the form of all sorts of reductionism: psychologism, biologism, rationalism, or economism are probably the most prominent examples. In post-modern terms it is a matter of "deconstructing" something as an appearance of something completely different: religion as a superstructure to an economic basis, aesthetic judgments as an expression of class interests, altruism as a sort of egoism in disguise, obvious irrational behavior as the deceptive effect of an unescapable rationality inherent in human action – to name just a few examples. In a different context, Jürgen Habermas once said that his theory of communicative action rests on the intuition that truth, morality and beauty are in the last instance of one and the same essence.

The dividing line of these two metaphysical attitudes is conceptually captured by two pairs of opposites: holism versus reductionism and "polymorphism"[4] versus monism. It is in the context of these opposites that I want to locate the potential for the concept of function. (9,10) It is connected to systemic views or organic holism and opposed to all sorts of monistic reductionism. This is the basic thesis that I will try to highlight by elaborating a few of its implications for the epistemology of contemporary social science.

A Detour with Ernst Gombrich's Hobby Horse

After this metaphysical grounding, I want to make one further preliminary remark. Georg Simmel once said that he had gained some of his basic insights for sociology "by the detour of reflections on the essence of art". (11, p101) Such a detour might also provide a suitable bridging passage to my subsequent arguments.

At a symposium on form in nature and art, the art historian Ernst Gombrich presented a paper entitled "Meditations on a Hobby Horse or the Roots of Artistic Form." There he argues that naturalistic art theories – "ghosts which still haunt the language of art criticism" (12, p210) as he calls them – that see exterior reality as the root of artistic forms are simply untenable. The forms we find in art are not the product of imitations of nature with

[4] Pluralism might be another terminological option. However, I prefer the expression polymorphism since it has a more specific epistemological meaning.

variations based on abstraction or imperfection nor are they symbols of ideas. If external objects and their forms play a role, they provide an occasion for an artist to initiate a process of artistic creativity. Conclusively, the resulting artwork is not to be characterized as a representation of a real object but as a "substitution" – as Gombrich calls it – in terms of art and so there is absolutely no need for formal correspondence. A hobby horse, therefore, must not resemble a real horse at all; instead it substitutes its *function*. "The first hobby horse," Gombrich writes, "was probably no image at all. Just a stick which qualified as a horse because one could ride on it. The … common factor was function rather than form." (12, p213) Gombrich furthermore suggests that this idea also applies to biological, psychological, as well as social processes.

By making a little detour with Ernst Gombrich's hobby horse we arrive at the conclusion that an understanding of art and more generally of socio-cultural phenomena is not a matter of formal correspondence or substantial equivalence or – expressed in the terminology introduced above – of homomorphy but of functional relations. The opposite of function as the concept is used here is not malfunction or dysfunction, as it was held by those who attacked functionalism as an affirmative ideology; the antonym in terms of Gombrich's art theory is, somewhat awkwardly formulated, "naturalistic exterior formal homomorphy" or, packed in a concept congruently used, of "substance".

Substance and Function

What I will call the "code" of substance and function was employed in key works of philosophy and sociology at the beginning of the 20th century. There are three examples that I see of special importance: in chronological order these were works of Georg Simmel, Ernst Cassirer, and Alfred North Whitehead.

What Gombrich had vividly presented at the example of a hobby horse can be found nearly identically worded in Georg Simmel's theory of art. In his late and mature work on Rembrandt, Simmel describes as "the most basic error of historicism and psychologism that is repeated in the naturalistic theory of art" that they bind the specific quality and essence of an attained result, a being or work … to the quality and essence that are specific to the conditions … of these achievements. Those theories are ultimately

opposed to the notion that there might be contents, categories and worlds … that are not deducible from each other. … And to construct … a culture out of economic circumstances, an idea out of experiences, a work of art out of impressions from nature, is no more sensible than developing the fully formed bodily figure out of foodstuffs…" (13, p148-9)

Art in this sense attains a functional autonomy and needs to be understood within its own criteria.

Substance and function is a basic conceptual distinction Simmel uses throughout his work. In his first *opus magnum*, *The Philosophy of Money* (14), he reconstructs the development of money out of a barter economy with certain goods and materials used for exchange based on substantial values to the intrinsically value-less pure functionality of money in the modern economy. Sociocultural evolution in general is characterized as a development from substance to function. (As a side note, Durkheim's shift from solidarity based on "similarity" in pre-modern societies to what he calls organic solidarity in modernity implies the same idea.) Money thereby is a symbol or an expression of a fundamental societal shift from a traditional – in Simmel's words – "absolutistic world view" (14, p716) to a modern world view of processual relativity. In an analogous way, Simmel speaks in his sociology of religion of substantial and functional religiosity. (15) And as a last example, of which sociology hardly took notice, I want to mention his view on what is called *verstehen* in Weberian tradition. For Simmel, *verstehen* is a functional version of which the substantial version is a "you", which in turn is a primordially given capability of humans to perceive other humans as distinct from natural objects. *Verstehen* as a function does not require sameness of meaning as Simmel argues in his famous essay on "historical understanding." (16)

While Simmel extensively used the concept of function as opposed to substance for a description of socio-cultural evolution, he nowhere elaborated his respective methodological ideas in an explicit way. But there is one implication that seems quite obvious to me: a function is closely associated to what Simmel ambiguously calls relativity. What is meant is that functionally defined objects attain their meaning and existence through a process of complementary interactional relationships – "interactions," in German: *Wechselwirkungen,* literally meaning mutuality of cause and effect – as in the case of a monetary value constituted through processes of exchange.

It is exactly this idea we find in the masterwork written on the topic by Ernst Cassirer. In his book *Substance and Function,* first published in German in 1910 (17), Cassirer reconstructs the development of modern science, of mathematics and natural sciences respectively, out of ancient thinking as a development from early substantially conceived objects (*Dingbegriffe*, literally translated: thing concepts) to relational concepts (*Relationsbegriffe*). The object of knowledge in modern science is a product of a web of conceptual relations, the objectivity of which is created by the concept. In analogy to Simmel's and Gombrich's theory of art, science does not provide a representational image (*Abbild*) of an exterior reality but a description and ordering of empirical perceptions on the basis of functional-relational conceptual systems. Modern science would be impossible in terms of archaic substance thinking.

A similar topic and somewhat similar answers are to be found in the book *Science and the Modern World* (18), published some fifteen years later and authored by the English mathematician and philosopher Alfred North Whitehead. In this book, as in his later *Process and Reality* (19) and *Adventures of Ideas* (20) Whitehead stands for a counter-position to what he calls substance ontology and the concomitant materialism, atomism, and empiricism, and replaces it by an organic-relational process philosophy. The concept of matter, basic for traditional thinking, gets replaced by the idea of an organic synthesis (18, p184).

Whitehead uses William James as a sort of key witness for a functional understanding of consciousness and of knowledge. "James denies", Whitehead writes, "that consciousness is an entity, but admits that it is a function. The discrimination between an entity and a function is therefore vital to the understanding of the challenge which James is advancing against the older modes of thought" (18, p143-4) and Whitehead continues with a quote "... there is a function in experience which thoughts perform… That function is *knowing*." Epistemology in terms of substance and quality, in contrast, results in a "the fallacy of misplaced concreteness" (18, p68), a famous Whiteheadian formulation frequently quoted by Talcott Parsons as a call for the necessity of a general frame of reference for the analysis of human action (21).

Cassirer as well as Whitehead had developed their views by dealing with contemporary advances in the natural sciences and in mathematics – which I would characterize as a post-mechanistic phase – and both came to the

steadfast conclusion that their analyses describe an irreversible philosophical and epistemological shift. Both were convinced that this shift would not be confined to the natural sciences but were of general validity, applying also to cultural and social sciences and more generally to profound changes in human life.

This intellectual atmosphere of a paradigmatic shift in the first part of the 20th century was also manifest in the social sciences. The period of what we now call classical sociology is characterized by the search for a new identity for sociology. Talcott Parsons, who was confronted with these developments in European thought during his study years at the London School of Economics and at Heidelberg University and who came into contact with Whitehead at Harvard University, bundled the developments in social and economic theories (22), the above described epistemological advances, and other major intellectual developments like systems theory and cybernetics. Soon the label of structural-functionalism was born for his syntheses[5] and we already know its short-lived fate.

Functional Differentiation of Social Sciences versus Neo-Empiristic "Interdisciplinarity"

The great achievement of classical sociology and of Parsons' synthesis consisted in what I would call a functional differentiation of the social sciences with their concomitant disciplinary conceptual frames. This differentiation had to be established against strong empiricist and reductionist traditions. The strength of theses traditions rested on their close relationship with life-world experiences and thinking. Whereas the success of natural sciences had backed the acceptance of what Alfred Schütz called the "meaning province" (*Sinnprovinz*) of science (23) completely detached from life-world concepts, this differentiation turned out to be historically much more difficult for social and cultural sciences.

It is my conviction that it was not so much opposing theoretical paradigms like conflict theory or critical theory that led to the decline of functionalism, as maintained in the common historiography, but the praxis of empiricist research based on life-world concepts and fused with political and economic influences.

[5] Parsons himself regarded the linking of structure and function in one concept as inappropriate and preferred the simple expression "functionalism". (27, p 100-1)

In contemporary social and cultural sciences we find a nearly unanimous postulate of interdisciplinarity. Interdisciplinarity, as the term suggests, presumes disciplines. In the praxis of social and cultural research, however, this presents itself simply as a sort of life-world based pre-disciplinarity. It is not a matter of a cooperation of disciplines, but there is an assumption to get along precisely without the *a priori's* of theoretically structured perspectives. The endeavors towards a disciplinary identity of pure sociology, characteristic of its classical period and Parsons' attempts of integrating the differentiated disciplines into a general frame of reference, have survived mostly as historical relics, as theoretical fragments, about which students get instructed in specialized university courses on the history of social ideas. An expression of this situation is the success of widely used introductory sociology textbooks that divide the social world into substantially defined segments like migration, urbanity, religion, family, gender, deviant behavior and some further similar phenomena conceived of as social. In sum these add up to what is supposedly the overall subject area of sociology. A final chapter is then entitled sociological theory and deals with structuralism, functionalism, or Marxism without any recognizable connection to the chapters that went before. The result is the establishment of a new version of an epistemological position that was for long considered to be obsolete: empirism or naturalism on the one hand and theory by and large separated from the research matter in question.

Substantial and Functional-Relational Object Formation in Sociology

This has consequences with respect to the conception of the objects of sociological research. Objects of life-world are not identical with objects of science as we have argued so far. Emile Durkheim in his *The Rules of Sociological Method* formulated the necessity to leave life-world concepts behind in a trenchant and unvarnished way: "The sociologist … has to free himself/herself from the false taken-for-granted concepts which dominate the naïve person and has to get rid of the burden of these empirical categories which … turn into a tyrannical power." (24, p129)

An example of long-standing relevance for sociological discourse is the notion of "the individual" whose in-divisibility is beyond dispute in the life-world context. A partition would unacceptably damage an individual.

For the world of science, however, this is by no means the case. For science everything is divisible or better formulated: differentiable so that what is regarded in life-world as an in-dividual can turn into a medical, a psychological, or a social object without getting fragmented, with each of these attaining a holistic meaning in a completely different sense than in the pre-scientific life-world. From this perspective, the conflict between methodological individualism and collectivism is a leftover of thinking in terms of life-world substances.

The problem gets all the more visible if one imagines a corresponding conflict in the natural sciences where physicists and chemists would fight over the question whether a certain life-world object is in the last instance of a chemical or physical character and whether therefore only chemical or physical explanations would be legitimate. In life-world experiences one might be dealing with one and the same object, e.g. a table, but it is something totally different as a physical object than as a chemical object, and this is also valid for the same table as an aesthetic, an economic, or a religious object. An altar is not to be mixed up with a bar counter although the life-world naturalist might be unable to notice a difference. The difference clearly is a functional one.

In short: functional concept formation is constitutive of the objects of scientific inquiry. Scientific subject areas are not entities of experience that are substantially discernable but are functionally constituted out of epistemological a priori's (without thereby being a product of a subjective construction and thus "unreal", as Luhmann held against Parsons' analytically conceived systems of action). Analytical realism, to which Parsons adhered throughout his lifework, is not a conceptual contradiction but an indispensable unity.

Causality and Function

Life-world based empirism has another crucial problem. Pure empirical description does not attain the status of a science. It represents a preliminary stage that only crosses the threshold to factual science by confrontation with why-questions. Research on cause and effect relations belongs to the definition of science. Empiricist research, however, is confined to description, which only allows for the detection of correlations and has no theoretical or methodological control of a distinction between correlation and causality. Causal misinterpretations of correlations are often grounded

in ideological views. Some of those who recognize the problem quickly end up in what one can call post-modern skepticism towards causality, because based on empiricist assumptions, causality cannot be observed. But functionalism, as I tried to show by recourse on Cassirer and Whitehead, takes an alternative route with different premises.

Causality and Functional Object Constitution

The question of causality is closely related to scientific object constitution through theoretical frames. Let me illustrate this with a prominent example. A nexus of sociological object constitution and causality is ideal-typically evident in the work of Emile Durkheim. In his well-known study on the causes of suicide (25) he begins with excluding empirically verified correlations as causal, for example correlations with seasons or religious factors. Starting from his definition of social facts he identifies social factors lying as it were behind these correlations, such as social cohesion or anomy. Thus suicide is from his perspective a genuinely sociological phenomenon with exclusively social causes. In his study on the division of labor (26) Durkheim proceeds in a similar counter-intuitive way. The causes are, according to him, not to be found in motives of striving for self-interest, as argued by the tradition of English utilitarianism, but again in genuinely sociological factors, namely increasing density and volume of societal life. Durkheim's studies provide clear evidence that statements on causality are bound to paradigmatic-conceptual assumptions. The question of the definition of sociology and its subject area and the question of causality are in the last instance identical questions.

"Polymorphy" and the Shift from Mechanistic to Functional Causality

The described differentiation of social science explanations allows for a functionally specific advance of knowledge. Sociology did not find a common, accepted way towards this aim, so we are confronted with a multi-paradigmatic situation. Those paradigms that detached themselves from life-world substance thinking seem to me to suggest matching conclusions for its subject area and for causal analysis. Whether we are dealing with Luhmann's *autopoiesis* and self-organization of social systems or subsystems, or with Parsons' structural independence of action

dimensions and AGIL functions, or with the meaning provinces described in terms of distinct meaning logics by Alfred Schütz, in all these cases I see the common denominator of a post-essentialist theory design in the polymorphous character of its subject area.

For causal analysis, the premise of polymorphy shifts the focus of attention from exterior factors, usually denoted as causes, to the reaction, the elementary processes and structural changes within a respective system. This precludes models of causal explanation that Heinz von Foerster has called "trivial machines", with a clear stimulus response correspondence as well as the formulation of general laws. Mechanistic explanations, or "factor theorizing" as Parsons has called it, are inadequate for social and cultural sciences. Instead, Parsons wrote on several occasions with reference to the biologist Ernest Mayr that why-questions are functional questions. (27, p102) This means that causal explanation is bound to the functional specific logic of the respective subject areas, of "action systems" or their "subsystems." This seems to me already the basic idea of the Durkheimian postulate that sociology has to explain the social through the social. Formulated in more general terms functional self-reference is a characteristic of advanced causal analysis in socio-cultural matters.

An immediate conclusion is the qualitative dissimilarity of a cause as an exterior condition and an effect as a process within a qualitatively distinct system. This very idea has concisely been formulated by David Hume: "… every effect is a distinct event from its cause. It could not, therefore, be discovered in the cause…" (cited by 18, p4) Although I completely concur with this view, there is no reason to conclude that causal analysis as such is impossible but it needs to shift from exterior conditions to an understanding of the logic and conditions of the respective object or system.

Seen from the perspective of the history of ideas, mechanistic causality is a constriction of a much broader idea of causality already advanced in ancient Greek philosophy. *Aitia*, which is held as the Greek word for causality, not only meant knowledge of exterior factors in Aristotle's philosophy but also knowledge about the object in question, its materiality and formal development. In other words, causes need to be searched primarily within the object. Modern functional thought confirms and deepens this epistemological path[6].

[6] In the concise formulation of Alfred N. Whitehead it reads: "The laws are the outcome of the character of the behaving things … This conception should replace the older idea of given things with mutual behavior conditioned by imposed laws" (20, p41)

Epilogue

Just as the natural sciences, the humanities and the social sciences obtain their *raison d'être* only as a form of functionally differentiated reflection. Luhmann once used the metaphor of a flight that lifts us beyond the clouds so that the navigation can no longer rest on the perceptions and concepts on which we rely in our life-worlds. He ended his *Social Systems* with the words: "we can now encourage the owl to no longer sob in the corner and start its night flight. We now have devices to control its flight and we know that it is a matter of an exploration of modern society."[7] (28, p661) I hope that following these words, a new unprejudiced generation of social scientists will have the confidence to build on our strong theoretical traditions and have the courage to go ahead for new adventures of ideas.

[7] My own translation.

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