ALIENS AT HARWELL: BRITISH REPRESENTATIONS OF NUCLEAR SCIENCE AND NUCLEAR SCIENTISTS, 1945 - 1961

By

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Abstract

In this dissertation, I study the representations of nuclear science and nuclear scientists in the early British post-war environment. Temporal framework is from the explosion of Hiroshima and Nagasaki atomic bombs in 1945 to 1961, when the public's fascination over nuclear energy decreased. How did nuclear science go from awe and horror of Nagasaki and Hiroshima bombings to the humanizing and peaceful application of nuclear energy? I restrict the study to the production of Harwell's space, British "hub" for post-war nuclear research, and John Cockcroft's image, Harwell's first director. I draw my methodology from current historiography that argues for an equal study of both verbal and visual historical reminiscence. In a comparative study of governmental documents, newspapers, pamphlets, news photography, newsreels and 1950s science fiction cinema, I weave complex representations of the British nuclear project. Although this is a micro history of a single British nuclear research establishment, this thesis argues that Harwell and Cockcroft were used as markers for the British nuclear program. The British post-war government (Labour and Conservative) were interested in guiding and securing the representations of this formidable national project in order to display British post-war competence and scientific excellence. "Aliens at Harwell" shows how the representations of British nuclear science and nuclear scientists were positive and served to ease the British public's perplexities over nuclear energy. Furthermore, these representations served as recruitment tools for the young science graduates who were lamenting on the changing post-war scientific environment.

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First, I owe thanks to the Central European University for granting a generous fellowship and to the International Visegrad Fund for further supporting my MA project. I admire the commitment of the wonderful and helpful staff at the Churchill College Archives (University of Cambridge), The National Archives at Kew, the British Library, and the British Film Institute. This research is indebted to the above-mentioned institutions. "Aliens at Harwell" would be impossible if it was not for these institutions' commitment to academic excellence.

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I am grateful to my friends in London, Milan and Dejan Skendžić, for taking care of me during research in April 2015. I was always happy to get back after a long day of archival backbreaking to the comfort of your home. Special thanks to my friend Dr. Judit Druks for the support.

Thesis writing is fun, but sometimes threatened by unforeseen drawbacks. However, I am grateful to the following individuals who have helped me regain strength to finish this thesis. I owe my thanks to my best friend of ten years, Momir Iseni for his unconditional love and support from Belgrade. My other best friend, Viktor Vilotijević, for organizing long-distance "pity parties" over Skype and for supporting my research from D.C. As well as my friends and fellow CEU colleagues: Nusi Nagyházi for being an awesome dinner organizer and even better cry-buddy, and Jian Zhang, for comforting me during a particularly dreadful night on the metro. This thesis, as my sanity, would be impossible if it was not for your love.

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I would also like to thank Dr. Jann Matlock, for the prep talks in December 2014, when I was at my lowest. Thank you for the friendship, love, and for finding time to have dinner with me in April 2015, amidst your busy schedule.

At last, I am indebted to my family for teaching me the importance of "home." Thank you for providing comfort and support during thesis writing in May 2015. I am especially grateful to my mother, Mira Skenderović for our long walks, bed-time snuggles and love. I always know the co-ordinates back to my "home planet." Special thanks to my sister Tamara Ćulibrk for reading my drafts.

My grandfather Dr. Bartul Skenderović is an example of how post-war research establishments (in his case, the Yugoslav Nuclear Institute at Vinča) provided a scientific "safe-haven" to young post-war science graduates. In 1952, Professor Pavle Savić (director of the Yugoslav nuclear project, e.g. Yugo's John Cockcroft) mentored my grandfather. During his "Vinča interlude," my grandfather bid farewell to his basketball career and commenced on a "scientific vocation" lasting to this day. I am sorry for the low marks in my high-school chemistry courses and for failing to understand the beauty (and logic?) behind organic chemistry. This thesis is an ode to the inspiration early post-war science graduates found in research establishments throughout the world. If Vinča is the Yugoslav counterpart to Harwell, I urge my readers to anticipate the forthcoming PhD thesis on the Yugoslav nuclear project by my friend and CEU colleague Marko Miljković.

This thesis is dedicated to my nieces — Anđela (12), Anja (9) and Petra (3) — in hope that young female scholars will commence bravely and independently as the three of you withstood your personal obstacles.

Author

Szabadka, June 2015.

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Trust me. I am telling you stories.

- Jeanette Winterson, *The Passion*

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"Alien at Harwell"

(Anon. *Harwell.* London: Her Majesty's Stationery Office, 1956, 57)

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Abbreviations

A.E.R.E.	Atomic Energy Research Establishment
ASA	Atomic Scientists' Association
CCA	Churchill College Archives
CFU	Crown Film Unit
CIA	Central Intelligence Agency
CND	*Campaign for Nuclear Disarmament*
GBN	Gaumont British News
FO	Foreign Office
IRD	Information Research Department
M.I.5	British Secret Service
MIT	Massachusetts Institute of Technology
MP	Member of Parliament
PM	Prime Minister
PP	*Picture Post*
OH	*Operation Hurricane* (UK, 1952)
RAF	Royal Air Force
SF	Science fiction
SFS	*Society for the Freedom in Science*
UCL	University College London
V-J Day	Victory over Japan Day (15 August 1945)
WWII	World War Two (1939-1945)

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INTRODUCTION

> Towards the end of 1945 the slogan "Shoot all scientists" was being chalked on walls in one London borough.[1]
>
> Mass Observation Report, May 1947

> As scientists we often have an uncomfortable feeling that the rest of the population regards us as a race apart — long-haired gentlemen without any normal human desires or weaknesses who go coldly about our esoteric researches without any contact with the community in which we live.
> This is, I assure you, an entirely false picture.[2]
>
> John Cockcroft, director of A.E.R.E. Harwell

After the bombing of Hiroshima and Nagasaki, Britons were distressed by the damage inflicted on the two Japanese cities. According to the Mass Observation report, written two years after V-J Day, science and scientists were described as of vital importance to British life. "Most people," the report argues based on interviews conducted in Britain, when "asked to think of science, think of the atom bomb."[3] The press reports did not seem to ease the public's perplexities with nuclear science and scientists. The only way in which the public might come to terms, according to the report, was in truthful and timely information on the workings of science. Tom Harrison, director of the Mass Observation Project and a scientist himself, describes a similar view a month prior to the official report: "This turning against a man who

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[1] Anon., "Where is science taking us?" Mass Observation Report 2489, May, 1947, 7.

[2] John Cockcroft, "The Scientist and the Public," *Harlequin*, Christmas, 1959, 25.

[3] Anon., "Where is science taking us?" Mass Observation Report 2489, May, 1947, 10.

could formerly do no wrong is a direct result of the public's immaturity in scientific knowledge and understanding."[4] In the immediate aftermath of WWII, British scientists (still in the United States and finalizing their work on the Manhattan Project) wrote to the British government. The scientists urged to have their petition on the international control of nuclear energy (restricting its usage for civilian purposes solely) made public.[5] British wartime scientists were interested in mending the shattered image of their profession from the onset of the "nuclear age." However, the British government successfully suppressed the scientists' will to go public with their concerns in the immediate post-war environment. Nevertheless, British post-war scientists would address the problem once again in 1947 through a magazine. *The Listener* ran a special "nuclear issue" with eminent British scientists collaborating on the publication.[6] The magazine urged the British public to understand the scientists' worries regarding nuclear weapons. Scientists, *the Listener* articles argued, were not blindly obeying politics, thus lending their work to destructive purposes. British scientists and the British public were equally concerned about the prospect of nuclear energy and post-war science.

The Manhattan Project and other wartime scientific projects altered scientific research. Prior to governmental "marriage" with science, scientists were expected to work in a institutional setting, collaborating with their international colleagues, devoid of any strict

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[4] Tom Harrison, "Scientists — Magicians or Monsters?" *World Review*, 10 April, 1947, 5.

[5] "We believe that there is only one acceptable and effective way of establishing confidence that scientists are not engaged secretly upon work connected with atomic bombs. That way is the establishment of complete freedom for scientists to meet and work together and to discuss scientific questions… We urge this because we believe it necessary to the security of the world and not merely on account of its undoubted benefit to science." See TNA, CAB 126/208, "Memorandum from British Scientists at the Los Alamos Laboratory, New Mexico," October, 1945, 4.

[6] CCA, CKFT 18/27, "Atomic Energy: A Symposium by Experts," *The Listener*, 13 March, 1947.

control and secrecy.[7] Post-war scientists would recall the interwar period as that of blissful freedom and prosperity. However, the Manhattan Project had for many the same nostalgic undertone, although this was yet to be exposed retrospectively in some autobiographies. For example, nuclear physicist Victor Weisskopf remembers the period as consisting of "an unusual community, an international crowd of extremely creative people."[8] Weisskopf also mentioned that he did not feel troubled, nor did he think about the impact of the bomb on the Japanese population.[9] The questions of moral implications and big-scale damage science was now able to inflict were being magnified by post-war political complexities. Michael Gordin argues that the anxieties (of both the public and scientists) were intensified in the post-war setting. According to Gordin, the U.S. military officials and scientists did not make a clear distinction between the bombing raids on German cities in 1944, nor the Tokyo raid in March 1945, which inflicted more civilian causalities than the atomic bomb dropped on Hiroshima.[10] The wartime scientific community did not think that a single bomb would end the War. Gordin argues that our current conception of nuclear weapons (e.g. their supposed capacity to end a conflict instantaneously) is part of the post-war thinking about nuclear weapons and Western policy-making strategies.

British nuclear policy-making was tied into notion that possession of a nuclear weapon would serve the "deterrence strategy." Deterrence argues for a need to possess the latest military equipment, nuclear weapons, in order to prevent attacks on the home country. It works on the principle of a "boogie man:" if the enemy is aware that a certain country possess the bomb, it will make the enemy reconsider striking first. However, historians John Baylis and

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[7] Charles Weiner, "A New Site for the Seminar: The Refugees and American Physics in the Thirties," in *The Intellectual Migration: Europe and America, 1930-1960*, ed. Donald Fleming and Bernard Bailyn (Cambridge, Mass.: Harvard University Press, 1969), 192-3.

[8] Victor Weisskopf, *The Joy of Insight: Passions of a Physicist* (New York : Basic Books, 1991), 139.

[9] Weisskopf, *The Joy of Insight,* 148-9.

[10] Michael Gordin. *Five Days in August: How World War Two Became a Nuclear War* (Princeton: Princeton University Press, 2007), 12.

Kristan Stoddart, in recently published book *The British Nuclear Experience: The Role of Beliefs, Culture, and Identity* problematize "deterrence." The initial reason behind the start of the British nuclear projects lies in first post-war British Prime Minister Clement Attlee's conviction that Britain should continue its wartime effort to develop the A-bomb.[11] Baylis and Stoddart remind us that Britain was the first state to initiate a nuclear warfare project by establishing the Maud Committee in 1940, two years before the Manhattan Project.[12] The Committee was based on the research conducted at the University of Birmingham by German-émigrés Rudolf Peierls and Otto Frisch (Lise Meitner's nephew, the co-discoverer of nuclear fission in 1938), who were excluded from it due to their German origin.[13] Until late 1945, Attlee sought to include the Soviets in the post-war project, but soon changed his mind and the project was shrouded in utter secrecy. The official "green light" for the project came in January 1947, but due to concealment and distrust within the Labour government, even important people like Henry Tizard, a wartime scientist, and an employee of the British Ministry of Defence were briefed only in May 1947. Secrecy was gripping both the confusing works and decision making within the Government, as well as causing anxieties within the British scientific community. How was one to conduct research in such an environment? What were the downsides of governmental meddling in scientific research?

Baylis and Stoddart argue for a "multicausal" approach, influenced by Scott Sagan's article,[14] to understand why Britain sought to extend the wartime nuclear project into post-war policy-making. The British Government was interested in the project for various reasons —

[11] John Baylis and Kristan Stoddart, *The British Nuclear Experience: The Role of Beliefs, Culture, and Identity* (Oxford: Oxford University Press, 2015), 11.

[12] Baylis and Stoddart, *The British Nuclear Experience*, 11.

[13] Christoph Laucht, *Elemental Germans: Klaus Fuchs, Rudolf Peierls and the Making of British Nuclear Culture 1939-1959* (London: Palgrave Macmillan, 2012), 42.

[14] Scott D. Sagan, "Why do States build Nuclear Weapons?: Three Models in Search of a Bomb," *International Security* 20 (1996): 54 - 86.

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keeping up with the demands of a modern post-war state, proving British independence from the U.S., protecting British citizens and acting as a guarantee for the Commonwealth, and so on. British nationalism was tied into the nuclear project and as any self-conception, it needed to be rightly constructed and represented to both the "inner" participants and the wider domestic (and "overseas") public.[15] The same multicausal approach can be used in understanding the reasons why British (by origin or émigré) scientists were eager to participate and why the British public was anxious to know more about nuclear research. This thesis addresses these multiple concerns and seeks to answer the question: How was nuclear science represented in post-war Britain as an exemplary scientific project despite scientists' and public concerns?

I argue that British nuclear science (part of British culture) is a complex set of phenomena involving manifold international participants living and working in Britain. In this thesis, I present a study of how the nuclear research establishment at Harwell and its first director John Cockcroft were constructed to provide a positive representation of the British post-war nuclear project. Cross-media representations of Harwell and Cockcroft were not only important for the "lay" public but also for the young, post-war generation of British scientists who were lamenting the "crisis" that had swept the scientific community. The period under study is from the end of WWII in August 1945 until 1961, when British society, in my opinion, seemed to have departed from preoccupations with nuclear energy. The temporal end refers to Cockcroft's

[15] "British nationalism" is a problematic term. What it meant to be "British" was contested during the early post-war period when new immigrants (or "aliens") settled on the British Isles. Most of these immigrants came from the "New Dominions" (e.g. the Caribbean's). Unfortunately, they were racially segregated and sometimes physically harmed as in the 1958 Notting Hill riots. See Randal Hansen, *Citizenship and Immigration in Post-war Britain: The Institutional Origins of a Multicultural Nation* (Oxford: Oxford University Press, 2000), 17-19. Cultural historian Jann Matlock argues, in an important study of post-war identity through on-screen American representations of hotel desks, that anxiety over identity was apparent in the post-war environment. See Jann Matlock, "Vacancies: Hotels, Reception Desks, and Identity in American Cinema, 1929-1964," in *Moving Pictures/Stopping Places: Hotels and Motels on Film*, ed. David B. Clarke, Valerie Crawford Pfannhauser, and Marcus A. Doel (Lanham: Lexington Books, 2009), 73-141. For my thesis, it is important to remember that identity and nationalism are not fixed terms. These terms were particularly flexible in the early post-war British environment. The British nuclear program provided a niche through which aspects of "British post-war identity" could be molded and represented.

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departure from Harwell and to the British public's altered nuclear concerns.[16] In early 1960s, nuclearity seemed to be less of a concern than it was a decade before.[17]

The primary documents used in this thesis are manifold. First, I employ British governmental documents gleaned from The National Archives at Kew (TNA; the Foreign Office and the Atomic Energy Department) and John Cockcroft's papers from Churchill College Archives (CCA), University of Cambridge. These are to provide the basis of "official" line of representation. Other printed documents used are newspapers, books and pamphlets published during the period. However, very important in a thesis about (popular) representations of scientific culture, visual representation is just as important as verbal, and this is also reflected in recent historiography that taps into concerns of the verbal not being sufficient for cultural history. I pay attention to British newsreel productions and juxtapose these with three 1950s British science fiction (SF) films.

The secondary sources are influenced by recent work on British nuclear culture. In 2012, *The British Journal for the History of Science* published a special issue on British nuclear culture. Jeff Hughes wonders why scholarship on British nuclear culture is lagging behind American or Soviet respective nuclear culture: "Where are the sociogeographical studies of Harwell, Windscale and Aldermaston to match Peter Hales's superb study of the spaces of the

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[16] British early post-war period is important because the production of popular science during the 1950s has been ignored. Historian Andreas W. Daum argues for a departure from Victorian and television-era studies of popular science. "We know far too little about the transformation of popular science between 1890 and the advent of the age of television in the 1950s." I would add to Daum's argument that television was not equally developed (e.g. U.S. 1950s television was far more developed than the British). Therefore, the "the age of television" varied from country to country. See Andreas W. Daum, "Varieties of Popular Science and the Transformations of Public Knowledge: Some Historical Reflections," *Isis* 100 (2009): 327.

[17] The decision to end the research in 1961 is, in part, influenced by the British SF film *The Day Earth Caught Fire* (UK, 1961). The film represents British nuclear science and scientists (and with them British politics at large) as irrelevant for international political and scientific progress. I am aware that films do not reflect history. However, films are important guides onto what the public and the producers of representations deemed relevant.

Manhattan Project?"[18] This thesis answers some of these "scholarly calls" and studies the production of popular knowledge on the example of Cockcroft and Harwell. Furthermore, my methodology of fusing verbal and visual texts is influenced by Vanessa R. Schwartz's work on Walter Benjamin and news photography.[19] Christoph Laucht's work on Central European scientists' role in British nuclear culture was also important for my decision to study Michael Polanyi and Jacob Bronowski in relation to the debates on British post-war science. Although my secondary sources are of recent date, I also study the "giants" of British nuclear history from the 1970s (Margaret Gowing) and early 1990s (Lorna Arnold).

In Chapter I, I look at how the British post-war scientific context had been constructed, argued and discussed. I focus on Central European émigré scientists working in post-war Britain — Hungarian Michael Polanyi and Polish Jacob Bronowski. The choice rests on Polanyi's and Bronowski's divergent political affiliations. By this juxtaposition, I depart from a scholarly focus on post-war culture as part of the cultural Cold War. Chapter II is devoted to a close analysis of the thesis' methodology in juxtaposing texts and visual reminiscence. I study how historical texts have been produced in post-war Britain and juxtapose these governmental strategies by studying British newsreels. However, I take a step further and contrast the "real" with "imaginary" representations of nuclear science and scientists by invoking examples from eminent British 1950s science fiction (SF) cinema.

The first two chapters serve to conceptualize and lay basis for concrete case studies in subsequent two chapters. In Chapter III, I study the construction of John Cockcroft as the exemplary British nuclear scientist through various media reincarnations. Furthermore, I find support for Cockcroft's media construction in the SF film *Spaceways* (UK, 1953). At last,

[18] Jeff Hughes, "What is British nuclear culture? Understanding *Uranium 235*," *The British Journal for the History of Science* 45 (2012): 501.
[19] I discuss my methodology, inspired by Schwartz and Benjamin, in Chapter II.

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Chapter IV departs from positive representations and dwells on spatial representations and on public's concerns over nuclear science. I start by giving examples of two important SF films *Quatermass II* (UK, 1957) and *Behemoth, the Sea Monster* (UK, 1959), through which I invoke examples of the "lay" public's doubts and fears involving the rapid industrialization of the British countryside. How did Harwell manage to represent its space as safe for the society and pleasurable for young scientists?

The aim of this thesis is to show the production of representations of nuclear science and scientists in post-war Britain. Although my study is restricted to Cockcroft and Harwell, it provides a wider claim onto how the British nuclear project was represented. How did the British government represent the domestic nuclear project to display its independence from the U.S. and its importance for displaying British post-war nationalism? What kind of publicity strategies was used to domesticize scientific "aliens" and the life-threatening nuclear science? How was publicity influenced by post-war debates on science and scientists? Why was Cockcroft chosen to lead the project and stand for the British nuclear experience? At last, how was the space of Harwell depicted as to withstand public's uncertainties over nuclear science and its influence on urbanity and British daily life? "Aliens at Harwell" addresses these questions and argues that the British nuclear project managed, by positive and cross-media representations of Cockcroft and Harwell, to carve a prominent place for itself. This meant easing British public's perplexities and fears over nuclear energy, as well as motivating young science graduates to join British "Big science" projects.

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CHAPTER I. Science in post-war Britain: Michael Polanyi and Jacob Bronowski

> Now that science appears in a destructive as well as constructive role, its social function must be examined because its very right to exist is being challenged.[20]
>
> J.D. Bernal

> They are not very happy about Bernal, and decide it would be better to get someone new - less associated with "it." Burhop is just as bad.[21]
>
> Surveillance file on Jacob Bronowski, 1957

> I do not agree with Professor Bernal — that is not on the question of the need for organizers in science, but in that they must not be administrators, they must be the scientists themselves. I think I can best express my meaning by comparing science with other creative fields, notably with the theatre and the films.[22]
>
> P.L. Kapitsa, 1959

In 1932, at the height of the Great Depression in Europe, two scientists working in the Cavendish Laboratory at the University of Cambridge, John Cockcroft and Ernest Walton, split the atom. A caricature reprinted in *The Times of India* represents the two scientists at the moment of their formidable discovery.[23] The peculiarity of this representation is that the scientists have their backs turned to the readers. (Fig. 1) Moreover, they are so aloof from British culture that the caricaturist had to put signs "Cockcroft" and "Walton" on the two

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[20] J.D. Bernal, *The Social Function of Science* (London: George Routledge and Sons, 1946), 1.

[21] TNA, KV 2/3524, 14/a, "British Youth Festival Committee," 30 January, 1957.

[22] CCA, CKFT 17/10, "Speech at the International Symposium on Planning in Science," 20 September, 1959, 2.

[23] CCA, CKFT 27/1, *The Times of India*, 27 May, 1932.

scientists for them to be comprehensible. In contrast to the petite scientists, framed in their own work, an alchemist is trying to solve the problems of 1930s British society. The caricature can be juxtaposed to the late 1950s epigraph at the beginning of this chapter, gleaned from British post-war scientists surveillance files.

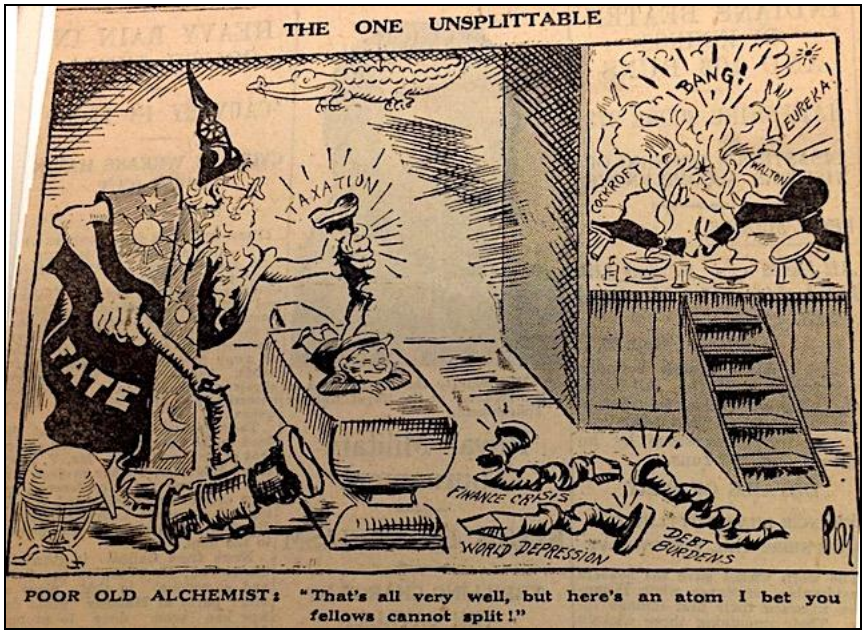

Fig. 1

The epigraph is a sample from the surveillance file on Jacob Bronowski, Polish émigré scientist and a potential threat, as perceived by the British post-war government. The document discusses an appropriate scientist for the opening of a youth festival. When did Britain's most acclaimed scientists become part of post-war British daily life and how did their relationship to the state become crucial for public appointments? The answer lies in a complex fusion of shifts in politics, history of science and the practice of science (particularly its organization) throughout Britain in the 1930s and 1940s. Chapter I depicts the context in which Harwell (as a marker of the British nuclear project) blossomed. Furthermore, it aims to outline the stakes

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Harwell had to battle with in order for it to be deemed as an exemplary, first-class British scientific project, satisfying anxieties widely felt by British nuclear scientists and the public.

Science and scientific progress were important for post-war Britain, as well as the much-demolished continental Europe. In the post-Hiroshima environment, science was represented as having helped to end WWII. *Picture Post*, an illustrated British magazine established in 1938 on the model of the U.S. *Life* magazine, published an article on 25 August 1945 praising British efforts in the Manhattan project. The article introduced the most important contributors giving Britain and America "the secrets of atomic energy."[24] Although the British and American radar programs dominated much of early wartime research,[25] it was nuclear energy that had seized the public interest following the post-war rendering of Hiroshima and Nagasaki attacks. The second reason for relating science to British progress was the coal crisis of the early post-war period. The bitterly cold winter of 1946/1947 made it apparent that Britain had to rely on alternative energy sources.[26] Nuclear energy was in this respect molded to magnify its civilian use, rather than destructive potential.[27] Science was, from this early period, already fighting on two fronts — as the "creator and bearer of life," and that of the "destroyer." The progress of science seemed determinable to post-war redevelopment. However, the organization of science (particularly the marriage between scientists, industry and the state) was less evident and highly debated in the years before and during WWII.

Robert K. Merton wrote about these problems in his formidable 1942 essay, *The Normative Structure of Science*, to address the problem of scientists' "state of acute self-

[24] Anon., "Scientists whose research gave Britain and America the secrets of atomic energy," *Picture Post*, 25 August, 1945, 13.
[25] Daniel J. Kevles. *The Physicists: The History of a Scientific Community in Modern America* (New York: Vintage Books, 1979), 321-322.
[26] John Cockcroft, "The Peaceful Uses of Atomic Energy," *Proceedings of the Royal Society of Medicine* 52 (1959): 488.
[27] Fyfe Robertson, "What Calder Hall means to You," *Picture Post*, 25 February, 1957, 28.

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consciousness" induced by the changing scientific field.[28] The essay considers the question of what institutions and societies are most beneficial for science. Although Merton's work is important, a clear British rendering of the organization of science must not be left out of sight because British government was interested in addressing domestic (scientific) concerns. A decade before Merton's wartime essay, Britain had hosted conferences on the organization and development of science. Historian Anna-K. Mayer argues that this was due to an interesting group established to study the history of science at the University of Cambridge.[29] German scientists Joseph Needham and Walter Pagel headed the Cambridge Committee, and were often in conflict with Marxist thinkers at Cambridge like J.D. Bernal on the organization of science and its relationship to the state and culture. What stirred the field of history of science were multiple ideologies and origins of its main participants. Unlike Needham and Pagel, Bernal was committed to the notion that history of science and technological progress rest on the relationship of science to the state and society. According to Bernal, there was no such thing as a scientific genius; only the workings of a society could bring forth scientific progress.[30] Bernal's work is a useful backdrop for the development of post-war British scientific context, since British anti-Marxist intellectuals disputed Bernal's work. For example, Michael Polanyi, a Hungarian physical chemist, addressed Bernal's work during WWII and well into the post-war period. My approach in describing British post-war scientific environment rests on Central European intellectual "imports" exemplified by the writings of Polanyi and Polish mathematician Jacob Bronowski.

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[28] Robert K. Merton, "The Normative Structure of Science," in *Robert K. Merton: The Sociology of Science - Theoretical and Empirical Investigations* ed. Norman W. Storer, (Chicago and London: The University of Chicago Press, 1973), 267.

[29] Anna-K. Mayer, "Setting up a discipline, II: British history of science and "the end of ideology", 1931-1948," *Studies in History and Philosophy of Science* 35 (2004): 43.

[30] Bernal, *The Social Function of Science*, 411.

In this chapter I study verbal documents from the last half of WWII up until *The Two Cultures* debate in 1959. Documents include pamphlets by Michael Polanyi written for the British *Society for the Freedom in Science* (*SFS*) and Jacob Bronowski's pamphlets on science as well as newspaper articles that address the complex relationship of scientists with the state and the public. However, these documents will also be read in the context of the *Encounter* magazine, which was sponsored by the U.S. Central Intelligence Agency (CIA) and the British Information Research Department (IRD).[31] The Congress for Cultural Freedom (also a CIA-sponsored cover-organization) invested large amounts of money and energy into tackling the "red menace" by engaging intellectuals like Polanyi to dispel the apparent threat of Communism.[32] In contrast to these papers and the *Encounter*, I bring the surveillance documents from TNA, particularly the two documents on Bronowski. These evoke the problematic relationship that both the British and U.S. authorities had with Bronowski's growing influence as a scientist and as an eloquent popularizer of science. However, the documents are also used to problematize historiography that stresses the importance of "Western" post-war science solely as part of the "cultural Cold War." I go beyond relating British Cold War culture as preoccupied with tackling the Communist threat. This chapter unites Polanyi's ("anti-Communist") and Bronowski's ("Communist") post-war writings and shows how they were addressing similar concerns. Post-war science, although part of the "cultural Cold War," was also a domestic concern. Among many issues raised, the formidable

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[31] The IRD was an anti-Communist propaganda agency. The British Foreign Office established it in 1948. It was seen as an important part of Cold War politics and diplomacy used to tackle "the Red Menace" in British colonies and ex-colonies. The role of the Department was "advisory." When the records were opened in 1995, Brits would find out that even George Orwell helped the IRD with conducting a list of "crypto-Communists" and homosexuals in Britain. See Andrew Defty, *Britain, America and Anti-Communist Propaganda, 1945-53: The Information Research Department* (London and New York: Routledge, 2004).

[32] Hugh Wilford, *The CIA, the British Left and the Cold War: British Intellectuals and the Congress for Cultural Freedom* (London: Frank Cass Publishers, 2003), 202.

one is the conduct of science and the threat that state has over scientific work in the post-war organization of science.

My methodology rests on secondary sources that discuss Central European influence on British nuclear culture, like Christoph Laucht's book *Elemental Germans*. Laucht argues that German émigré physicists Rudolf Peierls and Klaus Fuchs had a determining role in the formation of British nuclear culture.[33] Although Laucht is at times somewhat careless regarding the production of popular knowledge during formidable Cold War events (like the Klaus Fuchs case),[34] his approach allows one to overcome the problematic nationalist attitudes that argue that British nuclear culture was constructed solely by "British" influences.[35] In relation to this, I juxtapose the writings of the staunch anti-communist and anti-fascist Michael Polanyi to the Communist-leaning Jacob Bronowski. Their very similar views on how science should be organized (with state sponsorship in mind) and communicated to the wider public proves that post-war science was debated through complex questions which could not be reduced to the usage of "Western" science as a counter-agent for the inadequate "Soviet" science. What will science look like after the intense marriage between the state and scientists during their wartime collaboration? How did the latter influence the relationship between science and the public?

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[33] Laucht, *Elemental Germans*, 6.

[34] Laucht overlooked that the British government influenced Alan Moorehead's book *The Traitors* (on British nuclear espionage). It is important to have in mind the production of books. Moorehead's book was not an objective account. See Laucht, *Elemental Germans*, 98; See Alan Moorehead, *The Traitors* (London: Hamish Hamilton, 1952) in relation to TNA, FO 371/93226, GE 22/54/G, Letter from Alan Moorehead to General Frederick Morgan, 8 October, 1951, 1.

[35] Historian of science Margaret Gowing takes this stance, especially in painting the British nuclear project as resting on three British scientists. I will criticize her approach in Chapter III.

1.1. *The Two Cultures* debate in post-war Britain

The climax to the problems of post-war science and its relationship to society lie in C.P. Snow's 1959 Rede lecture delivered at the University of Cambridge. I start with the chapter's temporal end and the debates because *The Two Cultures* is a symptom of "mainstream science's" response to a changing post-war scientific environment. Post-war science was becoming increasingly interlinked to the state but struggled to find the most effective way to recast this state of affairs to the public (and fellow scientists). Snow's lecture is a rhetoric culmination on the changing post-war scientific environment. It is also a way to justify a technocratic post-war science. Furthermore, the 1959 debate argues against Polanyi's and Bronowski's views on the organization of science. The debate has a rich historiography, which is beyond the scope of this thesis; nevertheless, I extrapolate Snow's arguments regarding the integration between science, culture and the state.

Science does not resonate with daily life in late 1950s Britain. This sentence summarizes Snow's main idea and the reason behind the debate. The disharmony between science and society was a popular topic well before Snow's debate. It is either the dramatic title or the monolithic divide between the cultures of science and arts (predominantly literature), or perhaps both, that have seized public's interest from 1959 to this day. Snow places science vis-à-vis literary tradition, and tries to make sense of their discontent. The problem of post-war science is present throughout the world, but Snow sees the problem as "most important" in Britain.[36] This is due to an outdated British university tradition of classics and humanities, without giving enough space to scientific research.[37] However, the problem is "serious," Snow

[36] C. P. Snow, *The Two Cultures and the Scientific Revolution* (New York: Cambridge University Press, 1961), 18.
[37] "…the British schools turn out some extremely able students, they also turn out very high specialized students (especially on the Arts side), and I think this is now a well recognized fault of the British educational system at

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asserts. There are two utterly different cultures in "the Western civilisations."[38] At one pole, there are literary intellectuals, and on the other scientists, but most importantly "physical scientists." The two groups have absolute disregard for each other. The "literary intellectuals" regard scientists as shallow and too optimistic, unaware of current tragic conditions.[39] Snow dismisses the latter. The narrative strategy and the strength of argument emanate from Snow's reassurance that he has seen and participated in both cultures. He knows them inside and out. Scientists are equally aware of human tragedy, but unlike the literary figures, they refuse to sit and indulge in misery. They try to do something despite of human tragedy and poverty. "This is their real optimism, and it's an optimism that the rest of us badly need."[40] Literary culture, as represented by Snow, is that of confused individuals who know very little about the function of things and are accustomed to even having fascist ideas. What can society glean from this conflict? How should Britain reform its post-war education to help alleviate the conflict? Snow regards science as an important part of the post-war environment. However, Snow's attack on the humanities can be treated as a way of dignifying the new organization of science (under strict governmental control) without drawing a close attention to the state.

The gap between the two cultures is an intellectual loss for Snow and "the Western civilisation." Neither the literary figures, nor "pure" scientists are aware that education must be molded to serve the purpose of spreading scientific progress onto "poor countries," instead of waiting for the Communists to accomplish the latter. Contrary to Robert K. Merton's views that science and scientific freedom are best exhorted in democracies, Snow's arguments seem to suggest that these are not as relevant. Scientific progress will march regardless of the political

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the school level." See Sutherland, Gordon, "British and American Universities — Some Comparisons," *Memoirs and Proceedings of the Manchester Literary and Philosophical Society* 102 (1959): 3.

[38] Snow, *The Two Cultures,* 4.

[39] Snow, *The Two Cultures,* 6.

[40] Snow, *The Two Cultures,* 7.

system or ideology, and if "the West" were to do something about being on the forefront, then it is to expand their scientific knowledge in other regions. Science and scientific progress are equal to geopolitical success.

Historian David A. Hollinger remarks on the potential of post-war science and education to triumphantly leading the way in tackling Marxism and American menace such as the conservative Catholic Church. Science was used as a tool for projecting an ideal post-war society, led by rationalism, scientific objectivity and humility. This ideological use of science promised to alter the current state — public instead of private knowledge; open discourse to replace the closed; and democratic in the place of aristocratic models of authority.[41] The success of the program was apparent in Harvard's *General Education in a Free Society*, which outlined the organization of higher education in post-war America. "The report explicitly identified 'science' as the foundation of 'the spiritual values' of a democratic humanism and declared that American democracy needed citizens with 'the habit of forming objective, disinterested judgments based upon exact evidence.'"[42] James B. Conant, the director of Harvard, was aware of the divide between "the ethos of science" committed to the freedom of science, but instead asserted that scientists were fortunate to have their research backed up generously by the Government.[43]

Similarly in Britain, *The Two Cultures* debate opened questions of employing science against international threats to "freedom." C.P. Snow's lecture on Britain's supposed "two cultures" was debated by Michael Polanyi in the cultural magazine *Encounter*.[44] The debate –

[41] David A. Hollinger, "Science as a Weapon in Kulturkampfe in the United States during and after World War II", *Isis* 86 (1995): 444.

[42] Hollinger, "Science as a Weapon," 445.

[43] Hollinger, "Science as a Weapon," 446.

[44] Michael Polanyi, "The Two Cultures," *Encounter*, September, 1959, 61-5.

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as well as the magazine – serves as an interesting backdrop for discussing the role of science in post-war British society. *Encounter* magazine was established in 1953 and published in Britain. The target group of the magazine was left-leaning intellectuals, who were not strongly anti-communist, but needed to be kept non-communist. However, the triumphalism of "free society" over communism was reached in 1989. The opening of the archives around the world was enthusiastically greeted in the early 1990s. The archives often told a different perspective of the one anticipated by those celebrating the fall of "oppressive" regimes. Cultural Cold War scholarship was created because of these archival openings. An important book by journalist Francis Stonor Saunders, published in 1999, influenced scholarship on cultural Cold War warfare. According to Saunders, *Encounter* was created and sponsored by a joint-work of the IRD and the CIA.[45] The magazine was a political tool *par excellence* but its content was smartly disguised as addressing international cultural debates.

Polanyi's discussion of the debate in *Encounter* has to be analyzed from his recently published book *Personal Knowledge*, sponsored by the Congress for Cultural Freedom.[46] Much of Polanyi's work and life is paradigmatic of the changes in science, from the early twentieth century to the mid-century ideological usage of "the scientific," as discussed by Hollinger. However, Polanyi adds an important twist.

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[45] Francis Stonor Saunders, *The Cultural Cold War: The CIA and the World of Arts and Letters* (New York: The New Press, 2000), 165-189.

[46] Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (London: Routledge, 2005), Acknowledgments.

1.2. Michael Polanyi and the post-war organization of science

Polanyi agrees on the "gap;" however, there is something far more troubling in the development of science. Unlike Snow, Polanyi does not agree that science should be closely linked to the state and geopolitical success. Science should not strictly develop on technocratic lines, but should remain independent. "Our task is not to suppress the specialisation of knowledge but to achieve harmony and truth over the whole range of knowledge. This is where I see the trouble; where a deep-seated disturbance between science and all other culture appears to lie."[47] Polanyi made it apparent in the *Encounter* article that the answer does not lie in technological expansion, but in collaboration between scientific and art circles. Furthermore, Polanyi did not seem to play into the anti-Marxist scenario of Snow's predictions. The reason for this is that the *Society for Freedom in Science* (*SFS*), with which Polanyi was affiliated from its modest beginnings in 1941, had already delineated a new enemy to scientific freedom — the state.

On the occasion of *SFS*'s tenth year anniversary in 1951, George Thomson (the president of *SFS*) remarked on past and current enemies of science:

> The most spectacular danger to the freedom of science comes, of course, from Marxism, but I think we can, without unreasonable optimism, say that this danger is less now than it has been for some years. Paradoxically, the reason for this is largely that the relations between the west and the communist powers have become worse… There is, however, another possible danger, which though far less spectacular and for the moment less severe, should not be ignored. The increasing expense of many forms of science, particularly but not only in physics, has made it much harder to finance science in the way it used to be done. Almost the only way of getting enough money is to appeal to the State, and in consequence the State has acquired great power in science.[48]

[47] Polanyi, "The Two Cultures," 61.

[48] George Thomson, "Speeches made at the Dinner held to celebrate the Tenth Anniversary of the Foundation of the Society," *Society for Freedom in Science*, March 1951, 3.

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The shift towards the problems of scientific organization in Polanyi's work followed the general lines of *SFS*. The state was seen as restricting scientific freedom by imposing secrecy and constraint on scientific publications, thus limiting the "communism" and collegial respect Merton stressed as important components of the "ethos of science."

Rather than scientists working under the direction of the state, science would remain free and thriving only by a fruitful co-operation inside an institution. Robert K. Merton in the already mentioned formidable 1942 essay talks in great length about the importance of organized scientific life working towards the "ethos of science" as the building-block of scientific progress.[49] Similarly, Polanyi views the importance of having different scientists (with their personalities and expertise) contribute to "big science" projects. Historian of science Mary Jo Nye sees Polanyi's dedication to the social structure of science in his 1920s work at the Kaiser-Wilhelm Institute in Berlin.[50] Nye argues that Polanyi enjoyed the scientific community established in Weimar Germany and that he was reluctant to leave his post even when the Nazi regime came to power and threatened to reorganize the scientific community according to anti-Jewish laws. The expulsion of Polanyi soon followed and he accepted an earlier offer for a chair in physical chemistry at the University of Manchester.

In Polanyi's 1953 pamphlet entitled "Pure and Applied Science and their Appropriate Forms of Organization,"[51] he attacks the "Neo-Marxian theory of science" from the 1930s, but moves on to clearly divide the difference between science and technology (the "pure" and

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[49] Merton, *The Normative Structure of Science*, 268.

[50] Mary Jo Nye, "Historical sources of science-as-social-practice: Michael Polanyi's Berlin," *Historical Studies in the Physical and Biological Sciences* 37 (2007): 423.

[51] Polanyi had attacked Marxist view of science from the earliest days of the *SFS*. In the 1945 pamphlet "The Planning of Science," Polanyi takes a strong stance against J.D. Bernal's work. See Michael Polanyi, "The Planning of Science," *Society for Freedom in Science*, Occassional Pamphlet No. 4, February, 1946: 1-14.

"applied") but also to show how they intermingle.[52] In a short summary of the Neo-Marxian theory, Polanyi aims to deal with the supposed conviction that "all research (whether scientific or technical) must be directed centrally as part of the process of economic planning." Polanyi will develop the distinction between science and knowledge on this last Marxist conviction. Technology can be centrally planned and has a clear pyramidal structure of authority and task delineation. Work is divided by subordinate tasks (done by experts working on a single task given by the superior) and independent tasks (that arise in the worker by his own inclination and ingenuity). However, the higher-ranking individual supervises all work in technology. In contrast, science functions differently.

> In view of the systematic nature of science it might be thought possible that scientists could be organized as the subordinates of an authority centrally directing the completion of this system; each scientists being assigned the task of filling in one particular gap in the system. Tasks of this kind do in fact arise in the course of a process of surveying, but they are regarded as mere routine investigations, having little scientific value.[53]

Polanyi believes that science is creative, run by the same ingenuity found in the arts. Science must be original and the creation of ideas occurs in the individual's mind. An idea could never be assigned externally. If science is a creative product as literature and fine arts, why is science not self-sustainable? Polanyi argues that this is because science is spread by personal contact rather than written precept. However, if a scientist fails to prove his/her originality, the latter will justly fail to obtain an independent academic post. The state, as the establisher of scientific institutions (like Harwell), should acknowledge that science must operate in a creative and independent atmosphere. The state should not override its

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[52] Michael Polanyi, "Pure and Applied Science and their Appropriate Forms of Organization," *Society for Freedom in Science*, Occassional Pamphlet No. 14, December 1953: 1-13.

[53] Polanyi, "Pure and Applied Science and their Appropriate Forms of Organization," 9.

responsibility to support the thriving of science. But what Polanyi does not mention is the public and the growing inability to understand modern science.

The problem of scientific specialization and wider public (and transcultural) interaction is paradoxical. Historian of science Theodor Porter argues that with specialization, slowly starting to appear from the mid-nineteenth century to take over through the twentieth century, came the great divide and the exclusion of the public from the "workings of science."[54] In a scientific expansion to all walks of society (most predominant during WWII), the public had lost understanding of basic concepts of science. Science became too technical for the general public to understand and support.[55] How could the "gap" between the specialized science and the public be overcome to benefit and contribute to the problematic policy-making in nuclear Britain? The Communist-leaning mathematician Jacob Bronowski had written extensively on the subject in the 1950s. It is important to remember that the "gap" between the public, and Snow's view of the "gap" between science and humanities are not the same problem. While Snow justified the post-war technocratic science, Bronowski argued that science must remain independent of governmental meddling. Bronowski's anti-technocratic argument was justified by comparing science to the arts, thus alleviating the "gap" between the two cultures.

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[54] Theodore M. Porter, "How Science Became Technical," *Isis* 100 (2009): 293.

[55] Although the divide and specialization of science began in mid-nineteenth century, many scientific institutions, like the Parisian observatory depended on public participation and donations. Astronomy was becoming more technical and "boring" (particularly with the division of labor — the technicians and intellectual workers), yet it made sure to organize and project itself as part of the Parisian late nineteenth century culture. See David Aubin, "The Fading Star of the Paris Observatory in the Nineteenth Century: Astronomers' Urban Culture of Circulation and Observation," *Osiris* 18 (2003): 95.

1.3. Jacob Bronowski and the obligations of a scientist

Jacob Bronowski was born in Poland and immigrated to Britain at the age of twelve. He was soon integrated into the British educational system, gaining a fellowship from Jesus College at the University of Cambridge to study mathematics. Upon completion, he was offered a chair at the University of Hull where he remained throughout 1930s. Surveillance documents give much description of Bronowski's personality and career at Hull.[56] Although he was a Communist, he was never present at local Communist meetings because he deemed himself intellectually more competent than the rest of Hull's communist community. The 1930s files also reflect on the troublesome effect that Bronowski might have on the students with his political ideals. Nevertheless, Bronowski was appointed to work on wartime projects, particularly on perfecting the British bombing campaigns.[57] After the War, Bronowski would be part of the British Mission to Hiroshima and Nagasaki in 1946 to determine the effects of the recent atomic bombings.[58] The experience would influence his views of science, as well as provide an opportunity to become an outspoken public figure and popularizer of science on both sides of the Atlantic.[59]

Bronowski was under surveillance, as was his family, by the British government. The authorities were particularly interested in the apparent Communist membership of his mother, resulting in M.I.5.'s record of telephone conversations over baby food and household

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[56] TNA, KV 2/3523 and KV 2/3524.

[57] His appointment and suitability for wartime work were extensively discussed. See TNA, KV 2/3523, 28a, Letter from H.W.H. Sams to H.G. Kelsey, 28 January, 1943.

[58] Anon., *The Effects of the Atomic Bombs at Hiroshima and Nagasaki: Report of the British Mission to Japan* (London: His Majesty's Stationery Office, 1946), iv.

[59] Ralph Desmarais, "Jacob Bronowski: a Humanist Intellectual for an Atomic Age, 1946-1956," *The British Journal for the History of Science* 45 (2012): 588.

trivialities.[60] Nevertheless, Bronowski's career flourished in the 1950s. He was an appointed director of the National Board for Coal, held numerous radiobroadcasts and wrote newspaper articles on the relevance of post-war science. It is not clear why the British government allowed Bronowski to be eloquent about his "radical" ideas. Some of it might be due to previous government's 1951 embarrassment in having sacked UCL's physics professor Eric Burhop's passport three days before a visit to the Soviet Union.[61] Bronowski's speeches were monitored and he was not allowed to speak on British nuclear research. [62] However, the most important topics Bronowski addressed during the 1950s was the position of the post-war scientist vis-à-vis the state and the public. What were the responsibilities of a scientist? How was a scientist to conduct and make available his research for both policy-makers and the public?

These concerns were addressed in the pamphlet *The Dilemma of the Scientist* published in 1955. In it, Bronowski touches upon the transition of a scientist and the newly acclaimed political and financial status. Before scientific engagement in WWII, scientists could have never dreamed of being granted the opportunity to discuss and advise with the highest echelons of power.[63] Bronowski is blunt about the new post-war position and does not try to play the modest game over it. Scientists like their new status, high-salaries and political importance. The only aspect worrying Bronowski are moral ramifications. The public, Bronowski argues, hates scientists. He might have remarked this based on his personal experience, or more concretely, by reading the 1947 Mass Observation Report (which I mentioned in the introduction). The

[60] TNA, KV 2/3524, 126a, PF. 49,676, 6 March, 1957.

[61] The incident reached both the newspapers and the House of Commons. The issue of Burhop slipped through the press and caused a scandal. The chapter's epigraph displays how the government was still sensitive to Burhop's case and did not want to attract attention regarding the matter. See TNA, FO 371/93226, GE 22/49/G, Letter from John-Boyd Carpenter (MP) to H.S. Morrison (FO), 14 September, 1951, 1.

[62] In December 1955, Bronowski was due to give a BBC talk on atomic energy, however the government intervened and the radio show was cancelled. See TNA, KV 2/3524, 114a, Letter from N.E. Wadsley (BBC) to M.J. Findlater, 12 December, 1955.

[63] Jacob Bronowski, *The Dilemma of the Scientist* (London: National Peace Council, 1955), 4.

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danger lies in the public's hatred and the growing governmental grip over scientific work. What needs to be done, according to Bronowski, is an open dialogue with the public over the stakes of post-war science. Through an open dialogue, the scientist is elevated to a status of a public mediator between the state and the public. Moreover, the scientist is not in danger of losing his public prestige, but perpetuating it. The post-war scientist's role is not motivated by "altruism," but by a new way of technocratic reasoning. The scientist is a bridge between the complexities of modern science and the public. What deems scientific knowledge such high prestige that it should be prophesied to the "laymen," as Bronowski refers to the general public?

In series of lectures delivered at MIT in 1953, which Bronowski compiled in a book *Science and Human Value,* he addressed the peculiarities of scientific knowledge.[64] Science is a creative endeavor comparable to the arts. It is also very personal and human, since science is conceived in the analysis of nature. Therefore, the process of scientific and artistic work is very similar. Obviously, for Bronowski, there are not two cultures; there is a public misunderstanding and distrust of science. Science is not an assembly of facts that lay claim to the ultimate truth, but "a human progress, and not a set of findings but the search for them."[65] Although both Polanyi and Bronowski regard science to be a creative endeavor, they stress the importance of scientific organization as a way through which the highest merits for both science and the public will be achieved. Bronowski stressed: "…the society of scientists is more important than their discoveries. What science has to teach us here is not its techniques but its spirit: the irresistible need to explore."[66]

Did Harwell live up to the expectations set up by Polanyi and Bronowski? If science is creative and can only flourish in a creative atmosphere, how did the British authorities represent

[64] Jacob Bronowski, *Science and Human Value* (Harmlondsworth, Middlesex: Penguin Books Ltd, 1956).
[65] Bronowski, *Science and Human Value,* 70.
[66] Bronowski, *Science and Human Value,* 80.

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Harwell and British nuclear project in relation Polanyi's and Bronowski's concerns? The chapters to follow will engage with various aspects of this question. In Chapter III, I study the construction of John Cockcroft's image and how, by the end of his directorship at Harwell, the British media equated him to Harwell and the British nuclear research at large. In the last chapter, I look at how Harwell's space was constructed in newsreels and how these representations overcame the unfavorable representations of "Big Science" found in the period's SF cinema. However, before I commence on the study of case studies, a chapter dedicated to the British government's publicity policy regarding the nuclear project is important. First, the publicity campaign was changing and was influenced by the developments at Harwell (e.g. the Soviet espionage case involving Harwell's scientist Klaus Fuchs). This fluidity allows for an analysis of the importance of media in post-war Britain, thus serving as a methodological chapter on news photography, newsreels and SF cinema.

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CHAPTER II. Reading visual, contesting verbal: British science fiction cinema and newsreels of the 1950s as historical documents

> History decays into images, not into stories.[67]
>
> Walter Benjamin

> Please tell the Americans what we are doing, so that they may not get their first intimation from a burst of publicity.[68]
>
> Secret Cypher Telegram, July 1948

> Again the Gaumont British cameras give you raw history!
>
> *Czechoslovakia Crucified* (UK, 1940) newsreel

Harwell made world headlines in early February 1950. Émigré German scientist, Klaus Fuchs, head of Harwell's theoretical physics division, confessed on scientific espionage charges to fellow scientist Michael Perrin. Fuchs had immigrated to Britain in 1933.[69] As a member of the British wartime mission on the Manhattan Project, Fuchs lived and worked at the Los Alamos laboratory in New Mexico, during which he gave away "atom secrets" to the Soviets,[70] presumably paving the way for the first Soviet nuclear weapons explosion in August 1949.[71] Roger Makins, a British diplomat working at the British Embassy in Washington D.C. at the

[67] Walter Benjamin, *The Arcades Project* (Cambridge, Mass.: Harvard University Press, 2002), 476.

[68] TNA, AB 16/402, "Visits to Harwell," from Cabinet Office to B.J.S.M. Washington, 14 July 1948.

[69] TNA, PREM 8/1279, "Klaus FUCHS," March, 1950, 1. See Laucht, *Elemental Germans*, 34.

[70] TNA, PREM 8/1279, "Summary of Statement by Dr. K.E.J. Fuchs of Information Passed to the U.S.S.R.," March, 1950, 1.

[71] There is no such thing as an "atom secret." Making bombs is inseparable from scientific institutions, finances and politics. It is impossible for a nuclear scientist, even at the top level, to give away a formula with which one could assemble "the gadget." "When they studied the information Fuchs had supplied, Kurchatov and Khariton decided to use it for the design of the first Soviet bomb. Stalin wanted a bomb as soon as possible… Everything in the report had to be checked, of course: all the same calculations had to be done, and all the theoretical and experimental work. Only a very few people knew of the intelligence material. Apart from one or two men, the scientists and engineers who built the first Soviet bomb did not know that they were producing a copy of the American design." See David Holloway, *Stalin and the Bomb: the Soviet Union and Atomic Energy, 1939-56* (New Haven and London: Yale University Press, 1994), 138.

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time of the "Fuchs case," informed the Foreign Office (FO) on his brief rendezvous with the U.S. Secretary of State Dean Acheson.[72]

> He [Acheson] had no suggestions as to how matter could best be handled from public relations point of view. He thought there was really not much that could be done and felt we must grin and bear things, unpleasant though the consequences were bound to be. He did not think there was any way in which matter could be played down. As regards official point of view, Acheson said that these developments would clearly mean that the tripartite talks about the modus vivendi would have to be slowed down if not suspended.[73]

Acheson's prognosis proved correct. The Labour Government and PM Clement Attlee were bitterly attacked on both sides of the Atlantic. Anglo-American nuclear co-operation (suspended with the American McMahon Act in 1946) was severely damaged by Britain's supposed inability to impose security clearance in line with the American and Canadian practice.[74] The British nuclear program, committed to represent Britain as a modern state, was often tied into British hopes of attaining a close Anglo-American nuclear co-operation.[75] Although the Fuchs case was a major embarrassment for the British authorities and the secret service,[76] the Labour Government became aware that the previous "third world power" dream was now slowly shattering, well before the diplomatic blow of the Suez Crisis in 1956.[77] Furthermore, the Fuchs case made apparent for the British government the imperative to ease

[72] Roger Makins would later serve as a British Ambassador to the United States (1952-56) and as a chairman of the British Atomic Energy Committee (1960-64).

[73] TNA, PREM 8/1279, Cypher Telegram no. 387 from Roger Makins (Washington D.C.) to Hoyer Millar (FO), 2 February, 1950.

[74] TNA, FO 371/93226, GE 22/53/G, Letter from C.E. Steel to Roger Makins, 19 October, 1951, 2.

[75] Historian Michael Goodman problematizes Fuchs' role in the Soviet and British thermonuclear projects, arguing that Fuchs' spying was beneficial not only for the Soviet program, but also for the British. See Michael Goodman, "The grandfather of the hydrogen bomb?: Anglo-American intelligence and Klaus Fuchs," *Historical Studies in the Physical and Biological Sciences* 34 (2003): 16.

[76] "M.I.5 has been shaken to the core by the Fuchs case… But it is doubtful whether the menace of the hidden Communist can be overcome unless our attitude to Communism and alien infiltration is overhauled. It would be a big task to check up on the 275,000 aliens who have settled among us since the war. But such a check may be deemed necessary." See Anon., "Not Even Asked if They're Communists: Scandal of Alien Influx into Britain," *The Sunday Post*, 5 March, 1950, 5.

[77] The Suez Crisis was a major diplomatic scandal involving many sides of the Iron Curtain. Britain was unhappy with the Suez Canal's nationalization (part of the British historic shipping route to the Old and New Dominions) and sought ways to bring down Nasser's Egyptian government. See Anthony Gorst and Lewis Johnman, *The Suez Crisis* (London: Routledge, 1997).

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the public's ignorance regarding the nuclear project. It was important to initiate a serious campaign of representing nuclear science and scientists as a positive national project.

In the autumn of 1950, months after the Fuchs case, British cinemas screened the film *Seven Days to Noon* (UK, 1950). The on-screen British scientist steals the A-bomb (in his briefcase, which is cynical to say the least because Britain had neither the A-bomb nor the airplanes equipped to carry the device in 1950) and threatens the Government with exploding the bomb unless the nuclear program ends. Tapping into the recent Fuchs case, the film shows a complex representation of a scientist, capable of nuclear annihilation for his personal and political convictions. The scientist is not evil, but fragile, with a split personality of both the bearer and destroyer of life.[78] Klaus Fuchs and the espionage trail that emanate from the case (e.g. the Rosenberg's trial and Senator Joseph McCarthy's "witch-hunts") inspired both the British and American film industries. Infatuated with a discourse of science in daily lives, film companies adopted a science fiction genre that often dealt with themes of infiltration and subversion, made possible either by a misuse of human technology (e.g. nuclear science) or a technology perfected by "aliens" endangering human life.[79] The American film *Invasion of the Body Snatchers* (USA, 1956) is a good example of how on-screen aliens infiltrate a Californian small-town and threaten to alter the mundane 1950s way of life — changing one's most treasured "allies" — a father, mother or high-school sweetheart. Similarly, *Seven Days to Noon*

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[78] Klaus Fuchs was deemed schizophrenic (split-personality) by the British press. See Anon. "Atom Scientist Sent for Trial: 'Jekyll and Hyde Personality,'" *The Press and Journal*, 11 February, 1950, 1. Christoph Laucht argues that Fuchs' lawyers tried to get a reduction of his sentence and plead for "controlled schizophrenia. See Laucht, *Elemental Germans*, 97.

[79] Peter Biskind, *Seeing is Believing: How Hollywood Taught Us to Stop Worrying and Love the Fifties* (London: Bloomsbury, 2000).

already addressed concerns over familial espionage.[80] The scientist's family was not only oblivious to his whereabouts, but also of the fact that "poor papa" planned to blow up London.

This chapter is devoted to problematizing and conceptualizing various primary documents I have encountered during my research. I argue in this chapter that although cultural historians pay attention to verbal documents, Cold War culture was equally dominated by images ("imaginary" and "real") and sounds. It is important for a cultural historian to adopt an adequate methodology through which it will be possible to get a sense of representations of nuclear science by a nuanced analysis of both verbal and visual reminiscence. Every culture is fluid, flexible and self-contradictory. A potential way of making sense of the "British nuclear experience" is by juxtaposing governmental documents, newspaper articles, personal documents, news representations (primarily newsreels) and science fiction cinema produced during the analyzed period.

This method is inspired by the historiography of philosopher Walter Benjamin, and more currently, cultural historian Vanessa R. Schwartz. Both Benjamin and Schwartz have argued for a more balanced approach to studying visual in relation to the verbal. Benjamin was particularly instructive in this respect, because he revolutionized historiography by implementing the concept of filmic montage to historic narrative. For example, in his unfinished magnum opus *The Arcades Project*, Benjamin sought to arrange his narration with quotes and images in order to resemble the school of Soviet dialectical montage. By re-reading Benjamin's approach,

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[80] Historian David Seed would disagree with me, arguing that *Seven Days to Noon* cannot be compared to later American or British espionage/infiltration films because they depended on a complex Communist (or "alien") network. I think Seed's point is irrelevant and a matter of future organization. If a country (or a family) already has a "problematic member," wouldn't it be possible to construct a network solely by the workings of "the fallen one"? See David Seed, "*Seven Days to Noon*: Containing the Atomic Threat," *The British Journal for the History of Science* 45 (2012): 650.

Schwartz encourages historians to adopt a nuanced analysis of verbal and visual.[81] In other words, one must adopt a sophisticated verbal approach to reading visual information, while at the other hand, the verbal information must be arranged as to create a visual impression of the scrutinized.

What does this mean? How is history imbedded in a photograph or on a strip of film? The first, and obvious, assumption is that when pushing the camera's button one is able to make an imprint of the moment. The photograph "steals" the present and preserves it for future generations. Acknowledging that the way a photograph or film is made depends on the mechanisms of power complicates the first example.[82] It can stem from the most depressing narratives of governmental censorship — the "top to bottom" model. However, the photograph can be rendered by the cameraman's choice of subjects or the framing in general. In film, by the process of montage, or the assemblage of images and sounds, the editor is able to create a unique historical experience. The investment in photographic or "mechanical objectivity" has been widely addressed. In history of science, Lorraine Daston's and Peter Galison's article[83] on scientific image-making (and the mid-nineteenth century turn towards mechanical objectivity) resonate in media historian Donna Schwartz's work: "Photography emerged as the visual medium best suited to take up the mantle of objectivity, based on the popularly held view that a mechanical device, a camera, makes photographs."[84] Photograph's apparent objectivity catered

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[81] Vanessa R. Schwartz. "Walter Benjamin for Historians," *The American Historical Review* 106 (2001): 1724.

[82] "…photography could no longer be seen as a unified medium whose status and value were inherent within it. Status, value, and meaning had to be produced — and they were produced locally and unevenly across a hierarchy of contingent and mutually defining cultural spaces in which what applied at one point might be totally at odds with what applied at another." See John Tagg, *The Disciplinary Frame: Photographic Truths and the Capture of Meaning* (Minneapolis and London: University of Minnesota Press, 2009), 12.

[83] Lorraine Daston and Peter Galison, "The Image of Objectivity," *Representations* 40 (1992): 81-128 and Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007).

[84] "…all photographs encode a photographer's point of view and the institutional requirements constraining his or her activities." See Donna Schwartz, "Objective Representation: Photographs as Facts," in Bonnie Brennen and

to the impression that mechanical representations (e.g. photography or film) were "real." Apart from studying the photograph and film itself, it is important to keep in mind the processes of picture-making and to be particularly sensitive to the visual markers one often looks across when studying visual media.[85]

I discuss my methodology and approach to reading visual documents by giving two narratives. The first one deals with the British government's strategies towards publicity and censorship in relation to the nuclear program. These concern newspapers and newsreel companies. By giving accounts of how the government allowed or restricted access to news representations enables one to understand picture-making policies as well as theoretical questions arising from the study of visual documents. The second narrative will deal with British science fiction cinema. I will give my own view of the genre and why I find it useful for studying the representation of nuclear science and scientists. How did science fiction cinema support or challenge the visual tropes established to governmental "meddling" of news agencies?

2.1. The British post-war government and nuclear publicity

The access of information on the British post-war nuclear program was debated from the establishment of Harwell in late 1945. As minutes of meetings show, scientists employed to work on British post-war nuclear research, led by director John Cockcroft, expressed strong belief that the British public, as loyal taxpayers, have the right to know about the development

Hanno Hardt, *Picturing the Past: Media, History, and Photography* (Champaign, IL: University of Illinois Press, 1999), 173 and 161.

[85] Jason E. Hill and Vanessa R. Schwartz, *Getting the Picture: The Visual Culture of the News* (London: Bloomsbury, 2015), 105.

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of nuclear research. In a meeting held on 25th October 1946, Cockcroft explained that Harwell should be open to the Press and that even the most intelligent visitor could not glean information on the workings of this secret Establishment.[86] However, the minutes from this meeting reveal a constant preoccupation of the British government with how the Americans might react to the opening of Harwell to press visits. How will publicity affect the British desire to ease the American McMahon Act, which induced a halt in Anglo-American nuclear co-operation? Guided by this concern, the authorities were reluctant to allow press visits for the time being.[87] The PM was particularly sensitive to visual information arising from press visits or the lending of visual information from the Ministry of Supply to external users. However, the concerns extended beyond the potential press visits to Harwell. British nuclear scientists, led by German émigré scientist Rudolf Peierls, took it on themselves to educate the British public on the workings of nuclear energy and ease the anxieties widely felt by organizing an Atom Train Exhibition. The imperative of the 1947 Exhibition was to display the civilian uses of nuclear energy and to move away from the "awe and horror" images of Hiroshima and Nagasaki. Christoph Laucht argues that the British Atomic Scientists' Association's (ASA) intention to exhibit the prospects of nuclear energy for "laymen" was severely damaged by PM Attlee's secret January 1947 decision to the build the bomb (and leave it out of the public discussion).[88]

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[86] TNA, AB 16/402, "Minutes of the Meeting held on 25 October 1946," 4 November, 1946, 1-2.

[87] "…Mr. Perin and I feel bound to suggest that a Press visit to Harwell should not be allowed for the time being, but that we should watch what the Americans do (they will presumably be under pressure from their own journalists), and follow, rather than lead, in this matter." See TNA, AB 16/402, Note from F.C. How to Permanent Secretary, 5 May, 1947, 2.

[88] Christoph Laucht, "Atoms for the people: the Atomic Scientists' Association, the British state and nuclear education in the Atom Train exhibition, 1947-1948," *The British Journal for the History of Science* 45 (2012): 593.

The Labour government lost the subsequent elections and the Conservative Party took over in late 1951. R.E. France, who replaced F.C. How, lamented on the previous governmental policies regarding photographs of British nuclear research.

> The Former Prime Minister was always reluctant to approve the publication of photographs of the Atomic Energy Production Establishments whether in our own interests (e.g. to stimulate staff recruitment)… or on behalf of the Press. Even where the photographs were entirely free from security objections it was considered undesirable to attract public attention to the project.[89]

The Labour government felt uneasy about initiating public discussions of nuclear energy independently from American efforts. The British government pondered between the efforts imposed by British scientists and American practices adopted at the highest level. The train exhibition of 1947 is a text-book example on a partly failed attempt for the British government to support nuclear scientists' wish to educate the public on the workings of modern science and to bridge the gap (between nuclear science and the respective public) well before C.P. Snow's *Two Cultures* debate in 1959. Only after the Americans initiated a successful international atomic exhibition of their own, were Britons (this time under the Conservative government) inspired to host international nuclear exhibitions of British achievements in harnessing nuclear energy for civilian purposes.[90] British governments failed to independently carve a place for themselves on development of nuclear energy. Lagging behind the United States, the British government felt vulnerable and dependent. However, high hopes of displaying British scientific competence and independence were resurrected during the A-bomb tests in late 1952 as well as with the accompanying documentary film production.

In October 1952, Britain exploded its first A-bomb off Australian shores. The event was important because Britain was the third country to independently produce and deliver an air-

[89] TNA, AB 16/1057, 330/6/8, "Photographs: Publicity," Note from R.E. France to Permanent Secretary, 6 February, 1952.
[90] TNA, AB 16/1216, "European Travelling Exhibition," 1954.

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borne A-bomb, after the United States (1945) and the Soviet Union (1949). Equal to the importance of exploding the first bomb, the British government was interested in securing the right media rendering of this formidable event. *Operation Hurricane* (UK, 1952) is a film produced by the British government showing the production of the atomic bomb from the inconspicuous British countryside to the Australian test site, metaphorically uniting the British Commonwealth. It was produced and directed by the most acclaimed British documentary filmmakers who were once part of the world-famous interwar British Documentary Film Movement.[91]

Preparations for the documentary film of the first British A-bomb tests started in late 1951. William Penney, a British scientist working on the bomb's design, proposed in July 1951 that a film be made to show the work of Harwell and other British nuclear establishments.[92] The governmental film company Crown Film Unit (CFU) had already been shooting films of the work carried out throughout British Establishment and which were not available for the public.[93] Since the project was of national and international importance, the authorities sought to produce a film "on somewhat ambitious lines" with an acclaimed documentary filmmaker.[94] The first choice for directing was Cyril Frankel. It is not clear from the archival sources why they switched Frankel to Stuart Legg to lead the project as a producer?, but security concerns and affiliations were particularly troublesome for the government in employing people who worked outside the CFU.[95] Stuart Legg came from the British Documentary Film Movement in

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[91] Anon., "Documentary - A National Asset," *Documentary News Letter* 5, 1944, 42-43.

[92] William Penney was also one of the few British scientists who have remained in the United States after the War to work on the 1946 Bikini Atoll A-bomb tests.

[93] TNA, AB 16/567, 330/6/7/7, 26 July, 1951.

[94] TNA, AB 16/567, 30 January, 1952.

[95] TNA, AB 16/567, 19 March, 1952.

1930s. The produced film was of indeed high quality[96] and the British government was anxious for a wide theatrical distribution in Britain and abroad. An anecdote from the National Archives (TNA) testifies to the importance British government hoped *Operation Hurricane* (*OH*) would stand for.[97] In Washington, a British brigadier Jehu took on himself to project *OH* to a group of colleagues. Unfortunately, the film split during the projection and the officials were furious with the brigadier's careless exhibition of this important film.[98] In order not to jeopardize the access to theatrical screens, the government had to be very careful in their approach to newsreel companies, who would be given selected material on the tests, even though the medium (newsreels) were not deemed prestigious as *OH*.[99]

However, even the media-aware Conservative government did not focus on all aspects of news reporting. A document found in PM Winston Churchill's papers urges the Conservative government to pay more attention to newsreel productions. A member of parliament, David Gammans wrote a letter to Viscount Swinton (Secretary of State for Commonwealth Relations until 1955), with the following conviction:

> News reels [sic] in this country are seen by 30,000,000 people each week (more than the number of people who listen to the 9 o'clock news) and taking the world as a whole 300,000,000 people see them. Most of this public is between 17 and 25 years of age - the type that does not listen much to the BBC nor read the newspapers very intelligently. Incidentally news reels also earn the country a lot of dollars.[100]

Although the figures mentioned by the MP should not be taken with assurance, the fact that young people are the dominant cinema-going audiences should. This was a time when

[96] Although the initial plan was to shoot a color film, the production team had trouble finding a suitable camera to do the job accordingly so they had to opt for a black and white production. See TNA, AB 16/567, 2 May, 1952.

[97] "…it is an excellent production and should go far to show the American public that we can quite effectively produce our own atomic weapon without assistance from them." See TNA, FO 371/105692, GE 1/4/G, Notes by E.H. Peck, July 27, 1953, 1.

[98] TNA, FO 371/105692, GE 1/4/G, Letter from Roger Makins to Pierson Dixon (FO), July 23, 1953, 1.

[99] TNA, AB 16/567, "Film on the Atomic test," Written by N. Dugdale, 9 April, 1952, 2.

[100] CCA, FICA 2/2/1, "Churchill and the Cameraman," Letter from David Gammans to Viscount Swinton, 24 May, 1952, 1.

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television in Britain had not been widely dispersed, as it would be in the following decade. The early 1950s were also a time when science fiction films were becoming more prominent, also targeting a younger audience. Relations with newsreel companies would soon try to ease the tensions felt by newsreel companies and initiate a stronger co-operation, particularly because newsreels held a wide distribution network.[101]

Films were an important medium during the 1950s, both in their pre-television, widespread cinema-going consumption, as well as for their importance in governmental propaganda strategies. However, this study relates to two different types of films: British newsreels and British SF feature films. Newsreels, as a non-fiction film genre, depict topical events, with a voice-over commentary. The events are not covered as breaking news (the audiences were already acquainted with the subject), but newsreels evolved around bringing "visual history" to the audiences. [102] Some British newsreel producers, like British Gaumont News from the chapter's epigraph, would exclaim that they were bringing "raw history" to the screens,[103] but in fact, newsreels were well-cooked and served with delicate care as to provide a peculiar representation of the depicted events. IRD archives testify to how the post-war British government was interested in guiding and manipulating the production of newsreels.[104] This is contrary to what a few recent British media historians have argued, for instance John Jenkins, who stated that newsreels were never a serious preoccupation of the post-war British Government.[105] Furthermore, the IRD archives also testify to the government's knowledge

[101] Leo Enitcknap, "The Non-Fiction Film in Post-War Britain," (PhD diss., University of Exeter, 1999), 63.

[102] "…films are seen not simply as passive 'reflectors' but as potentially active producers of political and ideological meanings." See Tony Shaw, *British Cinema and the Cold War: The State, Propaganda and Consensus* (London and New York: I. B. Tauris, 2001), 2.

[103] *Czechoslovakia Crucified* (UK, 1940)

[104] TNA, FO 1110/50, P.F.D. Tennant to R. Murray, 21 April, 1948.

[105] John Jenkins. "Hot News/Cold War: The British State, Propaganda, and the News Media," (PhD diss., University of California Berkeley, 2000), 178.

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about how difficult it was to sometimes influence the work of British documentary filmmakers.[106] Media historian Phillip Woods sees post-war British newsreels as an important media for sustaining an illusion of post-imperial Britain.[107] Newsreels were introduced in 1909 and were, of course, silent renderings of formidable events.[108] However, with the wide spread of sound, newsreels adopted commentary and narration, by which their propaganda significance arose.[109] During WWII, newsreels were used to paint the wartime efforts on both sides. Newsreels would not change their form in the post-war setting, but will be able to provide a claim to objectivity while displaying a highly mediated experience through creative editing of image and sound.

Newsreels potency and influence on rendering cultures lies in their peculiar exhibition practice. In every British cinema during the early post-war period, newsreels were exhibited before a feature film, taking ten minutes of the program. In a fusion with the feature, the 1950s cinema experience was a cultural experience with both "real" and "imaginary" incarnations. And at last, the 1950s British cinema was an important space for viewing nuclear representations but also discussing the future of British thermonuclear tests. What kinds of films merging developments of nuclear energy in Britain (as displayed) on newsreels were seen in conjunction with feature films?

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[106] TNA, FO 1110/850, 1956.

[107] Phillip Woods, "'Business as Usual?' British Newsreel Coverage of Indian Independence and Partition, 1947-1948," in Chandrika Kaul, *Media and the British Empire* (Basingstoke, Hampshire: Palgrave Macmillan, 2006), 149.

[108] Raymond Fielding, *The American Newsreel: A Complete History, 1911 - 1967* (Jefferson, North Carolina: McFarland & Company, 2006), 45.

[109] Philosopher Roland Barthes argued that news photographs gain meaning through words and the closer the words are to visual representation, the easier it is to construct propaganda. See Roland Barthes, "The Photographic Message," in Susan Sontag, *A Barthes Reader* (New York: Hill and Wang, 1983), 197-198.

2.2. British 1950s science fiction cinema

Scholars of Western nuclear cultures often choose to analyze the film *Dr. Strangelove Or: How I Learned to Stop Worrying and Love the Bomb* (USA, 1964) by director Stanley Kubrick for illustrating the anxieties brought on by intensive nuclear tests.[110] However, the film has obvious limitations to a nuanced study of attitudes to nuclear science and scientists. First, the year in which the film was in cinemas, 1964, was already a time when threats of nuclear annihilation had been replaced by more timely topics like the Vietnam War, or the recent assassination of President J.F. Kennedy. I am not implying that the nuclear threat was not apparent in 1964, as it was in 1954 (the year of the Lucky Dragon incident[111]), but people became more accustomed to the threats of the "nuclear doomsday." In Britain, *Dr. Strangelove* was screened six years after the first March to Aldermaston.[112] The situation was different during the 1950s, when a large number of Britons wrote open protest letters to the Government, in hope of ending nuclear tests.[113] The public was already well acquainted with the threats of nuclear research and power. The second reason for the limitations of *Dr. Strangelove* is that it is satirical comedy. Hence, the film is incredibly stereotypical in its representation of scientists. Part of its pastiche representation stems from the satirical genre's characteristic — in order for the satire to be effective, comic effects and personalities should be reduced to the knowledgeable minimum. Irony and satire are present in a more homely fashion by looking at

[110] See Christoph Laucht 2010; Peter Goodchild, *Edward Teller: The Real Dr. Strangelove* (Cambridge, Mass.: Harvard University Press, 2004); Margot A. Henriksen, *Dr. Strangelove's America: Society and Culture in the Atomic Age* (Berkeley, California: University of California Press, 1997).

[111] Contamination incident involving Japanese fishermen who found themselves in the Pacific Ocean within the radiation radius of American thermonuclear bomb testing. See TNA, FO 371/110695, GE 18/25, Letter from A.S. Halford to C.T. Crowe, 7 April, 1954.

[112] The British civil organization *Campaign for Nuclear Disarmament* (*CND*), was established in 1958. The same year, a group of citizens with public figures such as actress Vanessa Redgrave and philosopher Bertrand Russell, went on a first anti-nuclear weapons march from London's Trafalgar square to the Aldermaston nuclear weapons factory. I write more on the *CND* in my next chapter.

[113] TNA, FO 371/129246 and FO 371/129241, 1957.

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film shot during the *Campaign for Nuclear Disarmament*'s (*CND*) March to Aldermaston. "4 Minutes Warning. Just time to boil your last egg," is written on one of the signs.[114] At last, the limitation of the film, paradoxically, lay in its high-budget production. By employing acclaimed actors (like Peter Sellers), the film both secures box-office success and limits the development of characters, because certain behaviors are automatically ascribed to actors because of the long tradition of the Hollywood "star-system" in place since early 1920s.

I study SF films in contrast to the visual tropes established in newsreels. The reason for choosing this film genre is closely related to my methodology and understanding of visual culture. Both Benjamin and Schwartz have argued for an egalitarian study of culture. This meant the blurring between "low" and "high" brow culture. It also meant the shattering of "art" vis-à-vis "mass culture" paradigm. From the late 1990s, particularly within the group gathered around the publication of Nicholas Mirrzoef's formidable reader,[115] it became apparent that all visual phenomena merit scholarly attention. More currently, works in new film history are strongly advocating a move in film studies from the late 1960s French-inspired "auteur" approach (studying films that were directed by "artists" e.g. Stanley Kubrick) to more audience-driven studies.[116] This meant a growing interest for the ignored or obscure film productions devoid of the "artistic aura." Though to some it would seem that just a mere glimpse at some of the titles (*Devil Girl from Mars; Attack of the Crab Monsters*) would deem these films unworthy of scholarly enquiry, their cultural and social significance for the Cold War period is

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[114] *CND London to Aldermaston March*, Easter 1959, https://www.youtube.com/watch?v=x8t-go-xEL4, Accessed on 21 April 2015.
[115] Nicholas Mirzoeff. *The Visual Culture Reader* (London and New York: Routledge, 1998).
[116] James Chapman, Mark Glancy and Sue Harper. *The New Film History: Sources, Methods, Approaches* (London: Palgrave Macmillan, 2007), 4-5.

indispensable.[117] This was due to the high number of cinemagoers watching both American and British "quota quickies."[118] Furthermore, the film medium was taken very seriously by the Foreign Office as a means of propagating British achievements. Historian Tony Shaw understood the importance of British 1950s audiences in viewing newsreels and feature films collectively, which would induce the effect of combating Communism.[119] However, Communism was not the only menace during the 1950s. Although not comparable processes the industrialization of the British countryside is another marker (devoid of Communist infiltration narratives) of changing post-war Britain.

British SF cinema, with its often tongue-in-cheek attitude is able to transcend the limitations and give a more nuanced view of how nuclear science and scientists were represented in 1950s Britain, at a time when Harwell sought to be represented as the exemplary British scientific project. SF cinema is interesting for analysis for two main reasons.[120] First, these films were produced as "quota-quickies", ensuring a fast production on a limited budget.[121] Because they did not have vast resources (as 1970s Hollywood science fiction films like *Star Wars*) the topics had to be topical and in a domestic setting. The companies could not afford costly special effects and outer-space extravaganzas. Second, the budget restrictions denied access to acclaimed film workers. The lack of "the star system" is beneficial for my study. Actors and actresses could develop more complex characters, because they were not

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[117] "…not 'real' history, but a constructed version of history that accords with the ideological values of its makers and the cultural tastes of its audiences." See Chapman, Glancy and Harper, *The New Film History*, 7.

[118] Steve Chibnall, "*Quota Quickies*"*: The Birth of the British* "*B*"*-Film* (London: Palgrave Macmillan, 2007).

[119] Shaw, *British Cinema and the Cold War*, 33.

[120] Darko Suvin's rendering of the genre is particularly instructive for my thesis. "SF is…a literary genre whose necessary and sufficient conditions are the presence and interaction of estrangement and cognition, and whose main formal device is an imaginative framework alternative to the author's empirical environment." See Darko Suvin, *Metamorphoses of Science Fiction: On the Poetics and History of a Literary Genre* (New Haven and London: Yale University Press, 1979), 7-8.

[121] See Steve Chibnall and Brian McFarlane, *The British "B" Film* (London: British Film Institute, 2009),

expected to portray a certain role pre-destined for them by the studio. The scientists found in these films, portrayed by unknown B-rate actors, were changing according to the situations and environments in the film. This allows me to trace different representations of nuclear scientists in British science fiction cinema. Furthermore, financial limitations probed filmmakers to use stock footage and transcend the limited shooting locations. How does one say what is a newsreel and what is a science fiction cinema if they are both providing similar narratives and images? The fusion of genres enables a scholarly work on the representations of nuclear science in the 1950s. The next chapters will address this more concretely by a study of cross-media renderings of John Cockcroft and the Harwell establishment.

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CHAPTER III. Constructing Cockcroft: British representations of a post-war nuclear scientist, 1945 - 1961

> Without any fuss, Cockcroft has directed British research on the applications of atomic energy… He has made the name of a disused airfield a household name… If ever man and institution can be identified they are Cockcroft and Harwell.[122]
>
> *The New Scientist* article, 1957

"Ladies and gentlemen a toast to Deanfield!" Professor Koepler raises his glass to commemorate Deanfield's (fictionalized top-secret British research establishment) scientific achievement. "You have all worked with seamless energy to achieve this. There are many nationalities among us, but only one team." The research establishment, under Professor Koepler's directorship, is represented in the British film *Spaceways* (UK, 1953). The film reached British cinemas a year after the first British A-bomb, in an atmosphere of national pride and extolled nuclear independence, although the stockpiles were far from abundant. At the same time, the British audience could see the documentary *Operation Hurricane*. The documentary celebrated both the technological accomplishment as well as the British "homely" touch to the bomb, by invoking manifold scenes of Britons working at Fort Halstead arms factory. *Spaceways* also revolved around the discourse of "homely science." Although the science represented on film was a governmentally backed science — "Big Science" — involving a variety of talent in a secret and heavily controlled environment, the film's narrative revolves around tensions between the scientists. It is for Professor Koepler's mentorship and

[122] Anon., "Sir John Cockcroft: The alchemist's dream was fulfilled," *The New Scientist*, 12 September, 1957, 26-27.

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Deanfield's scientific atmosphere alleviate on-screen tensions. *Spaceways* represents a group of international scientists working on the first British space mission. The film is not implicitly showing nuclear research but represents workings of a post-war scientific institution and the perils behind an important scientific project. Professor Koepler concludes the address with acknowledging British government's support for the project: "I am happy to announce that after full consultation with the Defense Council and his inspection of our work, General Haze has authorised us to proceed at once!" Unfortunately, the British post-war nuclear research was not as optimistic in 1945.

British scientists were contesting the future of British post-war nuclear science as early as V-J Day. A letter from Australian-born, Cavendish-trained physicist Marcus "Mark" Oliphant to John Cockcroft on 14 September 1945 paints a slightly different picture on the importance of science than *Encounter*'s "the clash of civilizations" narrative. Oliphant, represented alongside Cockcroft in the *Picture Post* 1945 article, wrote a distressing letter to Cockcroft, who was at the time in Canada. Cockcroft was finishing his wartime work on Canadian atomic piles, when Oliphant wrote on British post-war nuclear research.[123]

> …it is a matter of vital practical importance to this country and the Empire, and our future as a real factor in the world of industry and politics depends on our position in T.A. Vigorous action now will attract the best of our technical men and will ensure enthusiasm and rapid progress. If no plants are built and the research effort is on an inadequate scale, good men will neither join the project nor remain in it, whether they are scientists and engineers or the administrators who are essential for its success.[124]

Oliphant states that Rudolf Peierls, German émigré scientist to Britain, is also urging the establishment of a British body to tackle further development of nuclear science. The letter goes on to cite the inefficiency of the government to set up a body for the work on nuclear research. Oliphant provides a list of scientists willing to work on nuclear research and outlines those that

[123] CCA, CKFT 25/27, Letter from Marcus Oliphant to John Cockcroft, 14 September, 1945, 1.
[124] CCA, CKFT 25/27, Oliphant to Cockcroft, 2.

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do not seem interested. The letter opened the question, because of Oliphant's long description of British scientists and their suitability, onto who was to be the leading figure in British nuclear research. It was apparent that both the scientific community and British society was in need of that special someone. If the person who will lead the British nuclear project is not found soon, Oliphant pessimistically predicts the end of physics in Britain. Therefore, British scientists were interested in promoting governmental and industrial funding for research not only from their ideological positions to fight the "enemy," but rather, to secure their jobs and places in the post-war research system. In this chapter, I study the construction of John Cockcroft's image across manifold British media. I argue that Cockcroft was represented as an exemplary British nuclear scientist who was able to lead British post-war science. The representations were persistently strong that by the end of Cockcroft's directorship over Harwell, the two names became inseparable to British late 1950s public.

Historian of science Margaret Gowing published a classic work on British nuclear research in 1974, in which, she scrutinized the British nuclear project.[125] Although at times very critical towards the Labour government's lines of command and secrecy surrounding the project, Gowing deemed it "… the most successfully executed programme in British scientific and technological history."[126] There is of course no doubt that this was, according to Gowing, a result of the excellence of scientific men working and conducting the program on day-to-day basis — John Cockcroft, William Penney and Christopher Hinton. The emphasis Gowing places on their effort is astounding and testifies to the late 1960s British view of scientists as important components of modern society's proper functioning. This, I argue, is in part the result of an extensive campaign to represent Cockcroft and Harwell favorably.

[125] Margaret Gowing, *Independence and Deterrence: Britain and Atomic Energy, 1945 - 1952,* Volume I (London: The Macmillan Press, 1974).
[126] Gowing, *Independence and Deterrence* I, 57.

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However, Gowing's work has not been adequately scrutinized. This is an unfortunate, because new declassified materials have become available since it was first written in 1974. Furthermore, if we were to trace the materiality of Gowing's work, as Leah Price suggests in her book,[127] Gowing's divide between the volumes (on "policy-making" and "nuclear science" respectively) testifies to post-war British understanding of science as somewhat separate from politics and society.[128]

Regardless of my criticism towards Gowing and her methodology, I find her work still very valuable for the argument. The late 1960s and early 1970s was a period in which British society frequently extolled its scientists. Gowing's decision to divide the work on British nuclear science, from British policy-making, serves to paint the scientists as individuals devoid of ideological ramifications. In other words, British scientists are those that are fighting their way through the often hostile policy-making. How did Gowing's representation of Cockcroft adhere to the resolution of debates on science? To what extent was Gowing influenced by 1960s renderings of scientists? I think the latter might be an interesting study, independently of my thesis, although I will touch upon this question throughout Cockcroft's depiction. I begin my analysis of the construction and representation of the exemplary scientist in Britain by looking at first newspaper renderings of Cockcroft and I finish it with a discussion of Gowing's chapter "The Men."

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[127] Leah Price. *How to do things with books in Victorian Britain* (Princeton: Princeton University Press, 2012).

[128] Shapin argues that "Anglo-American" history of science in the 1970s was "eclectic," acknowledging that science was not entirely separate from society, but although not solely indebted to society. "… the proper procedure was deemed to be an eclectic selection of the respective 'factors' and a judicious admixture of elements from both orientations towards scientific change." See Steven Shapin. "Discipline and Bounding: The History and Sociology of Science as seen through the Externalism-Internalism Debate," *History of Science* 30 (1992): 342.

3.1. Constructing Cockcroft

"The Man in charge goes strolling on the site of Britain's first atomic pile" is a caption under *Picture Post*'s article introducing Cockcroft.[129] This article, particularly the visual information supplied in it, will serve as a starting point for further renderings of Cockcroft's public image and British nuclear research. The first photograph is a film-noir inspired one, in which a man (Cockcroft) seen from the back is walking on an isolated terrain. (Fig. 2) The photograph is masterfully done to convey the grim financial prospect of Britain, but also to underline the importance of a single man in this project. The latter is, naturally, false—British nuclear research was governed by other political and scientific bodies besides Cockcroft. Nevertheless, relating the project to one man has a humanizing undertone.

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[129] The article's subtitle describes the urgency of the matter: "Britain, poor in oil, and hard-pressed for coal, needs fresh power for her industry. The scientists claim that, within a couple of decades, the atom can supply much of that power. The Government backs that claim with its research station at Harwell." See Anon., "Our £ 100,000,000 Atom Stake," *Picture Post*, 7 December 1946, 9-10.

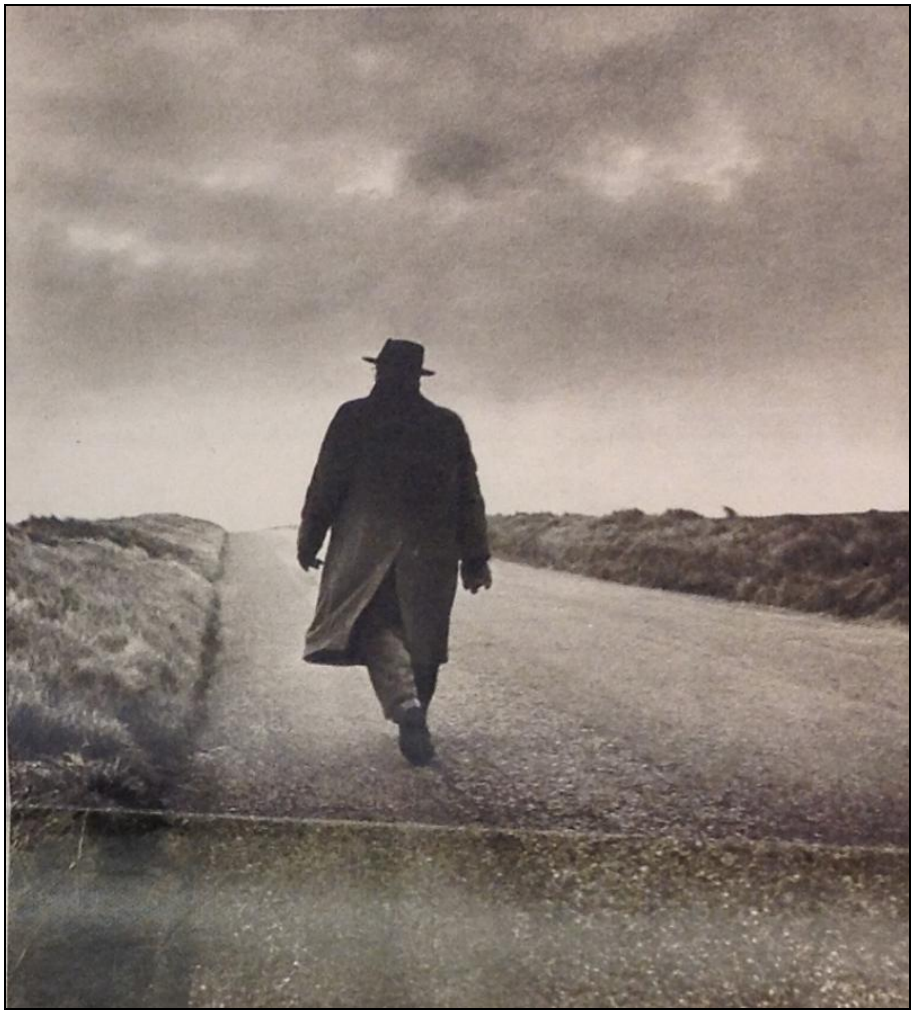

Fig. 2

When the readers turn the page, a grim and noir-ish prospect becomes a familiar representation — Cockcroft is photographed, in a less artistic manner, with his four-year old son Christopher. (Fig. 3)

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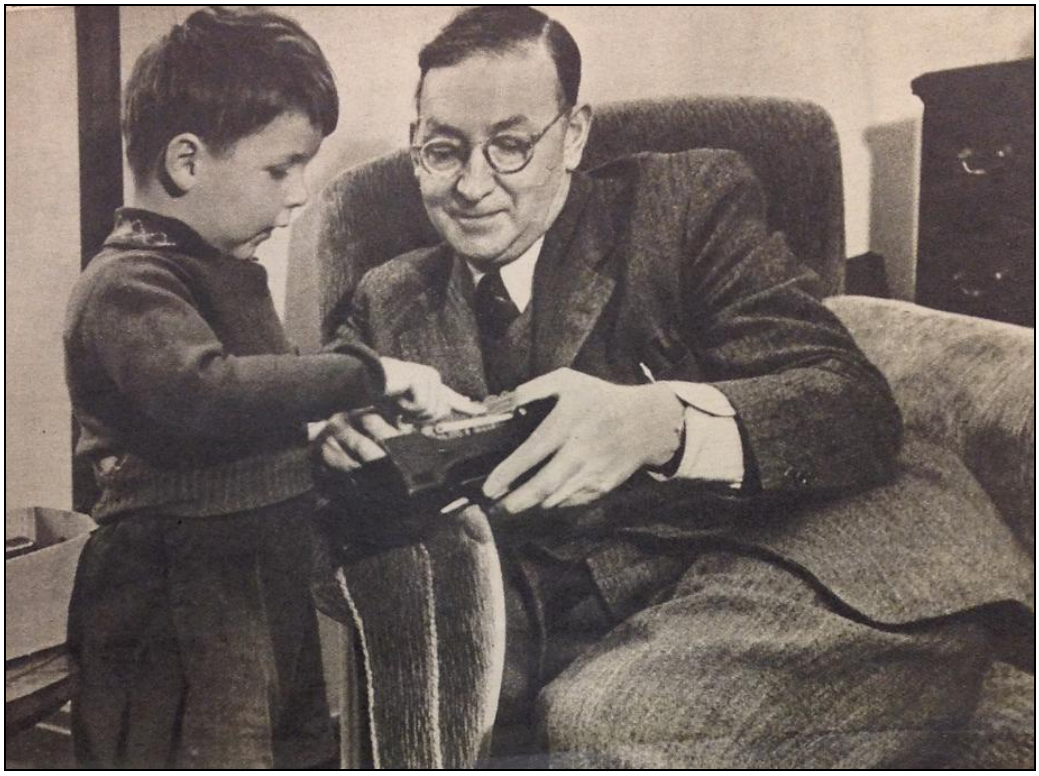

Fig. 3

Tracing the materiality of this photograph is an interesting prospect, because the reproduction of a similar rendering resurrects today. For example, a book on Jacob Bronowski runs a cover rendered in a similar fashion to that of the photograph of Cockcroft with his son.[130] (Fig. 4) It is that of a scientist, teaching and guiding the younger generation to use the knowledge of science for humanity. The photograph of Cockcroft with his son evokes a notion of homeliness, love, kindness and modesty.

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[130] Anthony James. *The Happy Passion: A Personal View of Jacob Bronowski*, Exeter: Imprint Academic, 2011.

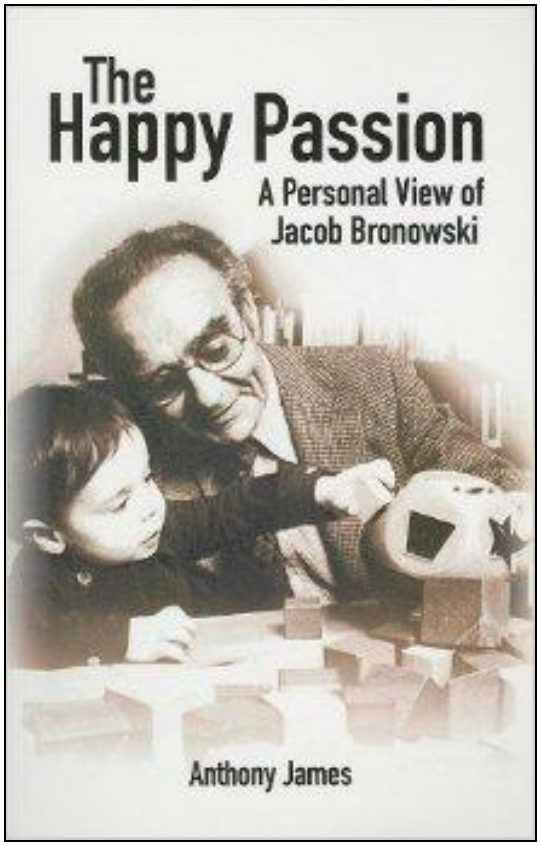

Fig. 4

The language used in the *PP* article, in relation to the bomb is also interesting. While the American scientists referred to the bomb as "the gadget," Cockcroft's photograph with his child talks about the bomb as a "toy." The bomb, as well as nuclear energy, affords the prospect of becoming a pleasurable plaything if one has the correct teacher to lead the project. The subtitle of the second photograph is: "Much of Professor Cockcroft's leisure is spent in correcting the idiosyncrasies of his children's new toys: All his working life is devoted to steering on to the right lines the new toy of humanity." This is an exaggeration that associates post-war scientists' responsibility with the benefits to humanity. Cockcroft had been working for an industrial firm Metropolitan-Vickers in the early 1920s until 1924, when he left to work at the Cavendish Laboratory under Ernst Rutherford. He had only been granted some notion of celebrity with the 1932 experiment with Walton on the transmutation of the atom. In discussion with Lise

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Meitner, over her coming to Cambridge in 1939, Cockcroft advises her to think it through: there is barely anyone left at Cambridge working on experimental physics, since all have gone to work for the Government.[131] The letter discloses no complexities as to governmental work. The discourse of science for "humanity" would come only later with the Hiroshima and Nagasaki A-bombs. Responsibility and the need to humanize scientists would also arrive with A-bombs. A great way to humanize a representation of science is to represent scientists alongside "humanly" and "normal" daily activities — such as playing with children. Moreover, Cockcroft was also included in the 1959 "Living Biographies" series. These were dedicated to documenting the lives of famous British men and women. The intended public for the book were children and young adults ("teenagers"). The publisher hoped to inspire children and teenagers by the lives described in the books. Journalist Ronald Clark wrote Cockcroft's biography in 1959. Archival documents do not suggest Cockcroft's contribution, apart from supplying the publisher with photography requests.[132] Clark derives his sources from newspaper articles on Cockcroft and gives a saccharine portrayal of him. Cockcroft was "…born in 1897, the year of Queen Victoria's Diamond Jubilee. The son of a Todmorden cotton manufacturer…"[133] and educated in a pre-WWI non-specialised style which gave equal importance to science and the humanities, which implied that Cockcroft was able to bridge the rhetorical gap opened in 1959 by C.P. Snow's debate.[134] Not only was he gifted in both classics and science, but Cockcroft also gained a dual education — in "pure science" and engineering. Clark renders Cockcroft as displaying a special personality, an unusually good and broad

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[131] CCA, CKFT 20/22, Letter by John Cockcroft to Lise Meitner, 15 October, 1939, 1.
[132] CCA, CKFT 24/3, Letter by Ronald Clark to John Cockcroft, 26 October, 1959, 2.
[133] Ronald Clark, *Sir John Cockcroft* (London: Phoenix House, 1959), 10.
[134] Clark goes on to extol Cockcroft's stress on the humanities and communication among people as crucial for his success in managing Harwell and adapting to a new research environment of "Big Science." See Clark, *Sir John Cockcroft,* 106.

education, as well as a stress-free, yet efficient life outlook. Yet Clark gives his own view of Cockcroft's image of a scientist as not apparently suitable for the stereotypical notions of what a Cavendish-trained physicist should look like: "Round-faced, twinkling-eyed, slow-speaking and confident of himself, he might well have been taken for one of the successful farmers from the neighbouring countryside."[135] Perhaps the most important claim that Clark makes in his book, which was an effect hoped to be achieved with newspaper rendering of Cockcroft is that his name is automatically associated with Harwell.[136] Cockcroft had successfully established, as Clark points out, "Harwell University."[137]

Although the readership intended for Clark's book was limited to children and young adults, its influence has been noticed, although not cited, in scholarly work. Gowing's portrayal of Cockcroft taps into tropes established by Clarke's biography. The saccharine story of Cockcroft's success has found its way into Gowing's rendering of Cockcroft's work. Both Clark and Gowing argue that Cockcroft is Harwell, and that his influence surpasses that of "science" onto future education and proper conduct in post-war society. Cockcroft's modesty, work ethics and "whole human" appeal were a desirable model for recruitable generations in expanding post-war British industries. However, Cockcroft will be equated to Harwell as early as 1948 in a particular newspaper rendering of his public speeches.[138] (Fig. 5) Steven Shapin wrote on how important it was for scientists, leading governmental scientific projects, to adopt a certain charismatic persona. "The closer you get to the heart of technoscience… the greater is

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[135] Clark, *Sir John Cockcroft,* 44.
[136] Clark, *Sir John Cockcroft,* 88.
[137] Clark, *Sir John Cockcroft,* 86.
[138] Anon., "'Cockcroft of the Atom' talks to Britain's citizen's of tomorrow," *The Daily Mirror*, 29 December, 1948, 5.

the acknowledged role of the personal, the familiar, and even the charismatic."[139] Robert J. Oppenheimer, the leader of the wartime Los Alamos laboratory, is a good example of how a charismatic leader was able to lead a closely guarded governmental project.

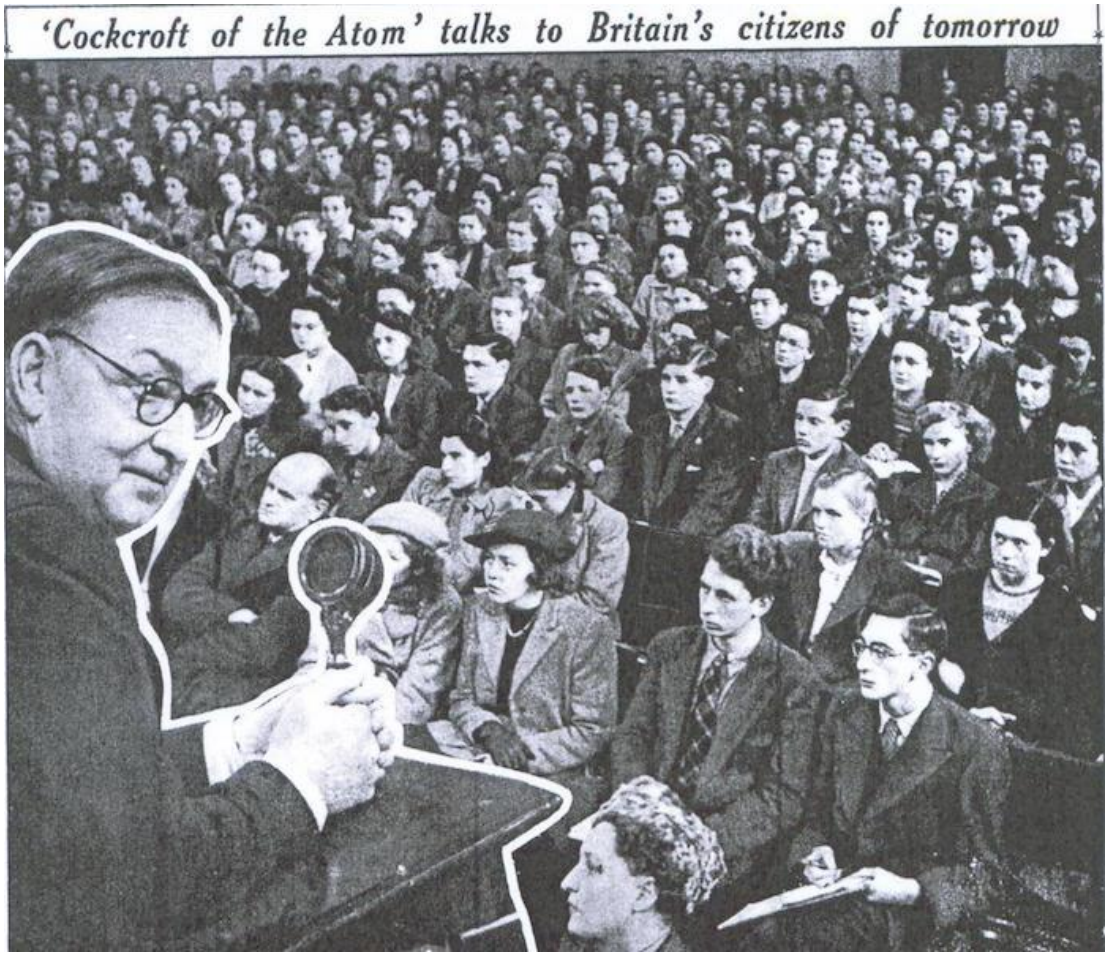

Fig. 5

3.2. Labor shortage and "the Cockcroft magnet"

In my previous discussion of Margaret Gowing's history of British nuclear research, I have proposed some apparent problems, but I think she gives a remarkably accurate rendering of Cockcroft's function in late 1950s Britain. Gowing refers to the potential of Cockcroft's

[139] Steven Shapin, *The Scientific Life: A Moral History of a Late Modern Vocation* (Chicago: The University of Chicago Press, 2008), 5.

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persona to recruit people, acting like a magnet. I am rather skeptical about whether this is about Cockcroft's character and personality (as proposed by Clark and Gowing), and would rather suggest that this was a part of the Government's strategy to address the wide-felt professional (scientific) labor shortage.[140] Cockcroft, according to Gowing, reassured British scientists that a university-like community would be set up at Harwell to accommodate the scientists' anxieties.[141] Steven Shapin gives an American perspective onto recruiting talent for post-war "Big Science" work. The tremendous growth of industrial research demanded a lot more scientists to the job, and these were of greater concern than, for example, military stockpile.[142] Similarly, Cockcroft was used to attract young and reluctant graduates to join the British nuclear project and alleviate the labor shortage. If Cockcroft was a magnet for young talent, how did the Government shape and implement his representation for that purpose? What was the relationship between the British Government and Cockcroft?

Gowing states that nuclear scientists at Harwell were not very political; although leaning more to the left "Labour" than to the "Tories," they were at Harwell because of their "strong sense of duty" for British prosperity.[143] This is, of course, highly problematic and already disputed in this chapter by Oliphant's September 1945 letter, which argues that scientists were eager to continue their professional careers, regardless of "national duty." Nevertheless, in order for Cockcroft to attract talent, his persona had to be shaped according to expectations and in contrast to the dangers of scientists giving themselves to wrong ideals (e.g. Communism).

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[140] After Harwell, Cockcroft was appointed Master at Churchill College (University of Cambridge), solely dedicated to education in science and technology. The College was set up in 1958. "Young people have not shown themselves reluctant to take up scientific or technological careers once the opportunities are clearly presented and the facilities for study and training are readily to hand." See Anon. *Industry and Schools* (London: Federation of British Industries, 1965), 3.

[141] Gowing, *Independence and Deterrence* II, 27.

[142] Shapin, *The Scientific Life,* 101.

[143] Gowing, *Independence and Deterrence,* 10.

Money, Gowing asserts, was never of importance to the scientists at Harwell. They were not joining the team because of financial benefit, although Shapin claims differently. Shapin attests that money was particularly a strategy to attract the reluctant scientists.[144] Cockcroft had to be portrayed in a romantic, yet promisingly modern scientific way. His persona was to transmit the message of modern science done without corrupting one's moral or "vocation." Cockcroft had to be humane but also had to provide an assurance for a creative scientific environment.[145]

The personalization of British nuclear science was at the core of Governmental strategy.[146] It would play onto proving that science was still conducted under mentorship and friend-relations, such as the ones fostered in the university system. This seeks to alleviate the gap already widely felt across both continents. Scientific "vocation" was changing for the scientists, but also for the public. In Britain, the public was aloof from the workings of science. Similarly, scientists were also becoming aware of changing scientific organizations. It was no longer based on personal, freedom-loving research atmosphere, but rather in dehumanizing military-industrial establishments. A more publicly active scientist, like Bronowski, invoked the conflict between science and industry in the post-war period. It became the dominant trope of the period, as dominant that it needed to be addressed and stressed in Harwell's publicity campaigns. The problem of scientific vocations and the diminishing of individual agency were embodied early as 1918 in Max Weber's acclaimed lecture *Science as a Vocation*.[147] The Government had to work against paradigms on post-war science. According to research

[144] Shapin, *The Scientific Life*, 109.

[145] Cockcroft was concerned over British scientific education and his personal papers testify to his concern over the British "brain-drain" to the U.S. See CCA, CKFT 17/6, Letter from F. A. Vick (Harwell) to Cockcroft (CC), 7 March, 1966.

[146] I will discuss this more in the next chapter which analyses the Government's treatment of the Windscale disaster and how little media coverage has been afforded to this apparent catastrophe.

[147] Max Weber, "Science as a Vocation" in *The Vocation Lectures*, ed. David Owen and Tracy B. Strong (Indianapolis and Cambridge: Hackett Publishing Company, 2004), 1-31.

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conduced by anthropologist Margaret Mead with American high school students in 1957, their view of scientists was very negative and immoral;[148] it was threatening to shatter the recruitment needs of industry, as described by Shapin. Mead advised for a wider campaign on mending the shattered image.

The brochure from 1949 is the first of such instances in Britain, a decade before Mead's American research.[149] It brings a fresh twist to the depersonalized newspaper ads. The brochure was aimed at recruiting young scientists much needed to work at the newly established Harwell. The first strategy was to ease the common tensions between scientific roles carried out at universities and in the governmental or commercial sectors. What did it mean to work for the government in the post-war environment? According to Cockcroft and the campaigns, "an interesting research environment" that surpassed anything capable at a university level. The 1949 recruitment brochure begins with a personalized note written by Cockcroft:

> To assist in the solution of the many problems posed by atomic energy, we need to recruit from the universities many young graduates. Those of you who come will find a good scientific environment in which to work and develop your scientific life.[150]

The brochure begins by introducing the importance of research at Harwell. The first photograph of Harwell is a total shot of the living quarters, taken from the airplane — it looks no *different* from a small British town. There is a certain cozy atmosphere in this first impression. The project, as Cockcroft's foreword, is molded so as to invite young graduates to participate in the creation of British nuclear energy. The brochure expects the graduates to become active participants. The presentation of different branches of research climaxes in the

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[148] Margaret Mead and Rhoda Métraux, "Image of the Scientist among High-School Students," *Science* 30 (1957): 384-390.

[149] Anon., *A.E.R.E: The Atomic Energy Research Establishment, Harwell, Berkshire*, London: Ministry of Supply, 1949.

[150] John Cockcroft, *A.E.R.E: The Atomic Energy Research Establishment, Harwell, Berkshire*, (London: Ministry of Supply, 1949), Foreword.

brochure's conclusion by extolling Harwell's commitment to academic co-operation with universities. The brochure reassures young graduates that their research and publication is beneficial for the establishment because it keeps the scientists up to date with new developments. Harwell was also active at organizing conferences and scientific meetings.[151] Furthermore, the brochure invokes an interwar international appeal to the discipline by citing visiting lectures and "big names" in the field of nuclear physics such as Edward Teller, Hans Bethe, Max Born and so on.[152] Housing and entertainment is also referred to be at a high level, providing both ease of access to research and recreational facilities. Gowing refers to the Establishment's cozy atmosphere by bringing forth photographs of scientists working at Harwell. On one such photograph, Cockcroft's ten-year-old son is leisurely posing with the scientists.[153] If a child is living in such an atmosphere, then it must be safe to live and work at Harwell. The light-hearted optimism of scientific freedom is complicated by the archival documents, however.

In 1950 John Cockcroft was to deliver a lecture at the University of Oxford on international control of atomic energy. The question was a pressing one for nuclear scientists, particularly those in the United States. The government re-drafted Cockcroft's speech.[154] As a matter of fact, Cockcroft was first to approach Roger Makins asking if there is anything "that would be better left unsaid at the present time."[155] From the official governmental minutes of this document, John Cockcroft stressed that he is talking as an individual and not on behalf of the government. If that is the case, why did the individual and governmental coincide in the

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[151] Anon., *A.E.R.E: The Atomic Energy Research Establishment, Harwell, Berkshire*, (London: Ministry of Supply, 1949), 13.
[152] Anon., *A.E.R.E,* 14.
[153] The photograph has already been mentioned in this chapter and it is important to notice how this image was the dominant trope, still invoked when representing exemplary scientists.
[154] TNA, FO 371/88532, UP 233/53, Letter from Roger Makins to John Cockcroft, 13 May 1950.
[155] TNA, FO 371/88532, UP 233/53, Letter from John Cockcroft to Roger Makins, 11 May 1950.

correspondence? Why is Cockcroft pressed to report on every of his public appearances, although he is advised to stress his individualistic approach to the issue? The latter example testifies that the government was interested and controlled the image and words of Cockcroft. On another occasion, Cockcroft addressed students at a conference at Reading University. In 1958, Cockcroft already remarked on the need of scientists to be properly educated on both fields and to communicate their findings with the public.[156] However, similarly, to what Bronowski was writing at the time, Cockcroft argues that scientists do not make political decisions. The scientist's role is creative in the production of knowledge and in finding ways to communicate the findings with the public. The government also heavily censored this address.[157]

On another instance, Cockcroft would write for an obscure, housewife-targeted weekly *Everybody*. "Catch our scientists young!" is the title of the article that urges younger people (whose career choices are supposedly influenced by their parents) to consider engineering careers.[158] (Fig. 6) A newspaper ad for Harwell summarizes the points Cockcroft was trying to get across: "The key to advancement in science and technology is inspiration. The inspiration behind the atomic energy programme is the imagination of the scientists and engineers who could visualise what only they knew to be possible and who had the courage and tenacity to achieve it."[159]

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[156] TNA, AB 27/18, "The Contribution and Responsibilities of the Scientist to the Development of Nuclear Power," Lecture on 25 March, 1958, 5.

[157] "The Chairman feels that the last paragraph might be a little dangerous, since there is some risk that it could be used in publicity for propaganda." See TNA, AB 27/18, Letter from A.K. Rawlinson to J.M. Pye (Cockcroft's secretary), 21 February, 1958.

[158] John Cockcroft, "Catch our scientists young!" *Everybody*, 20 October, 1956, 19.

[159] TNA, AB 16/2066, "Careers for Young People," 1957, 1.

Fig. 6

On the contrary, to Cockcroft's claims on labor shortage, John Sandalls applied for a position at Harwell, dreading that he might never be chosen for the position since the competition was high. Before Harwell, Sandalls worked for the rubber industry, but chose to apply to Harwell because of its prospect to encourage young graduates to continue their education while working for Harwell at the same time.[160] Although Sandall's self-published memoir does not adhere to be historically reliable methods (nor was that Sandall's ambition), the book is good for giving a glimpse into how 1950s "youngsters" were recruited — through ads and media. Sandalls saw an advertisement in the *News Chronicle*. But how did newsreels and feature films influence young graduates' views of British nuclear science? The next section is going to address this question.

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[160] John Sandalls. *Thirty-six years at the Atomic: My time at AERE Harwell, 1958-1994* (Evesham, Worcestershire: Perfect Image, 2004), 2.

3.3. Cockcroft on film

In 1948, British Movietone news produced *British Progress in Atomic Energy Research.* The newsreel opens with triumphant music magnifying the importance of British scientific research. The first shot is a panorama of typical south British countryside, with cows being grass-fed. The narrator tells of the location of Harwell and that it was once a military base. These few shots are very intelligently used to refer to many things. First, the peaceful and organic British countryside invokes a sense of serenity and the pleasurable aspects of atomic power. Indeed, at this time, the British public had no idea that Britain was set to produce its first nuclear weapon. Second, the fact that Harwell was built on the site of a previous RAF base gently invokes the national importance of the project, particularly in relation to defending itself (successfully, since British strategic bombing added considerable blows to Germany in 1944-45). However, the shots later refer to the secrecy and "barbed-wire" aspect of Harwell. The first shot actually showing Harwell is taken from a moving car, alongside a barbed wire, which is then juxtaposed with a montage of airplane shots of the establishment. Cockcroft is introduced right in the middle of the newsreel, equating Harwell to his presence. The first shot showing Cockcroft is that of him showing his pass to the security guard to which the narrator states that no one is left unexamined. A shot after is that of Cockcroft talking to other scientists, he is in the middle, discussing matters at "the nerve center" of Harwell. (Fig. 7)

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Fig. 7

Later shots dissolve into talking about the actual technology of Harwell. The shots represent a few, impersonalized "white lab coat" scientists working on radioactive isotopes. The newsreel is important in revealing the location of Harwell and relating it to a pleasant and "homely" British environment. Cockcroft is then (again) equated with Harwell by being the only one identified and shown through multiple shots. Technology comes in the end, as to outline the development and potential of British nuclear science.

However, following the Fuchs case, Harwell's public image, as depicted also on newsreels, would change considerably. *The Secrets of Harwell,* a British Movietone newsreel shown just months after the Fuchs case, invokes how Harwell has changed the landscape of the village: the camera refuses to portray prior footage of its surroundings, rather focusing on the inside work of the scientists. In this newsreel, Cockcroft is not depicted, but it is important to note how the representation of science and scientists was affected by the Fuchs case. I will discuss this particular newsreel in more depth in the next chapter devoted to the spaces of science.

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How was Cockcroft's image impacted by the Fuchs case? What was his role in mending the shaky image of "a schizophrenic scientist" such as Fuchs, as depicted by the British press? Fortunately, Cockcroft received a Nobel Prize for physics in 1951, jointly with Ernest Walton. It would be interesting to investigate how the Fuchs case's damage to Harwell's image might have influenced the choice of Cockcroft as the following year's Nobel Prizewinner. Before 1951 British scientist Patrick Blackett received the Nobel Prize in 1948 for his work on cosmic rays. Blackett would cause much headache to the British Government for his undivided belief that under no circumstances should Britain develop nuclear weapons. Mary Jo Nye argues that Blackett was the only British scientist who was at the time very vocal against the bomb and the only British scientist against the effort.[161] Blackett gained much prominence in the press by publishing a foreword a pamphlet on the dangers of atomic energy.[162] Contrary to the British Civil Defence efforts,[163] Blackett stated that it was very unlikely that Britain would survive A-bombs. Deterrence, Blackett argued, was not the best option for British policy-making. Blackett's case reminds us of the special concerns and problems that the Nobel laureate might cause for the Government in painting the picture black or white. Cockcroft's image was not thus easily molded by just stressing the importance of his Nobel Prize work. It seems that this prize was in fact not that much used (in the press and newsreels) as an indicator of Cockcroft's scientific brilliance, apart from it being put on display in Harwell's Library.[164]

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[161] Mary Jo Nye, "A Physicist in the Corridors of Power: P.M.S. Blackett's Opposition to Atomic Weapons Following the War," *Physics in Perspective* 1 (1999): 137.

[162] Anon., *Atomic Attack: Can Britain Be Defended?* (London: Association of Scientific Workers, 1950).

[163] See Matthew Grant, *After the Bomb: Civil Defence and Nuclear War in Britain, 1945-68* (Houndmills, Basingstoke: Palgrave Macmillan, 2010).

[164] TNA, AB 6/990, Harwell Bulletins (1951)

3.4. Cockcroft as Professor Koepler in *Spaceways* (1953, UK)

Professor Koepler, an older British scientist is leading an international project of sending rockets into space and establishing the first satellite. The Government and a team of international scientist help him in the project. The main protagonist is an American scientist, Dr. Stephen Mitchell, who is married to an unhappy British housewife. Not understanding the culture of science and bored of living in heavily guarded scientific quarters, Mitchell's wife Vanessa seduces an already antagonistic scientist, Dr. Phillip Crenshaw. The couple, because Dr. Crenshaw is a Soviet spy, leave the Establishment in secrecy, which causes an alarm among the scientists. Dr. Mitchell is accused of murdering the couple and stuffing their bodies into a space rocket's fuel tank, orbiting the Earth. In order to disprove the British Intelligence service, Mitchell sacrifices himself and boards another space rocket to bring back evidence.[165] The love-narrative becomes even more complicated with the mathematician Dr. Lisa Frank (a Central European character, perhaps roughly modeled on Lise Meitner?) falling in love with Dr. Mitchell and following him on the first human mission to Space. The melodramatic and saccharine sub-plot might dominate a more gender-based study of the film, particularly in relation to the juxtaposition of Dr. Lisa Frank and Vanessa Mitchell.[166] However, what can be said about the representation of British science in this film? How does the compound function? To what extent is the film referring to the work environment at Harwell? How is Professor Koepler, the fictional director, molded on the public image of John Cockcroft? By already establishing the fact that John Cockcroft is used and represented as the exemplary British

[165] "We… require to recruit physicists who are good experimentalists, and we also need those human qualities which will them good group leaders in their early thirties and good organizers of projects or larger groups in their later years." See John Cockcroft, "First Session, 15 November 1956," *The Education of Physicists in Universities and Colleges of Technology* (London: The Institute of Physics, 1956), 4.

[166] Historian Bonnie Noonan wrote an acclaimed book on 1950s SF cinema in which she argues that the genre's female characters were often portrayed as progressive. See Bonnie Noonan, *Women Scientists in Fifties Science Fiction Films* (Jefferson, NC: McFarland, 2006).

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scientist with both vast scientific knowledge and a particular talent for recruiting and motivating workers, how does this representation tap into Professor Koepler's film persona?

Professor Koepler's first appearance in the film is when he is introducing the team to a military official who is responsible for budgeting the Establishment. The Professor is playful and loving towards his team. Upon having gained the needed economic support from the Government to proceed with scientific research, the Professor begins a speech by remarking: "There are many nationalities among us, but yet we are a single team." This invokes a sense of international co-operation, normal in interwar scientific circles. The fictionalized and the "real" Cockcroft seem to share certain similarities. First, they are both "older and wiser" than the men and women working at the Establishment. This implies a high level of experience. They know their science well and have worked in an acclaimed university setting. Koepler is the only character in the film referred to as "the Professor," while Cockcroft's pre-war position was at St. John's College (University of Cambridge) as a professor of natural philosophy.

Second, Cockcroft and Professor Koepler are kind, helpful and paternal. They re-evoke "the good old days" of university-based research done under the mentorship of a great scientist. The older and experienced scientist is brought out of duty for science and nation to educate the younger generations and bring rapid scientific progress. Dr. Lisa Frank even confesses her love-troubles to Professor Koepler over a late-evening conversation. (Fig. 8) Incidentally, Cockcroft also related himself as the paternal figure at Harwell. In a speech on the opening of Harwell's radiochemical laboratory Cockcroft referred to himself as "the father of the family at Harwell."[167]

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[167] CCA, CKFT 25/24, Speech given on the opening of the Radiochemical Laboratory at Harwell, 1.

Fig. 8

Both Professor Koepler and Cockcroft are acclaimed for giving their Establishments suitable working conditions and character. Their style of "command" is not authoritative and the atmosphere established in both fictionalized and real Harwell is that of companionship and respect. The mission goes terribly wrong in the end, but it is the love and Mertonian-like "communism" of the scientific staff that saves the mission.[168]

At last, both Dr. Koepler and Cockcroft are fully co-operative with the Government. They understand and respect authority and are represented as working for the Government and national interests. Even the Governmental figure in the film, a military officer who is advised to overlook the project is represented as a likeable character supportive of post-war science. If Polanyi and Bronowski saw *Spaceways,* they would have undoubtedly supported the exemplary "scientific community" – a term Polanyi coined in 1943.

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[168] Merton, *The Normative Structure of Science*, 273-274.

Cockcroft was constructed across different British media and these representations suggest two important aspects. First, Cockcroft's image was persistently molded as to relate his persona to Harwell. If the latter research establishment was the marker of British nuclear program, Cockcroft's image was constructed as to stand for the whole British nuclear project. Second, manifold representations of Cockcroft suggest that he was constructed as the exemplary British nuclear scientist. My arguments can be tested through an interesting representation of post-war science in *Spaceways*. In the next chapter, I depart from positive representations and problematize the contested danger nuclear science was threatening to inflict on post-war British environment.

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CHAPTER IV. Harwell University: Representing an "intimate" military-industrial complex, 1946 – 1961

4.1. British SF "creature-features": Screening the threat of "Big Science" on British nature

> Social space works as a tool for the analysis of society.[169]
>
> Henri Lefebvre

> When you get just beyond the fork in the road, the contrast between the Britain of yesterday and the Britain of tomorrow really begins.
> On the right-hand side of the road is the atom town, a hotted-up version of a wartime poison gas factory. It is guarded by police roaming about inside the 8ft. high wire fences. And on the other side of the road is a centuries-old windmill, with chickens scratching about beneath its shadow.[170]
>
> *The Daily Mirror* article, 1949

> What's all this debris? You think this could be the village that disappeared?
>
> Marsh, *Quatermass II* (UK, 1957)

"Tomorrow you might not have a job. In fact, no one of us may have jobs… They're giving us no more money," exclaims Dr. Bernard Quatermass upon returning from London to his secluded research establishment in rural Britain. "No more money? Didn't you explain?" asks the senior scientist. Quatermass walks into a room with a model of his lunar invasion project: "Try and justify this to a committee of Whitehall bureaucrats!" (Fig. 9)

CEU eTD Collection

[169] Henri Lefebvre, *Production of Space* (Oxford, England: Blackwell, 1991), 34.

[170] Anon., "3 Hamlets in Plutonia," *The Daily Mirror*, 10 March, 1949, 2.

Fig. 9

Quatermass' "pity party," resembling Polanyi's and Bronowski's "scientific nightmare" come true, is disrupted by unusual occurrences registered by the radar.[171] (Fig. 10)

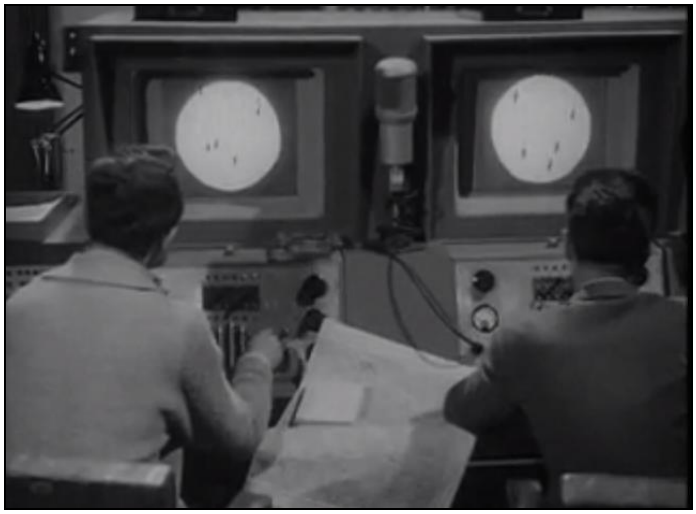

Fig. 10

Quatermass and junior scientist Marsh go on a trip to investigate the place where supposed meteorites fell. Instead of finding an old British village, with Marsh remarking the epigraph's quotation, the two scientists discover a full-scale copy of Quatermass' lunar project.

[171] The film's imagery of radar technology invokes a notion that WWII was actually won by radar work on both sides of the Atlantic, rather than with the explosion of A-bombs. "To most American physicists before 1943, and to the many who even after that time never joined the Manhattan Project, physics in World War II meant the Rad Lab." See Daniel J. Keyles, *The Physicists*, 307.

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(Fig. 11) The British government, infiltrated by aliens, had stolen Quatermass' scientific project. The alien lunar project is not only threatening scientific research communities but also British environment.

Fig. 11

SF film *Quatermass* is often quoted as one of finest examples of 1950s SF genre.[172] Nigel Kneale, the series creator and screenwriter, explained his particular vision of the genre. In an interview for the *Picture Post*, Kneale argues for a more "homely" approach to SF's setting.[173] He is not interested in the drama of the galaxies afar, but rather in what is happening in the vicinity. Coincidentally, the film was in British cinemas at the time of the first nuclear reactor disaster in the world — the Windscale accident. Historian Jodi Burkett argued: "The power of nuclear weapons meant that it was no longer possible to see the planet as a discrete entity

[172] Paul Wells, "Apocalypse Then!: the Ultimate Monstrosity and Strange Things on the Coast…an interview with Nigel Kneale," in *British Science Fiction Cinema*, ed. I.Q. Hunter (London: Routledge, 1999), 48.

[173] Arthur Vincent, "Nigel Kneale: The Human Core of Science Fiction," *Picture Post*, 26 November, 1955, 62.

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separate from people and the decisions of politicians."[174] Burkett attests that it was the nuclear age and the British *Campaign for Nuclear Disarmament* (*CND*) that altered the British public's views on nature and nuclear weapons. I argue that this might be more the work of the 1957 Windscale accident and SF renderings of nuclearity rather than *CND*'s criticism over domestic employment of nuclear science.

Philosopher Hannah Arendt noticed the problem of nuclearity on modern conceptions of nature. She writes on how the human ability to destroy predates the post-Hiroshima horror. However, nuclear energy is novel in that humans are for the first time imitating nature. Nuclear energy is not an artifact, built by humans, which can be easily dismantled. It is a force, present in nature, now in possession of humans.[175] Since human beings are able to control nature, they are also able to control history of certain cultures (that can be wiped out by thermonuclear weapons), thus nature becomes just another object of history. Sociologists John Urry and Phil Macnaghten, in 2000 book *Contested Natures* argue for a flexible understanding of "Nature." Nature is culturally constructed; hence, there are multiple natures. Urry and Macnaghten limit their study to post-war British "contested natures," arguing that environmentalism and green-awareness does not stem from environmental catastrophes, but rather from the mediation of "signs, sense of agency and particular timings."[176] Ordinary Britons have "felt" these philosophical and sociological renderings of nature during the 1950s, particularly during the Windscale accident.

On 8 October 1957, a reactor fire at the British Windscale plutonium factory (described in the chapter's epigraph), caused radiation hazard to the local population and workers. In a

[174] Jodi Burkett, "The Campaign for Nuclear Disarmament and changing attitudes towards the Earth in the nuclear age," *The British Journal for the History of Science* 45 (2012): 626.
[175] Hannah Arendt, *The Promise of Politics* (New York: Schocken Books: New York, 2007), 155.
[176] Phil Macnaghten and John Urry. *Contested Natures* (London: Sage Publications, 2000), 3.

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speech that recapitulates British nuclear science and bids goodbye to Atomic Energy Authorities chairman Lord Edwin Plowden, Cockcroft praises Plowden's diplomacy in tackling the matter with the public.[177] In fact, Windscale was crucial for British nuclear scientists in understanding nuclear reactors, for which they had previously only adapted instrumental solutions.[178] Lord Plowden made sure that the media and the public would not be panicked. The matter was delicate since nuclear co-operation with American nuclear authorities was expected and the British Prime Minister, Harold Macmillan had written a letter to the U.S. President Dwight Eisenhower on the day of the accident, pressing (again) on the issue of co-operation.[179] On the other hand, the nuclear project could not be halted since the first nuclear power station in the world, Calder Hall, had been inaugurated in Britain just a year before Windscale.[180] It was a matter of urgency to let the accident pass with little media attention. By looking at *CND*'s mediation of the problems and their stress of nuclear-bomb testing, the Government did a good job of tackling concerns. Although the Government sought to minimize the effects and paranoia, the documents of lavish compensations that were later paid to the farmers and girls school in the vicinity paint a somewhat divergent picture.[181] The government was reluctant to continue the public discussion of the Windscale accident. Incidentally, the newsreel companies were also scarce in their portrayal of the disaster. For example, in the "Film on screen" Internet database,[182] dedicated to cataloging all newsreel productions, only a single newsreel is dedicated to the Windscale accident.

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[177] CCA, CKFT 25/24, Speech at Dinner to Lord Plowden, 2.
[178] Anon., "BEPO passes 'Windscale' test," *The Manchester Guardian*, 17 March, 1958, 1.
[179] Lorna Arnold, Windscale 1957: An Anatomy of a Nuclear Accident (London: Palgrave Macmillian, 2007), 84-85.
[180] Anon., "Windscale: 'Nobody's Health Affected'," *The Manchester Guardian*, 9 November, 1957, 5.
[181] TNA, EG 1/96, October 1957.
[182] British Universities Film and Video Council, "News on Screen," http://bufvc.ac.uk/newsonscreen/search/, accessed on 23 April 2015.

Historian of science Lorna Arnold would write a much-praised book on the Windscale accident thirty-odd years after. Arnold was "an insider" to the British nuclear program since she had worked on classified papers at the Ministry of Supply, in charge of nuclear energy. Furthermore, she served as an assistant to Margaret Gowing. The 1986 Chernobyl accident opened debates on post-Windscale Britain. This led the 1980s British government to consider a good candidate for an official account of the accident. Gowing became the obvious choice. However, during an early meeting, Gowing regarded herself physically unfit to work and recommended her former assistant Lorna Arnold.[183] Arnold agreed and was instructed, by now retired Plowden, to give a "more credible" and favorable account of the accident and the Government's efforts to tackle radioactivity. Arnold introduces the book by comparing two accidents that happened in Britain around the same time: first the Windscale accident in October with no death toll,[184] followed by a mining accident in Ayrshire, which killed 17 miners. Why did Windscale gain so much media attention and the miners almost none, Arnold asks.[185] However, the media attention seems to have been inspired by the events after Chernobyl, rather than the Windscale accident.[186] The scarcity of newsreels and newspaper renderings of the Windscale event tell a story of a much-orchestrated campaign to ease the probable panic. Lord Plowden's papers at CCA testify to his interest in coordinating a media

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[183] TNA, AB 48/1156, Letter from K. J. Russell to A.W. Hills, 28 August 1986, 1.

[184] Since Arnold was not employed in studying leukemia cases, she reported only immediate deaths (or, in this case, the lack thereof). See Arnold, *Windscale*, xii. I am, for one, very critical about the way the workers at Windscale were tested for radiation. Rather than testing all workers, the authorities handpicked people. This reminds one of the story historian Kate Brown told of the Hanford plutonium plant, Windscale's American counter-part. In *Plutopia*, Brown argues that the authorities, knowingly of the radiation threats, exposed their workers to the perils of radiation and employed similar methods of testing against radiation. See Kate Brown, *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (Oxford, UK: Oxford University Press, 2013), 67-68.

[185] Arnold, *Windscale*, xxi.

[186] Anon., "Macmillan ordered Windscale censorship," *The Times*, 1 January, 1988, 1; Anon. "Cover-up of fire at Windscale monstrous, charges Tory MP," *The Guardian*, 2 January, 1988, 12.

campaign for the newly acquired, post-Chernobyl, public's interest.[187] Historian Peter Henessy, in a foreword to Arnold's book revokes seeing a particular newsreel showing the government's efforts to minimize radiation threat by getting rid of milk from surrounding farms.[188] The government, by the employment of signs (milk being spilt and farms taken care of, as shown in the only existing newsreel), made sure that these attitudes were to be "untouched" for three decades. The same (and only) newsreel rendering of the accident undoubtedly influenced the *CND* campaigners.

Although *CND* was established mere months after the accident, it failed to give proper credit to the Government's responsibilities and the changes nuclear science had brought on the environment. As a matter of fact, *CND* even praised the Government in their Windscale cleaning-up efforts, in one of the campaign's pamphlets: "At the time of the accident at the Windscale plutonium producing factory…the authorities stopped the sale of milk from this area until the radioactivity had died away… Similar action should be taken again."[189] Important civil organizations, like the *CND*, did not understand the threat nuclear science was able to inflict on Britain. However, British 1950s SF cinema addressed these issues at the time of the accident.

The importance of *Quatermass* lies in its portrayal of nuclear and non-nuclear post-war spatiality. Furthermore, *Quatermass* and other SF films produced around the Windscale disaster were the only media renderings of a "domestic" nuclear catastrophe. These films allowed the British 1950s public to become acquainted with possible scenarios threatening British countryside by rapid industrialization and nuclear establishments. In 1959, two years after *Quatermass* and the accident, British cinemas screened an obscure but important film — *Behemoth, the Sea Monster* (UK, 1959). In the film, London is attacked through the Thames by

[187] CCA, PLDN 5/1/5, Letter from Warren Newman to Lord Plowden, 20 April, 1990, 1.
[188] Peter Henessy, forward to *Windscale 1957*, by Lorna Arnold, vii.
[189] BL, YD.2012.a.271, Campaign for Nuclear Disarmament, "Fall Out," 1962, 3.

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a prehistoric monster. (Fig. 12) The old nature was revived due to the nuclear tests in the Pacific Ocean and travels to London through water. Although Plowden and the authorities made sure that the Windscale accident would not cause much damage to the British domestic nuclear program, atomic tests in Australia caused concern to the British public.[190]

Fig. 12

In *Behemoth*, nature is an object that has agency, similarly to what Arendt remarked. It turns against humankind and takes its revenge on "Big science" and its wrongdoing. The prehistoric monster is important for problematizing the relationship to history in the atomic age. Nature, once a static component of human history, a background upon which humans have left their mark, is now threatening to become completely transformed. The monster (a marker of transformed nature) threatens to demolish Western civilization through shots of wreck and

[190] Many British organizations (from religious authorities to workers councils) wrote letters to the Government in 1957, urging them to stop the planned thermonuclear tests in 1957. See TNA, FO 371/129241, 1957.

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havoc of the Big Ben and the Tower Bridge. However, it is important to remember that the monster came from water. Water, a life bearing substance, is now serving as nesting ground for the beast. Around the time of *Behemoth*'s distribution, *The Manchester Guardian* would print out an article that refers to the contested dangers of the disposal of radioactive material in the sea.[191] Moreover, there were important claims submitted in writing to the Prime Minister asking whether atomic tests were to be carried out near the Atlantic Ocean, and thus endanger both shipping routes and food production in Europe and North America.[192] The importance of water and radiation had its origin in early American thermonuclear testing in the Pacific Ocean, which resulted in the Japanese ship "Lucky Dragon" being heavily contaminated. The concerns over "the Lucky Dragon" incident were so widespread that they even induced a thorough examination of radioactive threats at Harwell, initiated by the Health and Medical Department.[193] A notion that a threat from afar, and particularly a marine one, could come and cause danger to the urban population had already been in circulation well before *Behemoth* started screening in British cinemas. In the end, the beast (and nature) is put to rest by the new application of science of tackling the menace. The final scene of the film, in which the monster is tackled by vigorous commitment of scientists, evokes the 1950s British ambiguities of scientific progress. On one hand, Calder Hall, the first atomic power station in Britain and the world stands as a guarantor for the progress of humankind, while on the other hand, human harnessing of universal forces threatens to wipe out both nature and human history. Atomic energy, in the 1950s British context, is both the life-bearer and destroyer. It gives life to the pre-historic monster, but the invigorated monster is difficult to put back to sleep. Thermonuclear

[191] John Davy, "Scientists Clash on Atomic Waste: 'Lack of Knowledge' Claim on Effects of Sea Dumping," *The Manchester Guardian*, 22 November, 1959, 17.
[192] TNA, FO 371/129241, Z E112/120, 2 - 10 May 1957.
[193] TNA, AB 6/1275, Health Physics correspondence on defence against radioactivity, 14 May 1953 - 11 June 1954.

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weapons and the discussion in 1957 made apparent for the British public that nature and humans are threatened by "Big Science." By viewing SF films, the British public (via film spectatorship) "had lived" through the nuclear space promised by these unfortunate scientific developments.[194]

Although alien invasion narratives were common in 1950s SF, film historian Matthew Jones argues that some of films went past "infiltration" scenarios and problematized the government's ability to provide security.[195] The mistrust of the British Government (both in relation to the 1956 Suez crisis but in addition to the Windscale accident) was present in these features as one of the rare renderings of anti-nuclear sentiment. As previously discussed, even the groups committed to abolishing nuclear tests, like the *CND*, did not fully understand the threats imposed by nuclear plants on the home front. SF cinema provided an important niche through which mediations on human progress and its effects on nature were problematized. Works of Arendt, although reserved for the highest echelons of society, creep into some of "low brow" science fiction renderings, thus making these films relevant for understanding nuclear anxieties and providing an alternative through which discussions of "Big Science" could take place. These films also put stress on the research establishments across Britain. How did Harwell aim to represent its scientific space as an important contribution to the progress of Britain, without harming neighboring settlements and Britain at large?

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[194] "Film's spectatorship is thus a *practice* of space that is dwelt in, as in the built environment." See Giuliana Bruno, Atlas of Emotion: Journeys in Art, Architecture, and Film (London and New York: Verso, 2002), 62.
[195] Matthew Jones. "1950s Science Fiction Cinema's Depersonalisation Narratives in Britain," *Science Fiction Film and Television*, 7 (2014): 31 - 54.

4.2. Harwellian life on newsreels and in documents

> From what I have read in the Press and seen on Telivision [sic],it would appear that those Workers who are employed at the various Research Establishments throughout the country are quite happy, but for the fact that shopping facilities open to them are inadequate… I am seeking the information because, being very progressive in our outlook on life, my Wife & I, are desirous of moving away from London & commencing a business in a thickly populated area where competition is not so acute as it is in London.
>
> J.S. Isaacs of *Fay's Wear* [196]

> …the Research Group at Harwell, with its world-wide reputation as a source of inspiration and scientific advancement on the whole subject…[197]
>
> Job advertisement, 1957

While *Quatermass II* juxtaposed and problematized both the effects of industrialization of once rural British areas, as well as the dangerous effects of "Big Science," newsreels, official publications and the media at large painted a different picture. The public gained a more apparent critique of the Government from SF films than through other media outlets. Harwell had a difficult task in painting a favorable representation of itself, both for the public and in order to recruit further talent to work at the establishment. John Cockcroft would stress the importance of recruiting more people for scientific disciplines during eminent addresses or in housewife-targeted magazines.[198] If every society, or "mode of production", produces its own space, as Henri Lefebvre argued,[199] what shape did British nuclear research take in its

[196] TNA, AB 6/1711, Proposed shopping center at AERE, Letter from J.S. Isaacs to John Cockcroft, 6 February 1957, 1-2.
[197] Anon., "Nuclear Energy," *The Scotsman*, 1957, 41.
[198] CCA, CKFT 18/29, Cockcroft in newspapers 1945-1960.
[199] Henri Lefebvre, *Production of Space* (Oxford, England: Blackwell, 1991), 31.

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Harwellian incarnation? How was Harwell shaped to become a pleasurable research establishment?

The place of Harwell itself, as well as the strategy employed in choosing the place describes the general way Harwell was further molded as a dualistic, both "pure" and "applied" science research center. In 1945 Oliphant wrote to Cockcroft to inform him about the urgency to find a suitable place and person to lead the British atomic energy project.[200] However, Oliphant also discussed the potential places for the construction of the atomic research center. It was agreed that the place should be set up on a military base (in order to cater to the secrecy and military needs of the project), to have pleasant "natural" surroundings and to be near a university. The authorities, with Oliphant and Cockcroft, have selected Harwell, a village south of the University of Oxford. Already by choosing to provide pleasant accommodation and university-potential, the Government and scientists were aware that it needed to offer special conditions in order to bring scientists and industrial workers.[201] I will restrict this analysis to two important conditions for choosing Harwell: academics and leisure activity.

The first occasion when the press and newsreels would have the opportunity to view and present Harwell for the first time was in a short newsreel of 1947, but official access to Harwell was only provided in 1948. The newsreel *Didcot Atom Village* produced by British Pathe in 1947 shows the village setting of Harwell. It juxtaposes the sleepy village with the new science and life promised by "the Britain of tomorrow." Although I wrote about the influence of nuclearity on nearby spaces, the newsreel also gives a glimpse of living quarters of the new atomic village. The new village is at odds with the usual British countryside surrounding. The *Picture Post* article published in December 1945 made similar claims. For example, a

[200] CCA, CKFT 25/27, Letter from Marcus Oliphant to John Cockcroft, 14 September 1945, 1-2.

[201] TNA, AB 27/63, "Note of a meeting held at 16 Old Queen street, on 11th April 1945, to discuss proposed experimental establishment for Tube Alloys," 1-2.

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photograph representing Harwell's cemetery is reproduced with a caption "Harwellians who don't care."[202] (Fig. 13) The 1947 newsreel represents only Harwell's barbed wire fence and security man, to a contrast of British countryside. Neither Cockcroft nor any individualized and "familiar" persona is shown. This would change a year later, and Harwell would be represented in more favorable and less dehumanized form.

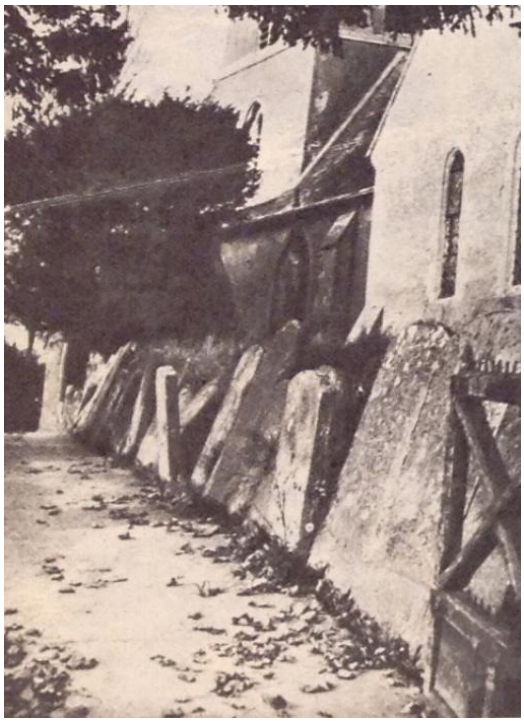

Fig. 13

The 1948 newsreels depicting Harwell start with a total shot of Harwell's surroundings, a countryside setting with grass feeding cows at the forefront. (Fig. 14)

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[202] Fyfe Robertson, "Atom Village," *Picture Post*, 8 December, 1945, 12-13.

Fig. 14

The security and importance of the project is put on the forefront: for example, the newsreel emphasizes how Harwell is heavily guarded because of the project's importance. Nevertheless, the space of Harwell will threaten to seem to be easily breached by espionage cases two years later. Lefebvre argues that the production of space ought to be looked at from a fluid point of view, as a process, rather than an accomplished freeze in time. Newsreels, mediated by the government, sought to show different views of Harwell than the one implied by the damaging effect of the Fuchs case upon the scientific community. Fuchs threatened to undermine what was understood as an "ethos of science."[203] How was the space to render a divergent representation?

The Secrets of Harwell, a newsreel by the British Movietone News aims to capture the interest of the British public with some of the press renderings of Fuchs' secretive undertakings during his time at the Manhattan project.[204] It shows that work at Harwell was secret (and secretive) and some of these secrets could have gotten to the enemy via Fuchs. Nevertheless, it

[203] Merton, *The Normative Structure of Science*, 268.
[204] *The Secrets of Harwell*, British Movietone News, Issue no.1099, 26 June 1950.

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was a modern Establishment with a usual, industry-like setting. Science was thriving, and a young and modern workforce was part of Harwell's project. The newsreel ends with a lively atmosphere of young and happy scientists eating at the local cafeteria, invoking a serene and everyday notion of a special and secretive place such was Harwell. (Fig. 15)

Fig. 15

The Gaumont British News also produced a newsreel with the title *Inside Harwell*.[205] It too is concerned with easing the anxieties that had arisen in relation to the Fuchs case. GBN's newsreel uses similar visual footage as the previous newsreel, from it can be concluded that newsreel cameramen were admitted on individual basis and that the material had to be shared among various production companies through the British Newsreel Association. If a comparative analysis of the two newsreels made by different British production companies is taken as a whole, some differences in their representation can be detected. The first newsreel, from its tone, music, treatment of Harwell and employing manifold close-up shots of young scientists seems to be aimed at the younger population — the prospective scientific employees for the Harwell establishment. (Fig. 16)

[205] *Inside Harwell,* Gaumont British News, Issue no. 1719, 26 June 1950.

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Fig. 16

In 1948, the year of first real images from inside Harwell, was also a year when Harwell's cultural magazine *Harlequin* was established, thus providing a cultural and artistic space for the manifold talents at Harwell. The first issue, as expected from Chapter III and the importance of Cockcroft's persona, starts with a huge photograph of Cockcroft on the left page and with an introduction on the right. However, the magazine's choice of name, obviously referring to the Establishment's self-image, is explained in length in the editorial:

> Just consider his characteristics. First and foremost he is overflowing with restlessness, with energy if you will… On other characteristic of Harlequin which leaps at once to mind is his fanciful attire. He is a creature of patchwork made up of squares of red, silver, black — all colours.[206]

Harlequin was to represent and create the special, collaborative atmosphere between young scientists. The atmosphere of Harwell was indeed about cutting-edge science, but it was to prove an outlet for the many talents the supposed Harwellian scientists held. Their

[206] Anon., "Editorial," *Harlequin*, July 1948, 4.

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"Elizabethian" persona should be harvested throughout manifold filmic and verbal reincarnations.

However, what was it like for people that have done their PhDs at eminent university centers to want to move to Harwell? Joan Freeman, an Australian physicist had recently completed her PhD dissertation at Newnham College, University of Cambridge.[207] She also had experience working in the intimate environment of the Cavendish laboratory (where she would meet many "legends" of the nuclear age like Lise Meitner and her nephew Otto Frisch).[208] Yet, Freeman continued her career in Harwell. Her first time at Harwell was spent during a part of the research for her doctoral thesis. Later recruitment would come from Cockcroft himself, who commenced on a journey to Cambridge to recruit young talent, which baffled the young Freeman as an unusual gesture given the popularity and high-standing reception of Cockcroft in scientific circles.[209] What Freeman did not know then, and which is apparent when the persona of Cockcroft and his public duties are deconstructed, is that he was being used as bait for young talent to see Harwell as a viable option for continuing their "pure" research. Although Freeman would not grant the space of Harwell the romantic undertone of studying at medieval Cambridge, the book suggests that scientific opportunities, in post-war Britain, were being transferred onto governmental research establishments and not the university setting.[210]

Freeman writes much about how invigorating and scientifically thrilling it was to work at Harwell, but were these activities and opportunities as present at Harwell as both Freeman and Sandall testify in their respective memoirs? A look at Harwell's Bulletins from 1950 to 1955

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[207] Joan Freeman. *A Passion for Physics: the Story of a Woman Physicist* (Bristol, Philadelphia and New York: Adam Hilger, 1991), 159.
[208] Freeman, *A Passion for Physics*, 151-152.
[209] Freeman, *A Passion for Physics*, 159.
[210] Freeman describes Cambridge: "There is still for me no more delectable place of man's contrivance, in all of Britain." See Freeman, *A Passion for Physics*, 102.

give much assurance that Harwell, although a state-run establishment dedicated to both civilian and military application of nuclear energy, was also hosting a range of scientific talks and opportunities for Harwell scientific employees to further their careers. Indeed, Bulletins testify to a thriving university-like atmosphere at Harwell, with at least three lectures taking place on weekly basis. Every year some famous scientist would come and give special lectures, like Hans Bethe, Victor Weisskopf or James Chadwick. In addition to this, Bulletins informed and motivated Harwellians to apply for summer schools and international conferences, thus expanding their knowledge and mastery of their subject.[211] A section for celebrating Harwellian PhDs and special courses was also given particular attention.

The marker of "pure" physics is often its fruitful interwar international co-operation. British newsreels aim to represent Harwell as a place where foreign scientists came to learn about the nuclear program – the British way, naturally. British Pathe presented a short visit of an international scientist to the Harwell Establishment as an interlude to the Geneva atom peace conference in 1955. *The World Sees Our Atom Secrets* starts with a general, birds-view shot of Harwell. The shot dissolves with the camera (and the British audience) being greeted by the security guard and carried into the special confinements of Harwell. Security, albeit liaised on the international delegations, is still stressed in the case of the British audiences. The security takes away the cameras of foreign scientists and leaves them at the gate. Security measures are then humanized with a close-up shot of John Cockcroft. This again invokes the apparent relationship between Harwell and Cockcroft's special persona. He is then seen bidding welcome to international visitors. (Fig. 17) The newsreel represents Harwell as an important atomic hub, but also a place of vibrant international friendship and companionship.

[211] AB 6/841 Harwell Bulletins (1950); AB 6/990 Harwell Bulletins (1951); AB 6/1154 Harwell Bulletins (1952); AB 6/1295 Harwell Bulletins (1953); AB 6/1560 Harwell Bulletins (1954) and AB 6/1776 Harwell Bulletins (1955)

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Fig. 17

As a conclusion to the concerns and questions addressed at the beginning of this chapter, Harwell's next thermonuclear reactor ZETA was represented in British newsreels in 1958. In a period of intensive nuclear debates in Britain, Harwell was represented by British Pathe newsreel company as taming thermonuclear energy for the benefits of humanity. *Taming the H-Bomb* (UK, 1958) newsreel begins by associating Harwell with employing thermonuclear energy for future nuclear power stations. The newsreel represents the space inside of Harwell, more concretely the ZETA apparatus. Newsreel's narrator remarks on this formidable reactor: "It may be many years for this great British achievement to reaches the power station's stage. But here at Harwell the first steps have been taken and this handful of British scientists may have given mankind the key to all the power we shall ever need." After my research, it would not come as a surprise that the only person allowed to speak in this newsreel is John Cockcroft, the director. Cockcroft addressed the public through his modest and calm tone on the importance of nuclear energy for Britain. Furthermore, British television also covered the event and turned the place of the ZETA apparatus into a makeshift TV studio.[212] (Fig. 18)

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[212] CCA, CKFT 26/5, Photographs, "Harwell: People."

In the late 1950s Britain, Harwell stood for the peaceful application of nuclear energy, even though thermonuclear energy threatened to annihilate human life. Harwell was represented as a place were dangerous forces are "tamed" and groomed to serve humanity's benefit, rather than destructive potential. According to media renderings and British post-war government's publicity, this was made possible by the special scientific atmosphere at Harwell under the directorship of John Cockcroft.

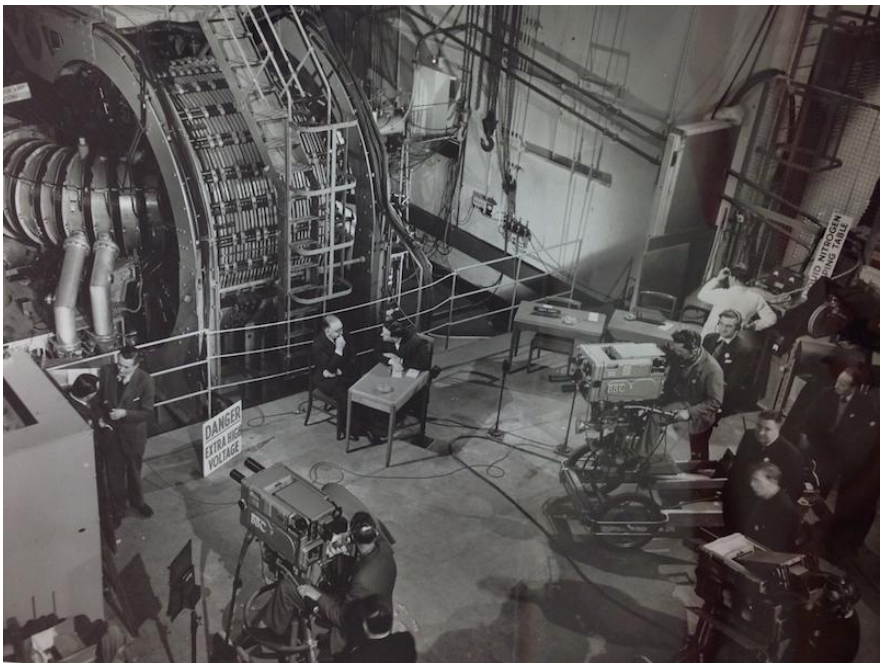

Fig. 18

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CONCLUSION

> …the function of the aliens is to reveal and clarify something that is already there, with their subsequent destruction a means of dealing, if only temporarily, with internal social tensions.[213]
>
> Peter Hutchings

The Atomic Age began with Hiroshima and Nagasaki explosions in August 1945. Although historians warn that WWII did not end because of nuclear weapons, the notion was common for the post-war public across the world. Nuclear weapons are powerful and destructive, threatening to end humanity, alter nature and forever change human history. Troubling aspect of the discovery was that humans were behind the production of nuclear weapons. International scientists, particularly nuclear physicists, working on wartime projects were represented as both ending WWII and endangering the already uncertain post-war environment. "Aliens at Harwell" touches many aspects of British post-war nuclear culture and uses "aliens" to refer to multiple aspects. First, nuclear scientists were viewed as monsters in the post-war environment, devoid of human feelings and sympathy because "their" scientific work brought painful death to the unfortunate Japanese population. The extent of nuclear destruction was made apparent by the British 1946 report cited in this thesis. Second, modern science was already too technical for ordinary people to understand the workings of it and the scientists were depicted as aloof from the British society. However, British post-war policy-making and nationalism were tied into the deterrence strategy. The possession of nuclear weapons was viewed as crucial for British diplomacy and self-conception as a modern post-war

[213] Peter Hutchings, "'We're the Martians now': British SF invasion fantasies of the 1950s and 1960s," in *British Science Fiction Cinema*, ed. I.Q. Hunter (London: Routledge, 1999), 40.

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state. How did the post-war British government represent its nuclear program to alleviate the anxieties felt by the public? This thesis addressed this question through multiple perspectives and argued that the British government provided positive representations of nuclear science and scientists by employing Harwell and Cockcroft as markers of the nuclear program.

In Chapter I, I have outlined the troubles British scientific "aliens" felt. The British nuclear program had to transcend many obstacles imposed by the public and scientists themselves who were debating the future of science in post-Hiroshima environment. Central European émigré scientists Michael Polanyi and Jacob Bronowski, although on different poles of politics, understood that in order for science to withstand the postwar chaos and uncertainties it had to hold on to its claim to independence. Polanyi and Bronowski both worked to prove that science could only thrive in an independent and creative atmosphere like that found in the arts. C. P. Snow's *Two Cultures* lectures and the debates that have occurred as the most paradigmatic of the post-war period had not resonated with Polanyi and Bronowski. Science had more things at stake than a fight against international Communism. The stakes were higher, because they encompassed the future of science in the troublesome post-war environment. The state had to be limited in its grip over scientific freedom and the public had to ease the hostilities it felt towards post-war "Big Science" institutions. Polanyi and Bronowski, both "aliens" by nationality, successfully adapted to Britain and made careers out of their postwar scientific engagements – Bronowski in particular, reached the peak in his career around the issues of popularizing science. However, what happened when Bronowski's ideas were intertwined in sophisticated media renderings? The 1970s BBC-produced show *The Ascent of Man* is an example of the Cold War fetishization of science, with Bronowski himself acting as the series writer and presenter. The post-war scientist became more than the gatekeeper to the

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wonders of nature in Cold War Western Europe and North America. The scientist, through his/her public engagement, became an example of human modesty.[214]

In Chapter II, I presented the government's publicity strategy regarding the production and control of public knowledge on the nuclear program. The British post-war experience was a multicausal endeavor. It was on one side a risk, and the Government had to work around unfavorable circumstances — public's distrust of nuclear science, and the post-war financial crisis. Nevertheless, the wartime-employed British scientists strongly supported the post-war continuation of British nuclear research. This was done well before anyone could have anticipated the fall of the Baruch plan (on international arms control with the Soviet Union) and the American McMahon Act (restricting access to information), both in 1946.[215] The Government and the scientists were aware that this had to be shaped accordingly, in order to communicate a wider message onto the successes of Britain. The marker of nuclearity is often the atomic bomb. Britain exploited the media potential of exploding its first atomic bomb. Perhaps it is of equal importance as the bomb, to mold the right kind of nuclear scientist to run the program. Who would lead the program and stand to represent British nuclear research? Did the British Government and media succeed in their aims?

In Chapter III, I studied multiple representations of John Cockcroft across different media. These representations imply that the government succeeded in communicating a unified and positive rendering of a homely, British scientist who had the prospect of a "lazy" academic career but chose to sacrifice that for his country and lead a strenuous research establishment.

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[214] Bronowski was particularly influential on Richard Dawkins' popular science work. Both scientists have found new media renderings in recent music project *The Symphony of Science*.

[215] The failure of international arms control, the Baruch plan, was an important event which led to a new turn in the development of American thermonuclear weapons. See Peter Galison and Barton Bernstein, "In Any Light: Scientists and the Decision to Build the Superbomb, 1952-1954," *Historical Studies in the Physical and Biological Sciences* 19 (1989): 280-281.

The representation of Cockcroft in the film *Spaceways* might have had a favorable reception by the young British audience during the film's screening. In the end, the British public, in case of Cockcroft and *Spaceways*, had an opportunity to witness the workings of a military-industrial complex. Even though the size of science employed was colossal, its relationships were projected as friendly and intimate. The latter representations resonated with young British graduates like John Sandalls who regarded Cockcroft's directorship as part of "the golden years of Harwell."

In Chapter IV, I problematized these positive representations of nuclear science by a study of British 1950s SF cinema. The analyzed films were the only media renderings of nuclear threats daunting on the British public in the wake of 1957 British thermonuclear tests. Thermonuclear weapons threatened to bring complete annihilation. Although the British *Campaign for Nuclear Disarmament* organized annual marches to abolish nuclear tests, the organization did not criticize formidable nuclear threats lurking behind research establishments across Britain. Harwell had a difficult task in order to represent itself as a pleasurable and safe place for scientists and the British public. Harwell, although not the only establishment where nuclear research was undertaken, served as the dominant example of the British nuclear experience. The *Campaign for Nuclear Disarmament* would continue to protest (spatially) with their annual, Easter-time marches from London to Aldermaston (the weapons factory), but it never actually strove to associate any injustice to "Harwellian" science. Although not directly employed in creating bombs, Harwell was there to employ "pure" science and study the theoretical workings of these weapons, among other things.

Harwell's unique "golden years" (under Cockcroft) have served to cater to the impression that both "pure" and "applied" science could live side by side, not threatened by each other. The British nuclear experience, similarly to the American and Soviet one, was imbedded in

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large military-industrial complexes. Science, which had turned "big" and colossal, remained small in its public and inside perception by representing Harwellian spaces as humane, international and companion-like. It was not only an institution where scientists would in secrecy build bombs that could potentially bring havoc and despair to unfortunate nations. It was a place of an extended university, yet on a large scale. It represented itself as an extension of the good time in physics of the interwar era, where international conferences and cosmopolitanism were at the core of the institution's life. Post-war aliens found their home planet in the quiet British countryside committed to scientific excellence, and few, unfortunately necessary, test explosions in distant Maralinga.

"Aliens at Harwell" focused on the production of popular knowledge about British post-war nuclear science. However, important aspect of these representations' reception is missing from my research. It is an unfortunate fact that scholars must either choose to study the production or reception of cultural texts. In order for the production and reception to be merged requires more space and a fusion of divergent methodologies. Hence, I was not able to bring the production and reception together in a single MA thesis. Nevertheless, this thesis hopes to inspire further scholarly work on the reception of these media renderings of Harwell or other aspects of the British nuclear culture. An interesting aspect of a future study might be a transcultural, comparative study of Harwell with other nuclear research establishments. For example, an important study could be commenced on how influential was Harwell (particularly under John Cockcroft's directorship) for the establishment and representation of the Yugoslav nuclear project under the guidance of Professor Pavle Savić. Documents that I have stumbled upon in the archives suggest that Harwell and the Yugoslav Nuclear Institute at Vinča were

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collaborating intensively during the 1950s and 1960s.[216] Furthermore, John Cockcroft was on an official visit to Yugoslavia in 1961 and personally inspected the Yugoslav nuclear program.[217]

"Aliens at Harwell" has argued that the British nuclear program was represented as an important and positive scientific project. Although the project included troublesome establishments, like the nuclear weapons factory at Aldermaston, the British post-war government smartly chose to exclusively focus on Harwell. The British nuclear program's Harwell incarnation, particularly during Cockcroft's directorship, has provided an inspiration and "safe-haven" for young science graduates who continued their scientific careers not at universities, but at governmental research establishments (e.g. Joan Freeman). However, this thesis has also made apparent that the production of representations is tied into the workings of "power." British political parties, both Labour and Conservative, were interested in guiding and controlling nuclear representations. Furthermore, they were also interested in surveilling and censoring scientific addresses.

In an environment of closely guarded representations, it is important to remember that power works in multiple ways. What cultural historian Jann Matlock referred to as a "history of resistance"[218] was addressed in this thesis through some of British science fiction cinema's unfavorable representations of British governmental science. Cinema is an important space for contesting "official" representations and making sense of British nuclear program's complexity. The latter awaits a nuanced study of the 1950s cinema's reception in relation to the British public's concerns over nuclearity. Nevertheless, this thesis argued that a nuanced

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[216] TNA, FO 371/189498.
[217] CCA, CKFT 11/12, "Letter from Sir John Cockcroft," 20 March, 1961, 1-2.
[218] Jann Matlock, *Scenes of Seduction: Prostitution, Hysteria, and Reading Difference in Nineteenth century France* (New York: Columbia University Press, 1994), 15.

historiography which includes both verbal and visual historical reminiscence is important for bringing forth the complexity of "nuclear culture."

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