Projecting the Light of Democracy
Michael Polanyi's Efforts to Save Liberalism via an Economics Film, 1933-1948

Gábor István Bíró

Dissertation

Supervisor
Dr. Gábor Áron Zemplén
BME GTK Department of Philosophy and History of Science

2017
Table of contents

Abstract .................................................................................................................. 3
Acknowledgements ............................................................................................... 4
List of Illustrations ............................................................................................... 5
Introduction .......................................................................................................... 8

I. Building, Bridging and Shifting Boundaries of Economics .................................. 20
   1.1. Freedom, Social Consciousness, and the Third Way ..................................... 20
   1.1.1. Boundary work against extreme liberalism .............................................. 21
   1.1.2. Boundary work against socialist planning .............................................. 22
   1.1.3. Building a joint boundary against extreme liberalism and socialist planning ......................................................................................................................... 23
   1.2. Crossing and Rebuilding Economics ......................................................... 33
   1.3. Approaching and Shifting Economics ....................................................... 30
   1.3.1. Bound for England, bound for economics .............................................. 30
   1.3.2. Boundaries of visual representation in economics .................................. 31
   1.3.3. Transforming the language of economics .............................................. 32

II. Films for Freedom: Polanyi's Sociotechnical Imagining to Save Liberalism and the Society ............................................................................................................. 35
   2.2. Embedding and Disembedding Attempts .................................................. 38
   2.3. The Silence of the Tutors, the Negligence of Keynes and an Imagined Resistance ......................................................................................................................... 43
   2.4. Physical and Disciplinal Barriers: How Polanyi’s Vision Struggled for Extension ......................................................................................................................... 46
   Conclusions ....................................................................................................... 49

III. Polanyi’s Visual Representation of Economic Matters ........................................ 50
   3.1. Visual Physical Analogies of Economic Laws in the 1930-40s ..................... 50
   3.2. Shifting Symbols, Fluid-like Motions and Educational Concerns ................ 60
   3.3. Similarities and Differences of the Neurath and the Polanyi Method ............ 75

   4.1. The Shades of Socialism on Polanyi’s Family Life ...................................... 79
   4.2. On the Relation of Polanyi and his Political Adversaries ............................. 80
   4.3. Keynes, Hayek, and Polanyi in Between ................................................... 81
   4.4. A Hungarian on the Boundaries of British Politics ................................... 81

Summary ............................................................................................................. 83

Bibliography ....................................................................................................... 84
Projecting the Light of Democracy
Michael Polanyi's Efforts to Save Liberalism via an Economics Film, 1933-1948

by
Gábor István Bíró

Submitted to the Program in History and Philosophy of Science in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in History and Philosophy of Science

Abstract

This historical micro-analysis examines how visualizing and saving a kind of liberal economics were connected in the sociotechnical visioning of Michael Polanyi during his disciplinary shift from physical chemistry to social sciences in the thirties and forties. The first chapter traces how Polanyi's boundary work for a reformed liberal economics and against "extreme liberalism" and "socialist planning" can be seen as connected to both his attempts to reconfigure communities learning economics, and his boundary shifting towards social sciences. This chapter shows how Polanyi's economic film, Unemployment and Money: The Principles Involved (1940n), connected the social worlds of economists, film experts, economics tutors, managers and others, and how such "bridging" between these social worlds could have helped Polanyi in his campaign developing and disseminating a sociotechnical vision to save liberalism and Western society. The second chapter seeks to show the development of Polanyi's sociotechnical vision of "democracy by enlightenment through the film". The chapter explores how an Individual idea on a specific film struggled in different social worlds to become a sociotechnical imaginary and to affect social policies. The third chapter focuses on the development of Polanyi's visualization of social matters and offers a detailed analysis showing how he rendered liberal economics visible with his film. Polanyi's work is compared with visuals of similar projects aimed to make economic processes visible for non-economists in the 1930-40s. The discussion here shows how Polanyi's illustrations draw on laboratory experience in physical chemistry. The fourth chapter examines the wider political-ideological context of Polanyi's sociotechnical imagining in order to show why it was particularly dangerous to be seen as involved in policy-making as an outsider in the United Kingdom during and right after World War II.
Acknowledgements

There are many people without whom this dissertation could not have been finished. First, I'd like to thank my advisor, Gabor Aron Zemplen for inspiring me to think in new, difficult directions, for helping me to revise and improve each chapter, and for being a true mentor during these years. He was pushing me hard when I hopelessly get trapped in a narrative or approach without realizing it, and was helping me finding a way out. He was a great supporter of me and my work from the moment I arrived to Budapest University of Technology and Economics (hereafter: BUTE). I feel honored to have been taken under his guidance.

I feel privileged to be able do my PhD research at one of the three centres of Polanyi research, BUTE. I was given insightful advice when it was most needed from leading Polanyi-scholars, particularly Marta Feher and Tihamer Margitay who were cultivating and improving Polanyi-scholarship for decades through the Michael Polanyi Liberal Philosophical Association (1992-). I was honored by their guidance in how to approach Polanyi, for which I cannot be grateful enough. Thanks are also due to their valuable work in organizing Polanyi-related events such as the Michael Polanyi’s Unemployment and Money - 75 workshop which was organized to celebrate the 75th anniversary of the release of Polanyi’s Unemployment and Money: The Principles Involved (1940n), and the Evolution and Theory: Philosophy, Psychology, Economics workshop. Without their passionate commitment for supporting the mobility of Polanyi scholars and building bridges between research groups in different countries this dissertation would have never been completed.

I was extremely lucky to have the chance to learn from Phil Mullins, a remarkable Polanyi-scholar and former editor of Tradition & Discovery: The Polanyi Society Periodical, during his Early Polanyi course at BUTE, and after. I remember one of our first discussions in Budapest back in 2014 when we started to talk about how the economic thought of Hayek, Keynes and Polanyi might be seen related, and what seems worth to study in this respect. Mullins has always been a source of good advice during these years, and played a pivotal role in shifting my interest towards the economic thought of Michael Polanyi. His unrivalled commitment to Polanyi studies made a great impression on me.

Thanks are also due to Benedek Lang and Janos Tanacs for maintaining and improving the Department of Philosophy and History of Science in a time of turmoil in Hungarian higher education. I thank Tihamer Margitay and Gabor Forrai for making such an excellent interdisciplinary doctoral programme. One could not wish for a more open athmosphere and inspiring environment in which to conduct research than what they provided me.

Special thanks are due to Marta Feher and Tihamer Margitay for making available a plethora of Polanyi materials they collected through the last two decades (correspondence and unpublished writings of Polanyi, hard copy of every issue of Polanyiana from 1992-). Special thanks must go to Gabor Aron Zemplen too for granting me access to the Polanyi materials Mihaly Beck donated to the department (mostly Polanyi’s chemical writings), and for providing me early Hungarian literature on the Polanyi family (written before the Hungarian Transition).
List of Illustrations

Figures

Fig. III/1. Cards from Norman Angell's *The Money Game: How to Play it: A New Instrument of Economic Education* (1928). From left to right and top to bottom: flourmill, sawmill, pottery, brickfield, wagon works, coal mine, harvester and trawler.

Fig. III/2. A standard card back from Norman Angell's *The Money Game: How to Play it: A New Instrument of Economic Education* (1928).

Fig. III/3. Polanyi's sketch on the back of a letter from 1937. Probably the first visual draft of the essence of his film *Unemployment and Money: The Principles Involved* (1940).

Fig. III/4. Visual representation of homes of the community in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/5. Visual representations of workers in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/6. Visual representation of housekeepers in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/7. Visual representation of the "Money circle" in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/8. Visual representations of "fields and mines", "factories and offices", and "shops" in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/9. Visual representation of the circulation between economic sectors in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/10. Revisualization of economic sectors from cartoonish visuals towards more abstract ones in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/11. A breaking of the macroeconomic perspective in Polanyi's visual narrative: a shift to the causes and effects of economic micro-decisions (by one segment of "homes" and "business units") in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/12. Visual representations of the functioning of the business unit with a moving flywheel, and the process of producing one parcel of good with changing contours from dashed to continuous lines in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/13. Visual representations of the accumulation of money in one business unit, and the cash flow from the business unit to home in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/14. Visual representation of exchanging one day's expenditure to one day's production in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/15. Periodic circulation of money from a business unit to a home unit; continuous circulation of money from a business unit to a home unit; continuous "squirized" circulation of money from a business unit to a home unit; and continuous circulation of "fused coins" in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/16. Visual representation of the "money belt" of multiple home and business units in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/17. Visual representations of the introduction of additional savings, and the increased level of savings in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/18. Visual representations of the reduced level of expenditure, and its affects to the circulation in Polanyi's *Unemployment and Money: The Principles Involved*. 
Fig. III/19. Visual representation of an increase in spending and the recoloration of additional spending in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/20. Visual representations of what happens in the bank when saving exceeds spending, and when spending exceeds saving in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/21. Visual representation of wages, rent and interest and profits, and the introduction of the manager in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/22. Visualization of comparability and commensurability of managers' business units in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/23. The manager of a business unit points to the level of profit to help the eye of the audience what to observe in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/24. Visual representation of decision-making of a manager in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/25. Visual representation of Unemployment in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/26. Visualization of observation, planning and banking activities of a businessman in case of increased level of employable population in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/27. Visual representation of the effects of new investment through machine works in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/28. Visualization of how the businessman takes possession of his business unit in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/29. A visual aid to figure out the way of the recently spent money in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/30. Visualizing the ageing of equipment in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/31. Visual representation of the process of ageing, and the relation between ageing and renewals in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/32. Visual representations of the system before being fulfilled with money, during it is being fulfilled with money, and when its reach full employment in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/33. Visual representation of assured employment outmatching the barriers in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/34. Diagrams from Otto Neurath's *International Picture Language: The First Rules of ISOTYPE* (1936).

Fig. III/35. Visualizations of the "bigger" flow representing increased quantity and the "smaller" flow representing decreased quantity of flowing money in Polanyi's *Unemployment and Money: The Principles Involved*.

Fig. III/36. A visual representation from Polanyi's *Mechanism of chemical reactions* (1949).

Fig. III/37. A visual representation from *Über einfache Gasreaktionen* (1931) by Polanyi and Eyring.

Tables

Tab.1. Visual representations and the related explanation in Mooney's *Apparatus designed to illustrate the laws of economics by physical analogies* (1934).

Tab.2. Visual representations and the related explanation in Mooney's *Apparatus for illustrating economic principles* (1941).

Tab. 4. Visual representations and the related explanation in Mooney's *Apparatus for illustrating relation between economic profit and loss* (1948).

Tab. 5. Visual representations and the related explanation in Mooney's *Apparatus for illustrating economics by physical analogies* (1949).
The Great Depression of 1929-33 brought economic hardship of an unknown scale for many. Millions lost their jobs, thousands of corporations went bankrupt and economic relations which had lasted for generations unravelled. The economic turmoil increased social tensions and threatened with political destabilization. As despair consumed more and more people, political extremities grew stronger. In such a sharp-edged situation, the rivalry between hubs of macro-political power must have affected basically everything. The field of economics was no exception. Making and arguing for economic-related knowledge-claims seemed to have higher political and societal stakes than ever. The importance of public understanding of economic ideas increased; economists needed to leave the beaten paths of making and disseminating economic knowledge to adapt to the new situation which was mirrored in the first clashes of the Keynes-Hayek debate in 1931-32. The rhetorical style of both the \textit{en garde} of Hayek and the \textit{au contraire} of Keynes seemed uncommon and extreme amongst contemporary discourse in British journals of economics. Hayek claimed that Keynes’ account was “difficult” (Hayek, 1931a, p. 271.), “unsystematic” (ibid) and having a “degree of obscurity which, to anyone acquainted with Mr. Keynes’s earlier work is almost unbelievable” (ibid). As a response, Keynes reviewed Hayek’s \textit{Prices and Production} (1931b), calling it “one of the most frightful muddles” (Keynes, 1931, p. 394.) he had ever read, and an “extraordinary example of how, starting with a mistake, a remorseless logician can end up in bedlam” (ibid). All these comments appeared in the professional journal \textit{Economica}.

Michael Polanyi is mostly known for his work in philosophy and physical chemistry. What is lesser known about him is that he was corresponded with John Maynard Keynes, Friedrich August von Hayek, Lionel Robbins, Joan Robinson, Richard Hicks and other leading economists, and made important contributions to the \textit{corpus} of economics himself in the two decades after The Great Depression. Polanyi managed to be seen both as a member of the Keynesian and the laissez-faire camp at a time when being seen as a member of both was generally thought to be inconceivable. He was a friend of Hayek, a founding member of The Mont Pèlerin Society and a wholehearted liberal. And, at the same time, he was among the firsts to write a Keynesian coursebook and was a pioneer in popularizing Keynesian ideas for the masses. Polanyi sought to save liberalism when it faced both internal tensions (e.g., the Keynes-Hayek debate) and external threats (e.g., Socialism, Fascism). This dissertation shows how Polanyi started to engage economics during his struggles to transform his individual sociotechnical vision into a collectively held imaginary which could save liberalism and modern Western society. It is about the journey of a remarkable natural scientist into the social sciences in an age of great social and disciplinal turmoil. It is about his struggles with boundaries, visions and imaginaries on a mission to save what he valued most in Western civilization.

\textbf{Why study Polanyi from an STS approach}

Science and technology studies (STS) seemed to offer a suitable niche for my several reasons. First, STS has been recently defined as a field which \textit{“explores the transformative power of science and technology to arrange and rearrange contemporary societies”} (Felt - Fouché- Miller - Smith-Doerr, 2016, p. 1.). Because my research is primarily concerned with showing Polanyi's efforts to develop a social imaginary around his film (mirroring his economic thought) to save liberal economics and society, and these efforts might be seen as playing with such \textit{transformative power} of science and technology. Second, recent trends in STS suggest that the field has growing entanglements with visual studies and social sciences (\textit{Visual Cultures of}
Science: Rethinking Representational Practices in Knowledge Building and Science Communication (Pauwels, 2005), Representation in Scientific Practice Revisited (hereafter: RSPR) (Coopmans - Vertesi - Lynch - Woolgar, 2014) and The Handbook of Science and Technology Studies (4th ed.) (Felt - Fouché - Miller - Smith-Doerr, 2016)). Both visual studies and social sciences are of great importance for my research. Studies in RSPR showed how individual visions became available for the perceptual space of a research group or a college class by stressing certain elements, and by choosing and disseminating a specific way of seeing the phenomena (Vertesi, 2014; Prentice, 2014; Myers, 2014; Myers, 2015) pointing out that learning a way of seeing is a kind of socialization. Others pointed out that entanglements of visibility, trust and objectivity could and should be examined in specific settings (Ruivenkamp - Rip, 2014; Mody, 2014; Frow, 2014); and that once a visual (re)presentation is created, it can be used for purposes unknown by and unrelated of its original creators (Giraud, 2014; Dumit, 2014). Regarding the tendency towards social sciences, and more particularly towards economics in STS, Giraud must be noted here who made an account on the dispersion of the Laffer curves (Giraud, 2014), and extensively studied the role of visual display and visual representation of economic knowledge in the United States (Giraud, 2010; Charles - Giraud, 2013).

Third, the concept of sociotechnical imaginaries (Jasanoff, 2015) seemed highly relevant for my research, particularly in my efforts to map the dynamics in and between the social worlds around Polanyi's film. It is also useful to find out how Polanyi's sociotechnical vision evolved and whether it became a full-fledged, extended sociotechnical imaginary affecting multiple social policies. This dissertation aims to study the production of epistemic, technological, and social orders together in a specific case-in-point which means it fits to another strand in STS (Jasanoff, 2004, Latour 1993). Polanyi aimed to reform economics education (epistemic) through his economic film (technological) which aimed, more broadly, to change the society (social). New ways of seeing and knowing the economy and economics were intended to be co-produced with a new method of teaching economics and a proposed social arrangement embracing the Polanyian vision and realizing it from bottom to top eventually reaching the whole society. The process of becoming a member of Polanyi's enlightened public, a specific collective of knowledgable people who could shape society and politics through their economic knowledge, makes this account even more relevant for those studying the entanglements of science and democracy. Explaining how political power affects what could and should be known in the economy, and how economic-related knowledge affects what could and should be done in politics to preserve and develop democracy can be seen as a framework narrative of Polanyi's economic thought.

An Overview of the Polanyi scholarship

Scholarship on Polanyi's non-scientific writing began in 1963 when Richard Gelwick, with the help of Michael Polanyi, produced a Polanyi bibliography and a microfilm collection of approximately 120 Polanyi articles. This material and the story of how Gelwick came to work with Polanyi in putting it together is included on the Polanyi Society web pages (polanyisociety.org). So far, much of the Polanyi scholarship clustered around three communities (The Michael Polanyi Liberal Philosophical Association; The Polanyi Society; The British Personalist Forum) and their respective journals published over in the last few decades: Polanyiana, Tradition & Discovery, and Appraisal. The brief overview given here of Polanyi scholarship has the double aim of mapping the work of the most notable Polanyi-scholars and showing how my account is indebted to these strongs traditions but also how it is different.
The Michael Polanyi Liberal Philosophical Association was established in 1991. Its bilingual periodical, Polanyiana, aimed to study and present the manuscripts and papers of Polanyi in Hungary, and to "re-connect them to the living tradition of anglo-american liberal thinking" (1991, p. 77.). The first lectori salutem referred to the establishment of a vital academic relation with The Polanyi Society and the sister journal, Tradition & Discovery; and expressed the intention of the editorial board to "bring home" (ibid) copies of the Polanyi Papers from The University of Chicago Library with the aid of the Soros Foundation. By looking back on the more than twenty-five years of Polanyiana, a few strands of the relevant Polanyi-scholarship can be discerned. First, Polanyi's political liberalism (Gabor, 1996; Feher, 1996; Allen, 1996; Nagy, 1996; Congdon, 1992) and his views on academic freedom were extensively studied from the early years of the journal. Making, reading and interpreting such accounts in Hungary had a specific meaning because they were published shortly after the Hungarian Transition when economic, social and political systems were still heavily constrained by dictatorial patterns of the previous era. The second strand is the analysis of Polanyi's views on and relations to religion (Mullins, 1992; Mullins 1997a; R. L. Hall, 1997; Gelwick, 1997; Scott, 1997). The third strand is the study of Polanyi's work in different subfields of chemistry. There was discussion on how Polanyi became a chemist (Beck, 2001, Beck 2003), how and why his contributions were pioneering to natural sciences (Berczes, 2003; Keszei, 2003; Inzelt, 2003; Benyei, 2003; John C. Polanyi, 2003; Olah, 2003; Benyei, 2007), and how the timing of the recognition of his contributions in chemistry might have affected his frequent change of research topics (Kovacs, 2009). The fourth strand is the micro-historical study of Polanyi's Budapest Years (Frank, 2010) and Berlin Years (Frank, 2001; Frank, 2002; Hall, 2008).

Regarding the micro-historical study of Polanyi's Berlin Years, at least two aspects were extensively studied by historians. An illuminating microhistorical account was given by Hall on how revelant practices of knowledge-production (and production of what did not become treated or stopped being treated as knowledge - failed experiments) in an industrial laboratory of the 1920s might have contributed to Polanyi's stance on the politics of skills in his concept of Republic of Science (Hall, 2008). Another strand was historical inquiries not only into the life and work of Michael Polanyi, but into the Hungarian intellectuals exiled in the 1920-30s. Frank showed how and in what sense Berlin was a sanctuary for Hungarian emigres such as Michael Polanyi, Leo Szilard, Eugene von Wigner and John von Neumann (Frank 2001; Frank, 2002), and why it was the first step of their double-exile (Frank, 2009). In his Polányi Mihály Berlinben [Michael Polanyi in Berlin - my translation] Tibor Frank wrote that "I consider it a scientific task to solve how these excellent scientists changed their topics, and even their fields, and disciplines" [my translation](Frank, 2002, p. 132.). My disseration might also be seen as an account to address this scientific task in case of one remarkable scientist, Michael Polanyi with a micro-historical account on his barely studied (Gowenlock - Frank, 2002) Manchester Years.

As Kmeczko pointed out (Kmeczko, 1998), Feher was the first to raise attention to Polanyi's concept of the development of science in the pre-Transition Hungary in her A tudományfejlődés elméletek története [History of the Theories on the Development of Science - my translation] (Feher, 1979), which was followed by a few essays from Nyiri in the second part of the 1980s (Nyiri 1985/86; Nyiri 1989) reflecting on Polanyi's philosophical writings. In her pioneering work in Polanyiana, Feher primarily studied how and why Polanyi considered planning a threat to the freedom of science (Feher, 2015), and how Polanyi might be seen cultivating the moral dimension of science (Feher, 2010). In the first essay, Feher reconstructed Polanyi's reasons and arguments against "planners" (Bernal, Hogben, Crowther) and shows why it is not possible or desirable, according to Polanyi, to intervene in science from outside. In the second, Feher argues that Polanyi expected scientists to have not just intellectual but also spiritual qualities. The complex process of becoming a scientist therefore
is also "a kind of character-forming process" (Ibid., p. 115.) in which newcomers acquire "the personal elements of knowledge" (Ibid.). It must also be noted here that Feher gave an illuminating account on the Polanyian view on acceptance and rejection in scientific communities (Feher, 2012). She reconstructed how Polanyi compared the Azande belief system and that of modern science. Polanyi's thought on incommensurability was analyzed in detail. Feher pointed out that, according to Polanyi, "acceptance and rejection is a question of commitment, a fiduciary act, which as he [Polanyi - my addition] admits is hazardous and may be erroneous" (Ibid., p. 76.).

The current editor-in-chief of *Polanyiana*, Margitay mainly studied the Polanyian theory of knowing. The topics of his contributions range from analyzing how and why Polanyi argued for a layered ontology (Margitay, 2010a), through discovering the Polanyian ontology itself (Margitay, 2013a) to the question of moral inversion in Polanyi (Margitay, 2016). His further contributions examined certain existential aspects of Polanyi's philosophy from Heideggerian existential hermeneutics (Margitay, 2010b) to Polanyi's indeterminacy theses (Margitay, 2006; Margitay 2007). Margitay's arguments against Polanyi's layered ontology invigorated the discussion on the topic. He successfully defended his argument against the criticism of Lowney and others (Margitay, 2013b), giving us an even more illuminating account of Polanyi's layered ontology.

The Polanyi Society was established in the early seventies. Its journal, *Tradition & Discovery: The Polanyi Society Periodical* also dates back to this decade with a related newsletter titled *Society of Explorers*. This periodical showed slightly different strands than *Polanyiana*. First, the most dominant strand is the emphasis on the critical study of Polanyi's epistemology, social philosophy and moral philosophy (Keiser - Foster - Gelwick - Musser, 2010/2011; Gulick, 2009; Doede, 2003/2004; Discher, 2002/2003; Mullins, 2011/2012) with many comparative studies (Agler, 2011/2012; Jacobs, 2006/2007; Moleski, 2006/2007; Schmitt, 2006/2007). Second, unlike *Polanyiana*, there were only a few studies on the chemical work of Polanyi. Third, many comparative historical accounts analyze the context of Polanyi's mature and later philosophical works (Jacobs, 1999/2000; Jacobs - Mullins, 2005/2006; Jacobs, 2006/2007; Jacobs - Mullins 2011/2012). Fourth, there are a few contributions on Polanyi's *Manchester Years* (Calvin 1991/1992; Craig Roberts - Van Cott, 1998/1999, Prosch, 2016). Topics of moral inversion (Yeager, 2002/2003; Geng, 2011; Geng - Paksi, 2013) evolution (Paksi, 2008; Gulick, 2011/2012; Paksi, 2011-2012), and emergent knowledge in Polanyi (Heder, 2012/2013; Heder, 2012) are explored in both of these journals.

Mullins, Editor Emeritus of *Tradition & Discovery*, is an important figure in the Polanyi scholarship. He wrote his dissertation on Polanyi (Mullins, 1976) and dedicated more than forty years of research to understand, cultivate, develop and promote the thoughts of Michael Polanyi. One could not undertake the task to adequately summarize his extremely rich and diverse scholarly work in the range of an introductory chapter. Therefore, here I only attempt to sketch some of the main strands of the research he has done with a special view to those somehow related to my dissertation. Mullins pointed out that the "years before World War II were particularly important for the development of his [Polanyi's - my addition] future philosophical ideas" (Mullins, 2010, p. 11.) and by doing this called the attention of the Polanyi scholars to a relatively uncultivated part of the Polanyi heritage. In the end of his essay Mullins drew a parallel between Polanyi's *tacit knowing* concept (Polanyi, 1958) and his vision of a *society of explorers* (Polanyi, 1941h). Mullins argues that that in *The Growth of Thought in Society* (1941h) Polanyi "articulates a vision of liberal society in which persons are engaged in pursuing transcendent ideals within a variety of subcultural communities or dynamic orders
that seem to overlap and cooperate in order to meet society’s material needs and intellectual aspirations” (Mullins, 2010, p. 27.) and adds that the same social vision could be found in Polanyi’s Personal Knowledge (Polanyi, 1958) "where he calls for a society of explorers in which human beings take on the challenge of inquiring about the universe and the nature of human responsibility” (Mullins, 2010, p. 27.). In my dissertation, I intend to show that Polanyi’s sociotechnical vision on his economic film (developed primarily between 1936 and 1945) could also be seen attached to the social vision Mullins discovered in The Growth of Thought in Society (1941h) and Personal Knowledge (1958) possibly extending its current time frame of 1941-58.

Mullins recently analyzed the correspondence of the economist, F. A. Hayek and Michael Polanyi (Jacobs - Mullins, 2016) with another excellent Polanyi-scholar, Struan Jacobs. The major merit of their article was that it sought to find the difference between Hayek’s and Polanyi’s liberalism, and claimed to find it in the dissimilar emphasis on public and private liberty. Mullins and Jacobs also gave us an insightful account on why we have to be very careful in our attempts to decide upon the priority claims for the concept of “spontaneous order” which became the holy grail of comparative studies on the social thought of Hayek and Polanyi in the recent decades. Jacobs studied the social thought of Michael Polanyi in a separate chapter of Knowing and Being (2010) primarily concerned with building bridges between the social thought of Michael and Karl Polanyi, but did not include bibliographical entries from Michael Polanyi between 1919 and 1940. In my dissertation, I intend to show that the correspondence, manuscripts and other materials of this period are worth to study in our attempts to unfold Michael Polanyi’s social thought.

The third society particularly concerned with the life and work of Michael Polanyi is The British Personalist Forum. Its journal, Appraisal was first published in 1996, but its history dates back to the first Michael Polanyi conference in Britain in 1974. After the conference, the interested Polanyi scholars formed an organization, Convivium, which was clustered around a newsletter, and later, a journal, both named Convivium. This early British Polanyi group Convivium was merged with The Polanyi Society in the early nineties but soon thereafter the organization which eventually became The British Personalist Forum was formed and began publishing Appraisal. Polanyi scholarship in Appraisal ranges from accounts making comparison between John Henry Newman and Polanyi (Moleski, 1997a; Moleski, 1997b), Oldham and Polanyi (Mullins, 1997b; Turner, 1999), through the address of questions of freedom, values and knowing in Polanyi (Margitay, 2003) to autonomous robots and tacit knowledge (Heder - Paksi, 2012). Because this journal is not exclusively dedicated to Michael Polanyi, and because most of the contributions to this journal are not closely related to my topic I shall restrain myself here from a more detailed coverage.

While much of the scholarship on Polanyi has been supported by these organizations having a special interest in Polanyi, the work of two other important Polanyi scholars working independently of these organizations deserves mention. Marjorie Grene was, of course, Polanyi’s collaborator (see the Acknowledgements of Personal Knowledge (1958) and the Polanyi-Grene correspondence in the Michael Polanyi Papers) from 1950 through the most of the rest of his life. Although she is not particularly interested in the early Polanyi, some of her publications (e.g., The Knower and the Known [1966], Tacit Knowing: Grounds for a Revolution in Philosophy [1977], A Philosophical Testament [1995]) are very important contributions promoting an understanding of the contours and development of Polanyi’s philosophical ideas. Mary Jo Nye, a historian of chemistry and a historian of twentieth century science, has done extensive work on Polanyi’s scientific and non-scientific thought. While her book, Michael
Polanyi and His Generation: Origins of the Social Construction of Science (2011) is a landmark study relating Polanyi to his historical milieu, her many earlier articles on Polanyi are also of importance.

Studies on the Polanyian Visual Presentation of Social Matters

A specific issue of Tradition & Discovery (Vol. 41. No. 2.) about Polanyi's Visual Presentation of Social Matters (1937f) is analyzed here in details because my dissertation is highly concerned with Polanyi's film, Unemployment and Money: The Principles Involved (1940n), and other forms of visual representation Polanyi used between 1933 and 1948. This issue contained Polanyi's original text and three relevant articles by Phil Mullins, Eduardo Beira, and Richard W. Mookey (the issue contained one more article by Martin X. Moleski which is on another topic). I agree with Mullins, and deem it very important that Polanyi aimed to "transform the social thinking about the economic order" (Mullins, 2014, p. 35.). I also agree with Mullins that reforming economic liberalism through the development of public understanding of economic ideas was a "central component" (Ibid) in reforming liberal political philosophy in the early thought of Polanyi. Polanyi made it clear that "democracy by enlightenment through the film" (Polanyi 1935b, p. 1.) is what he aimed for with his campaign to "facilitate the education of an enlightened post-war opinion" (Polanyi, 1942a, p. 3.). In this article, Mullins stated that Polanyi "perhaps anticipated what we today call "simulation"" (Mullins, 2014, p. 37.). While I do think there is a lot more to do before we could completely eliminate the "perhaps" from this sentence (if we could at all), it could be further substantiated by further evidence Mullins did not quote. Polanyi imagined students of economics to be engaged in social spaces at centres of economics education where they were not only expected to listen to the lecturer and watch the film demonstration as passive participants, but to take an active part in the learning process. Polanyi did not only consider moving picture technology as a device, but a way to "convey to the eye and put under the testing hand bodily a scheme of our working life" (Polanyi, 1936, p. 4.). Learners were introduced to the general model with "masses" and "proportions" to adjust. One might also find some similarities between Polanyi's education project and what we call today gamification. Actually, there are several interpretations of gamification, but if we consider it as a learning theory (Biro, 2013; Biro, 2014) it seems to share at least two key aspects with the Polanyian agenda. First, the role of visualization in the learning process is given a high importance in both. And second, the engagement in the learning-process is not individual based, but group based.

Beira argued that Visual Presentation of Social Matters (1937f) was important in "Polanyi's career change from chemistry to economics and philosophy" (Beira, 2014, p. 6.). I think Beira had illuminating insights on the Polanyian project on "economic enlightenment" (Ibid, p. 7.), and provided one consistent account on the relations between economics education, visual representation and the reform of liberalism in the early economic thought of Polanyi by analyzing a few manuscripts. While I rather agree with the main outline of Beira's article, there are a few minor points where I saw things in a little bit different light. I have spent almost three years with the archival materials doing historical research and carefully studied all the relevant documents in order to be able to provide a detailed micro-analysis of Polanyi's disciplinal shift from physical chemistry to economics during his Manchester Years. In the case of this article, Beira focused primarily on elements in this one manuscript (Visual Presentation of Social Matters) and a few other related ones and not on how to provide a comprehensive account on Polanyi's work in the mentioned time frame. Our different approaches or alternative ways of reconstructing the early economic thought of Polanyi accounts for our differences. The following three paragraphs are, therefore, not so much criticism, but an aid to
the reader intended to promote an understanding of what is different in our topics, methods and explanations.

Beira wrote that "in 1936 Polanyi was looking for a symbolic representation of the economic system and he did not find anything appropriate around" (Ibid, p. 8.). Based on my archival research, I shall rather disagree with this statement. There was a letter of 24th November 1935 from Oscar Jaszi to Michael Polanyi in which Jaszi commented on Polanyi's film idea, and suggested him to check two similar plans (Angell's and Oppenheimer's) to illustrate complex phenomena for the masses. This letter is to be analyzed in more detail in the following chapters. There was another possible source of inspiration to Polanyi. In a letter of 21st January 1937, Charles V. Sale, an official of the Rockefeller Foundation, called Polanyi's attention to a project of James D. Mooney, who was the President of General Motors Overseas. Sale forwarded an extract from Mooney's letter of 15th December 1936 to Polanyi in which Mooney wrote about designing machines using physical analogies to present economic laws, and stated that "I feel that motion pictures of the apparatus, accompanied by synchronised spoken explanation, and reinforced if necessary by simplified charts and diagrams in "moving cartoon" style, offer the best means of large-scale presentation" (Polanyi, 1937a, pp. 2-3.). A more detailed analysis of Mooney's physical analogies and ways of illustrating economic phenomena is also included in the following chapters with an outlook to his apparatuses, from which the first was patented in 1935.

Beira stated that Polanyi believed that with animated symbols and popular diagrams, "we can dispense [with] (audio) commentary"(Beira, 2014, p. 8.), and after the release of his film in 1940 "he found this was not true" (Ibid). I found that while Polanyi indeed expressed his thoughts on the redundant nature of audio commentary to his film in Visual Presentation on Social Matters (Polanyi, 1937f) and instead suggested it was important to "see the figures act and hear them talking" (Ibid, p. 18.), he was not unambiguously against using verbal notation in the case of his film. I argue that a softer interpretation should be given to his original stance. In his Notes on a Film (Polanyi, 1936), Polanyi did not address explicitly the question of using verbal notation, but expressed his vision on the social effects of his proposed film in a way which might be seen implying some kind of verbal interaction. He imagined that the model "would be exhibited and studied" (Polanyi, 1936, p. 4.) in centres of economics education. One might wonder why he used both "exhibited" (Ibid) and "studied" (Ibid) in the same sentence. A speculative explanation can be given here: because he intended to express the social character of learning and the process of interpretation not by an individual, but a group of learners in specific social spaces. In Polanyi's Memorandum on Economic Films from 1938, he wrote about the "lectures based on such films" [Polanyi, 1938g, p. 1.], and he made it very clear that his film relies on some kind of verbal notation: "The film is made for sound (i.e. 24 frames to the second) but the commentary has not yet been recorded; at present this has to be spoken by the lecturer while the film runs."(Ibid, pp. 1-2.). Polanyi planned to have some kind of verbal notation (audio commentary), and even made a normative statement on how it has to be substituted by another one till it is finished. This manuscript was dated 1938, so after Polanyi's lecture on the Visual Presentation of Social Matters, and before 1940, the date Beira thinks Polanyi found out that dispensing with audio commentary was not a good idea. Regarding the latter statement of Beira, one more note has to be added here. Polanyi regularly corresponded with Shearman ( Worker's Educational Association) and Kittredge (The Rockefeller Foundation) who helped him collect and summarize the feedback he received on his film. By analyzing the relevant letters, one could find out that at least a couple of economics tutors complained about their forced silence; they were provided with pre-made arguments constraining their freedom. One of them, G.D. H. Cole, wrote that "I know I should strongly dislike having my argument made for me, and I should have thought that most Tutors - at any rate when they had got past the novelty of experiment - would also dislike having their course shared for them in this way" (Polanyi 1943e, p. 1.). In a later part of his letter, Cole remarked that "of course,
this danger would be much less if silent rather than sound versions were used; but it would not be altogether eliminated" (Ibid); that is, a user of the Polanyi film after its 1940 release suggested removing its audio commentary to put an end to the undesirable silencing of the tutors. This issue is to be analyzed in details in the following chapters.

Beira argues that "Polanyi's idea for the film pre-dates his discovery of Keynes' ideas in The General Theory of Employment, Interest and Money" (Beira, 2014, p. 10.), and that "his first ideas about a model for the economic film, as presented in this lecture, had not yet been influenced by Keynes's book" (Ibid). Beira quoted a letter of 3rd of September 1937 from Polanyi to Toni Stolper in which Polanyi stated that he read Keynes' The General Theory of Employment, Interest and Money (hereafter: General Theory) for the first time at Christmas, 1936. The analysis of another letter might contribute to this discussion. In a letter of 19th April 1944 from Polanyi to Karl Mannheim he wrote that "Nor is my support of Keynes a recent afterthought. I was keenly interested in the Treatise on Money and the Tract on Monetary Reform and when the "General Theory..."came out in 1936 I was already engaged in a film presentation of the Trade Cycle which was then immediately linked on closely to the new Keynesian masterpiece" (Polanyi 1944b, p. 1.). Keynes' A Tract on Monetary Reform was first published in 1923, and his A Treatise on Money came out in 1930, thus Polanyi had the chance to read these before he read the General Theory. The "Trade Cycle" Polanyi mentioned in his letter was addressed in a way in both these earlier Keynesian writings. All I wanted to point out here is that the lack of influence of Keynes' General Theory on Polanyi's first ideas on the content of his film does not mean that there was no Keynesian influence on these ideas at all.

And last, but not least, the third article of the discussed issue of Tradition & Discovery concerned with Polanyi's Visual Presentation of Social Matters (Polanyi, 1937f) was written by Richard W. Moodey (Moodey, 2015). I agree with Moodey that Polanyi basily "stopped trying to present social matters visually, and stopped advocating such visual presentations"(Moodey, 2015, p. 25.) after the publication of his Full Employment and Free Trade (1945f). Moodey pointed out that "there are no diagrams in Science, Faith and Society (1946b), Personal Knowledge (1958), The Tacit Dimension (1966), or Knowing and Being (1969)"(Moodey, 2015, p. 26.), and however there are several in Meaning (Polanyi, 1975), these are unlike the visual representation Polanyi used before 1945. In seeking for the reasons Moodey wrote that Polanyi could have been stopped creating and promoting visual presentations of social matters because his film project was not successful against economic fallacies and misconceptions. Moodey also noted the explanation of Scott and Moleski, that is, “The film project may have failed, in part, because it told a peacetime story to countries at war” (Scott - Moleski, 2005, p. 179.). Another possible reason added by Moodey is that the film "was not effective without a verbal commentary"(Moodey, 2015, p. 26.). I shall only briefly refer back here to my remark on the relevant part of Beira's article: Having an audio commentary with a pre-made argument was impugned by certain economics tutors who felt it as an intrusion to their freedom and sphere of competence. Not having one was problematic for others who felt that they were left alone in the interpretation of the quite complex and somewhat controversial Keynesian ideas even the community of economisits could not agreed on. Moodey referred to a letter of 1943 from Polanyi to his sister Mausi stating that "only an expert and enthusiastic teacher can make proper use of" (Scott - Moleski, 2005, p. 179.) the film. With another quote, from Science, Faith and Society (Polanyi, 1946b) Moodey brought us closer to understand the change in Polanyi's use of visual presentation of social matters: "Parallel to the positivist movement there has occurred in our time yet another transformation of the premises of science. Earlier conceptions of reality, capable of visual presentation in space, were replaced by purely mathematical concepts (like multi-dimensional wave functions) signifying certain probabilities and determining certain energies, but having no conceivable pictorial meaning attached to them" (Polanyi, 1946b, p. 88). Other traces could be found in the archival materials supporting such
claim. The well-known economist, Richard Hicks wrote Polanyi the following in a letter of 7th November 1943: “I should be grateful if you would some time show me how you solve the integral equations you use - I don’t like taking even mathematics ... It gets beyond my math., but since the Economists also are beginning to use that kind of thing, I want to understand it.” (Polanyi, 1943c, p. 1.). Mannheim summarized such general trend of mathematization, not without some irony, as the following in a letter of 10th August 1944: “In the Social Sciences it is even more detrimental that it becomes the fashion to make disconnected investigations without a philosophical outlook behind it. I should be very grateful if you could make this point in your book emphasizing the tragi-comedy that the Social Sciences try to enhance their dignity by becoming exclusively mathematical just when the scientists themselves feel the need to go back to a meaningful analysis of Reality” (Polanyi, 1944c, p. 1.).

Moodey stated that Polanyi used "a system of fluid dynamics as a model for an economy" (Moodey, 2015, p. 28.) and that he used "fluid as a metaphor for money and commodities, and the volume of flows of the fluid as a metaphor for the combination of frequencies and monetary values of different kinds of economic exchanges" (Ibid). Moodey provided no detailed micro-analysis on what he thinks is fluid-like and how he believes this is used in Polanyi’s visual presentations of social matters; that is, he made no attempt to work out the contours of the fluid metaphor for money in these specific instances. He did not mention similar projects of visualizing economic phenomena for the masses, even though Polanyi was not the only one working on this in the 1930-40s. I make an attempt to treat both of these matters in the upcoming chapters.

Moodey noted "squirting", "pumping" and "fluid" as late traces of Polanyi’s fluid-model of economics which started to be taking shape in his economic machines in the 1930s, reached its peak in his economic film of 1940, and was cultivated until the publication of Polanyi’s Keynesian masterpiece, Full Employment and Free Trade (1945f). I think a greater emphasis should be given to these traces as they might help us draw a more detailed picture on the development of Polanyi’s fluid-model of economics. My language analysis of Full Employment and Free Trade (1945f) found more than forty of such terms throughout the whole book mirroring Polanyi’s pumping imaginary which made an impression that Polanyi wrote a popularizer book of Keynesian economics in the language of a laboratory chemist. This might be relevant for understanding the development of his model because his film, Unemployment and Money: The Principles Involved premiered 5 years earlier had only three of such terms in approximately thirty-nine minutes. This suggests something rather counterintuitive, that the vocabulary of the chemist has not been fraying steadily from Polanyi’s economic works. More is to be said about this in the following chapters.

Moodey described the time period in which Polanyi made considerable attempts to visually present social matters (cca. 1930s-1945), but did not try to give a general account on what role visual representation had in Polanyi’s entire scientific career. Without undertaking the task to give a comprehensive account on this, recalling a few episodes might help us understand Polanyi’s entanglements with visual representations. We know from Scott and Moleski (Scott - Moleski, 2005, p. 16.) that there was a graph in Polanyi’s first scientific paper which he wrote in 1907 at the age of sixteen about the molecular specific heats of gases. The Polanyi scholarship has also revealed that diagrams were also present in his groundbreaking work on potential energy surfaces and in his transition state theory (Berces, 2003, p. 57.; Keszei, 2003, p. 69.). In My Time with X-rays and Chrystals (1962) Polanyi told the story of how he was asked "to solve the mystery" (Polanyi, 1962, p. 1.) of a diagram, and how his explanation boosted his scientific career. These episodes suggest that not only his work on social matters, but also his work on gases, x-rays, chrystals, potential energy surfaces included entanglements with visual presentations. But, before we shall proceed a brief overview shall be given here on who was Michael Polanyi, and what made his life and work worth to study.
Michael Polanyi was born in Budapest on March 11, 1891. He was the fifth child in a family of great personalities. His father, Michael Pollacsek, was a railroad engineer working in Germany and Switzerland, who eventually settled down in one of the largest cities of the Austro-Hungarian Monarchy, Budapest. His mother, Cecile Wohl or as family and friends called her: Cecil-Mama, developed a long-lasting interest in socialist movements (Scott-Moleski, 2005, p. 6.; Vezér, 1986, pp. 7-8.), and became a prominent figure in the intellectual life of Budapest. She organized literary salons and other gatherings with distinguished participants such as Ervin Szabó, Oscar Jaszi, George Lukacs, Bela Balazs, Anna Lesznai and founded a women's lyceum in 1912 with lecturers such as Margit Kaffka, Frigyes Karinthy, Dezső Kosztolányi, Ferenc Tangl, Károly Zipernovszky, Endre Ady, Lajos Hatvany, Mari Jászai and Paul Ignotus (Vezér, 1986, pp. 8-9.). We know from a letter of 11th December 1918 to the minister for religion and public education that Cecil-Mama was not only concerned with organizing a new kind of school for women, but with fostering an educational reform in higher training of women. She asked the minister to support her studies in the "content and method of practice-oriented social courses" (Vezér, 1986, p. 46.) of foreign education institutes for women, and her proposal for the curricula and method to be implemented in Hungary. She was soon thereafter given a letter of recommendation and a scholarship to conduct her planned studies from Sándor Imre, a Secretary of the State (Vezér, 1986, p. 47.). As the following explains, Michael Polanyi did not only share her mother's talent and enthusiasm for teaching, but also became involved with launching a wide-scale educational reform.

Michael Polanyi's childhood was full of high hopes. He was taught to read and write by his cousin, Ervin Szabó (Scott-Moleski, 2005, p. 10.), who was a remarkable social scientist, library scholar and reformer who introduced the Universal Decimal Classification in the Metropolitan Library, Budapest in 1912. As Scott and Moleski pointed out, Polanyi "was multilingual by the age of 6" (Ibid) speaking Hungarian, German and French; he had a couple of private teachers and occasionally accompanied his father on business trips, collecting experience from an international professional milieu. He was also very good at sports (riding, fencing, hiking) and at making friendships that lasted for decades. Polanyi attended the Minta Gymnasium (today known as ELTE Trefort Ágoston Gyakorló Gimnázium) and graduated in 1908. This gymnasium was a model school focusing on providing a training ground for future university professors. The teachers were particularly committed to introduce their field to the students; emphasis was given to reasoning and providing interesting discussion of the material rather than just memorizing it. The Minta Gymnasium had graduates such as Theodore von Karman (graduated in 1898) and Edward Teller (1925). Based on my research Scott and Moleski (2005) were wrong in claiming that Michael Polanyi, Georg von Hevesy, Eugene Wigner, Leo Szilard and John von Neumann were graduates from the same school (Scott-Moleski, 2005, p. 16.). According to the school records Polanyi graduated from Minta Gymnasium, Hevesy from Piarista Gimnasium (1903), Wigner (1920) and Neumann (1921) from Fasori Evangélikus Gimnázium, Leo Szilard from Réáliskola (1916).

Polanyi studied medicine at the University of Budapest from 1908. First he became an unpaid assistant of Ferenc Tangl at the Institute of Physiology (in the 1910/11 academic year), then received a three-year scholarship. Another professor, Ignatz Pfeifer, arranged for him "to be a companion to a wealthy young man in Karlsruhe, so that he could earn his keep while enrolled as a student" (Scott-Moleski, 2005, p. 25.). During his tertiary education Polanyi also worked as an assistant to Georg von Hevesy at the Institute of Applied Physics of the Budapest University (MJN, HYLE 2002). He received his medical degree in 1913 with a thesis titled...
As far as we know, Polanyi first encountered economics in a systematic manner during the seminars of Jacob Marschak in Berlin, 1928, where he wrote an essay on the Soviet economy. One year later he organized a discussion group on economic issues at Harnack House (Kaiser Wilhelm Institute) and started to build a network of economists and non-economists including Toni and Gustav Stolper, Abraham Joffe and others (Nye, 2011). Other élite scientists (and Hungarian emigres) such as Leo Szilard, Eugene Wigner and John von Neumann also attended these meetings, a forum of natural scientists addressing social issues and approaching social sciences. Polanyi left Berlin in 1933 for a Chair in physical chemistry at the University of Manchester, but not because he sought shelter from the frustration of doing high-end research at an industrial laboratory. He refused to take a similar job at Manchester one year earlier, but the rise of the Nazi regime eventually gave him no choice but to leave Germany as soon as possible. Despite leading the laboratory in Manchester, he worked on multiple research projects. He did not take the job to "rest upon" his "laurels" as Neuberg suggested him (Polanyi, 1962, p. 1.), but sought for sanctuary and a way to save his career from the threatening power of the nazi ideology. After settling down in England in 1933, Polanyi gradually shifted towards social sciences. This dissertation focuses on his little studied early years in England (1933-1948) when he was still the head of a laboratory of physical chemistry but was increasingly engaged in economic projects. The time frame ends in 1948 when he was appointed to the chair of "social studies" as a sign of his disciplinal shift. Even though I do not think such line of demarcation could or should be drawn between Polanyi, the natural scientist and Polanyi, the social scientist (see my explanation on the entanglements of laboratory chemistry to his economic thought in the upcoming chapters), such official recognition by the university was a milestone in how others saw him and what he was doing.
Polanyi's most influential works from the 1940s till his death were *The Contempt of Freedom: The Russian Experiment and After* (Polanyi, 1940m); *Science, Faith and Society* (Polanyi, 1946b); *The Logic of Liberty* (Polanyi, 1951); *Personal Knowledge: Towards a Post-Critical Philosophy* (1958); *The Tacit Dimension* (1966); *Knowing and Being: Essays by Michael Polanyi* (1969); *Scientific Thought and Social Reality: Essays by Michael Polanyi* (1974); *Meaning* (with Harry Prosch) (1975). Based on Polanyi's philosophy of science mirrored in these books, some scholars deem him, in a sense, one of the earliest social constructivist thinkers. Nye pointed out that Kuhn's reference to Polanyi in the *Structure of Scientific Revolutions* (1962) brought the attention of the Edinburgh school to Polanyi's *Personal Knowledge* (1958) and *The Tacit Dimension* (1966) and fostered the inclusion of his thought in social studies of science (Nye, 2011, p. xiv.). Jacobs pointed out that Polanyi's view on the "conceptual frameworks 'segregated' by a 'logical gap'", in a sense, "foreshadowed Kuhn and Feyerabend's theme of incommensurability" (Jacobs, 2002, p. 1.). He claimed to find the origins of Polanyi's notion of incommensurability in Evans-Pritchard and St Augustine (Jacobs, 2003). Feher found similarities in the Polyanian view that "belief-systems or conceptual schemes can not be justified or falsified for (and by) those who accept or reject them" (Feher, 2012, p. 73.) and the symmetry postulate of the strong programme of sociology of scientific knowledge (SSK). By briefly referring to these accounts, I only wanted to show that Polanyi's work could be seen not only in terms of subject matter but, in certain elements, as a contribution to the development of the discipline we call today, science and technology studies. In my dissertation, I aim not to read the content of these later Polyanian books too much into his earlier writings. That is, I try to avoid as much as possible the trap of writing a whiggish history of the early economic thought of Polanyi through the lenses of his later philosophy.

**Structure of the Dissertation**

In the first chapter, I intend to show how Polanyi's efforts for a new kind of liberal economic thought and his criticism on both extreme liberalism and socialist planning might be seen as doing boundary work (Gieryn, 1983) to reach out for the wider public. Despite a few articles that briefly dealt with the Polyanian film in their account on his visual presentation of social matters, no author has mapped how several groups were engaged with Polanyi's film. Therefore I show how Polanyi's *Unemployment and Money: The Principles Involved* (1940m) connected the social worlds of economist, film experts, tutors, managers and others, and how such "bridging" between these social worlds could have helped Polanyi both in his shift to become seen as competent in economic issues, (or showing him as a boundary shifter (Pinch - Trocco, 2002)), and in his campaign developing his sociotechnical vision to produce the expected social effect and save liberal economic thought, and Western society.

The second chapter traces the development of Polanyi's sociotechnical vision which he summarized as "democracy by enlightenment through the film" from its origins through its embedding and disembedding attempts. My discussion seeks to discover whether Polanyi's sociotechnical vision became an extended sociotechnical imaginary. Elements of the economic, social and political milieu of Polanyi's vision are being introduced through his correspondence. Similar projects of visualizing economic processes in the 1930-40s and their related social visions are explained here, as well as Polanyi's possible connection to these. Resistance against Polanyi's vision and an undesirable alternative sociotechnical vision based on the hypothetic motives of the army are also discussed.

The third chapter explores Polanyi's visualizations of economic processes and economics. Comparison is made with Angell's, Mooney's and Neurath's visual representations and the related social visions. The analysis of the visual representation of Polanyi's film primarily follows the narrative of the film because certain pivotal elements of his visualization seem to
be better explained in this way than any other. Shifting symbols, fluid-like motions and multiple representations for the same represented are analyzed here.

The fourth chapter examines Polanyi’s embedding in the wider social and political context along four strands between 1933 and 1948. First, the possible influence of different shades of socialism is discussed through milestones in the history of the Polanyi family. Second, Polanyi’s political leanings are unpacked through his involvement in the debate on the relation of science and society. Some of his battles with the ”planners” such as Bernal, Hogben and Crowther are revisited to provide a wider context for the reasons behind Polanyi’s sociotechnical imagining analyzed in the previous chapters. Third, during his disciplinary shift from physical chemistry to social sciences, Polanyi managed to be seen both as a member of the laissez-faire camp, and of the Keynesian camp, which suggests he had excellent skills for politics that he successfully used even in uneasy situations. And fourth, Polanyi thought that his active political involvement would have been perceived differently because he was a foreigner, thus he made attempts to develop his economic thought to be seen more as economic theory than economic policy in order to be able to make societal effects without taking political risks.

I. Building, Bridging and Shifting Boundaries of Economics

The first chapter consists of four subchapters. The first introduces the concept of boundary work and shows how some of Polanyi’s seeing, doing and being practices between 1933 and 1948 might be seen as doing boundary work (Gieryn, 1983) for a revamped economic liberalism and against orthodox liberalism and socialist planning. The second argues that Polanyi’s film can be seen as a boundary object (Star - Griesemer, 1989) connecting the social worlds of economists, administrators, film experts, army officials and others. The third subchapter focuses on how Polanyi might be seen as a boundary shifter (Pinch - Trocco, 2002), changing from being a physical chemist to being a social scientist. ‘Old’ practices of representing physico-chemical phenomena and ‘new’ practices of representing economic phenomena are seen here as consciously manipulated and mixed to change how others see and represent who Polanyi was and in what settings he was embedded in. The fourth subchapter shows how the joint application of the three concepts of boundary work, boundary object and boundary shifter can contribute to our understanding of Polanyi’s shift towards economics.

1.1. Freedom, Social Consciousness, and the Third Way

In the original article of Gieryn (Gieryn 1983), the concept of boundary work was introduced to be able to better understand what strain and interest theories cannot fully grasp in ideologies of science. The demarcation of science from non-science was examined in practices of scientists by analyzing three case studies. The public lectures of John Tyndall in the 1870-80s, the phrenology debate in the nineteenth century Edinburgh and an encounter of national security and scientific autonomy were analyzed here as having a common rhetorical style. Gieryn argued that the aim of these practices is usually to preserve or enlarge material and symbolic resources for a specific group of scientists sharing ways of seeing, doing and being or to defend their professional authority or to attack the authority of others. He identified situations in which boundary work is likely to happen: in expansion of authority or expertise to the domains of others by heightening the contrast between them and us; in monopolizing such
authority or expertise by excluding others as outsiders or protecting the autonomy by putting the blame on people from outside.

This subchapter shows that some of Polanyi’s practices might be seen as doing boundary work of the first and second situation. I argue that Polanyi was doing boundary work against both (1) “extreme” (Polanyi 1940g, p. 24.), “crude” (ibid, p. 24.), “orthodox” (ibid, p. 26.) liberalism based on “classical Free Trade doctrine” (Polanyi undated, p. 2.) and “complete laissez-faire” (Polanyi 1940g, p. 26.), and (2) against the “economical collectivism” (Polanyi undated2, p. 1.) or “planned economy” (ibid, p. 6.) of “Socialist teachings”(Polanyi undated,p. 2.). It is being explored how Polanyi set these “two most pernicious extremes” (Polanyi 1943f, p. 4.) against Keynesian theory by heightening the contrast between them and the Keynesian ideas, and how he made efforts to monopolize the expertise for putting an end to the economic downturn without taking unnecessary collateral damage on freedom.

The first section of the subchapter shows Polanyi’s boundary work against “extreme liberalism” (Polanyi 1940g, p. 24.), the second focuses on how he was building boundaries against the "planned economy" (Polanyi undated2, p. 6.). The subchapter concludes by exploring how he was building joint boundaries against these two "extremes", how he was framing his 'third way', and flashes why analyzing his films as boundary objects seems relevant for this account.

1.1.1. Boundary work against extreme liberalism

Polanyi considered himself a liberal but this did not impede him from taking a critical stance towards the "classical Free Trade doctrine" (Polanyi undated, p. 2.) or policies of "complete laissez-faire" (Polanyi 1940g, p. 26.) even in the 1930-40s when the struggle between liberal and socialist ideas was particularly sharp-edged. In one of his first economic writings, On Popular Education in Economics (Polanyi 1937b), Polanyi claimed to identify four mistakes of utilitarians, whom he seemed to identify with promoters of orthodox economic liberalism, as the following: “they failed to see that the just reward of the factors of production did not lead to a just reward of the people disposing of these factors” (Polanyi, 1937b, p. 4.), “they failed to produce an idea as the limits to which human affairs should be regulated by buying and selling” (ibid, p. 5.), “gave no reasonable account of the trade cycle” (ibid), and made "self-seeking the supreme principle in economic life" (ibid) assuming “that people will be happy in seeing their blind acquisitiveness transformed into a maximum efficiency” (ibid) without making “the community conscious of and responsible for its economic life” (ibid).

These "mistakes" (Polanyi 1937b, p. 4.) or "inabilities" (ibid, p. 6.) were revisited in a couple of his early economic writings and used to enhance the constraint between "crude liberalism” (Polanyi 1940g, p. 24.) and Keynesian theory in favour of the latter. Regarding the first weakness, Polanyi thought that Keynesian theory avoids such failure, moreover that it is compatible with multiple ‘standards of economic justice’(Polanyi 1948, p.146.). He believed that “the economic machinery can be operated in conformity to any standards of economic justice”(ibid), so our further “task is to clarify our sense of economic justice and to establish sufficient agreement with regard to its demand” (ibid). Such an agreement of people was seen as an achievement.

Polanyi identified the second weakness as the utilitarians "overestimated the idea of free market" (Polanyi 1937b, p. 5.) because they "thought it to be applicable to all human relations" (ibid). He believed that there was "an element of superstitious fear in the idea of orthodox Liberals that the market takes revenge on society for any interference with its mechanism by inflicting on it the cure of unemployment” (Polanyi 1940g, p. 26.). He disagreed with this fear and suggested that "the alternative to the planning of cultural and economic life is not some inconceivable of absolute laissez faire in which the state is supposed to wither away, but that
alternative is freedom under law and custom as laid down, and amended when necessary, by the State and public opinion." (ibid) The power of buying and selling was not seen as entirely limitless, but as taking effect in a social and legal framework established and modified by the State and public opinion when it seems necessary. By stating that "the work of Keynes has brought an understanding of the trade cycle" (Polanyi 1937b, p. 12.), Polanyi seems to be suggesting that Keynesianism avoids what he called the third mistake of utilitarians, and by doing this he heightens the contrast between Keynesianism and "orthodox liberalism". The latter was said to be unable to address and handle economic cycles. He also stated that "the working of the economic machinery and, in particular, the mechanism of the trade cycle must be made accessible for a wide popular discussion" (Polanyi undated3, p. 1-2.). This leads us to what he deemed the fourth mistake of the utilitarians, that is, the inability to raise social consciousness. Polanyi developed a whole social agenda based on raising such social consciousness to reform liberalism, which is to be analyzed in detail in the third section of this subchapter.

Polanyi pointed out that extreme liberalism did not realized that certain economic phenomena have different meaning and value for the individual and for the community. Extreme liberalism therefore did not develop a common scheme of economic value. He thought that Keynesians, however, realized this and developed their ideas accordingly. Polanyi expresses this idea most clearly in his Full Employment and Free Trade (1948). Regarding the nature of money, he contends that "the main point to understand is that the possession of money is not the same, or even remotely similar, value to a nation as it is to the individual" (Polanyi 1948, p. 1.). But he did not think that Keynesians were alone in recognizing this need for a common scheme of economic value.

1.1.2. Boundary work against socialist planning

Polanyi stated that the socialists claimed to establish a common scheme of economic value, but it was "far from being able to summarise the essence of an economic situation independently of the autonomous exchanges which go on in the course of marketing, and to replace their operations by a comprehensive scheme of its own" (Polanyi 1940g, pp. 20-21.) According to Polanyi, eventually "the Government must recognise that it has no comprehensive set of alternative valuations to replace" (ibid) the individual valuations arising from the exchanges of economic agents. Going into the details, Polanyi reflected on some of the findings of Colin Clark's A Critique of Russian Statistics (Clark, 1939). Clark's book had revealed that "anomalies of Russian valuation which even within one group of articles of consumption amount to more than tenfold distortions of relative values" (ibid, p. 20.). Polanyi wanted to show the inadequacy of such economic valuation with the following simile: "the compilation of statistics on objects consumed, comprising the number of handkerchiefs, spectacles, prayer books, and countless other kinds of merchandise, are as meaningless from this point of view as would be the valuation of the National Gallery by square yards of canvas or pounds of paint" (ibid). Polanyi claimed that socialist economic theory propagated the "just reward of the people" (Polanyi 1937b, p. 4.) in its rhetoric similarly to orthodox liberalism but the source of such 'justice' was not seen coming from the market but from 'rule of the people by the people'.

Another weakness of socialist planning was its inability or unwillingness to develop an idea about the economic role of prices and profit. In such system, the central direction of prices and the elimination of profit dominated the ideology and the respective theories. However, as Polanyi pointed out, even though the influence of the "evil powers of the market" (Polanyi 1940g, p. 26.) were officially denied, they reappeared from time to time and were taking effect at an increasing level.
According to Polanyi, proponents of socialist planning recognised the existence of trade cycles, and claimed that a centralised direction of economic life could and should fight these in favour of the people. Economic planning was seen developing a kind of social consciousness which crude liberalism lacked. Polanyi wrote that social consciousness "is a historic force more fundamental for the present century than even the national idea and that the struggle for it will dominate public life until it has found reasonable satisfaction" (Polanyi 1937c, p. 32.).

He also realized that "the demand for social consciousness in economic life has only started on its way in history" (ibid), and that we might find multiple "attempts to achieve economic consciousness" (ibid, p. 31.) in Soviet planning, German Fascism and Roosevelt's economic policy. Socialist teachings gave "an example of a new life in which the daily work of all is conscious of a common purpose" (ibid). But Polanyi recognized that this did not come without its side effects on freedom.

Polanyi thought that "democracy can satisfy this craving for economic consciousness" (Polanyi 1937b, p. 11.) too by "creating a popular understanding of economic matters" (ibid). He saw this as "the only way to obtain economic consciousness while preserving freedom of thought" (ibid) by other means than "dictatorial regimentation" (ibid, p. 10.). His approach was "to elaborate the new economic ideas and at the same time to simplify their outline so as to make them comprehensible to the intelligent layman" (ibid, p. 12.). By doing this, one can raise social consciousness without limiting freedom.

1.1.3. Building a joint boundary against extreme liberalism and socialist planning

Polanyi conceived that "errors both of Classical Free Trade doctrine and of Socialist teachings have done a great deal to confuse people and to undermine their confidence in modern society" (Polanyi undated, p. 2.). He also pointed out that a common point in their rhetorics was the implication that there is no third way for handling or ordering economic affairs. He proposed that "instead of accepting this joint view [seeing each other as the sole alternative] of orthodox liberals and collectivists" (Polanyi, 1940g, p. 26.) a new kind of liberalism with social consciousness should be developed and disseminated. He thought that during their attempts "to oppose each other the social and individual interests of man seems to have separated two essentially connected elements and formed a pair of evil principles which tend to disintegrate society by pulling in the economic collectivism on the one side and of blind selfinterest on the other" (Polanyi undated2, 1. p.). He pointed out that "the orthodox Liberals maintain that, if the market is limited by the fixation of some of its elements, then it must cease to function, the implication being that there exists a logical system of complete laissez faire, the only rational alternative to which is collectivism. That is precisely the position [he continued] which collectivists want us to take up when asserting that none of the evils of the market can be alleviated except by destroying the whole institution root and branch" (Polanyi 1940g, 26. p.).

Polanyi thought that a form of Keynesianism was "destined to restore the decency and vitality of the capitalist system" (Polanyi 1941i, p. 2.) as the third way. Therefore more scope shall be given to its "social significance" (ibid) to bring its "vital message" (ibid) to "wider circulation" (ibid). He emphasized that "planning is not the only method of ordering human affairs, and that the alternative method is Supervision, which is almost the opposite of planning, in that it ultimately relies on the multitude of individual initiatives which planning would subordinate to a central will" (Polanyi 1940g, p. 3.). He conceived that "the public is left unaided in its perplexity: equally repelled by the recollections of the pre-war depression and by the systems of economic control, by which totalitarian countries use to ensure full employment" (Polanyi 1941i, p. 2-3.). Polanyi recognized that the perceived rivalry between extreme liberalism and socialist planning was not a unique phenomenon as there is a "permanent rivalry between the individualist and collectivist patterns of social life, and the balance between them is ever shifting to and fro" (ibid, p. 7-8.). He considered that "there is no more important problem in
politics than to ascertain the just mean between these two most pernicious extremes, to draw correctly the line which divides those cases of in which it is the duty of the State to interfere, from those cases in which it is the duty of the State to abstain from interference” (Polanyi 1943f, p. 4.).

Polanyi also realized that the justification for the inequalities in income is basically the same in the two system. He wrote that in a planned economy "If a manager gets the income of thirty workers, it is only because his work is thirty-times more valuable. Therefore there is no: exploitation. But this is exactly the same reason which liberal economy gives for inequality of incomes" (Polanyi 1937c, p. 28.). He also noted that "the extent of social injustice could become about equal in both systems” (ibid, p. 29.) and that even the "system of capitalistic enterprise can be made to conform to any standard of social justice on which society is sufficiently agreed” (Polanyi 1946c, p. 8.). Thus, members of the society must be adequately informed about the economic ideas to help them reach an agreement on a standard of social justice.

Polanyi thought that both socialist planning and extreme liberalism failed to produce an idea about the limits of buying and selling. But unlike orthodox liberals who deemed its power limitless, promoters of socialist teachings thought buying and selling does not have power at all. Both caused much trouble for their supporters because, as Polanyi pointed out, "starting from the principle that production is to be decreed by the state, the Soviets have, out of necessity, submitted more and more to the guidance of prices and profits. The development in the Western countries was just opposite: While continuing the traditions that prices and profits should be the basic principle of business life, they have, out of necessity, admitted a wide range of restrictions and subsidies by the State” (Polanyi, 1937c, p. 29.). Polanyi believed in the power of buying and selling, but thought that it is necessary to establish limits by the State and public opinion. Such limits were not seen as unchangeable and set once-and-for-all, but "ever shifting to and fro” (Polanyi 1941i, p. 7-8.). The balance between individual and collectivist patterns of social life according to Polanyi "is never at rest, and every historical force, all rival interests and ideas deflect its position in one way or another” (ibid, p. 8.). Polanyi wrote that "Communism, arising in the middle of the 19th century, attacked utilitarianism at all the weak points to which I have referred. It demanded that exploitation, marketing, the trade cycle should be wiped out and the acquisitive system replaced by a community consciously working for its common needs” (Polanyi 1937b, p. 6.).

Polanyi believed that a "correct Keynesian policy should regenerate free competition and re-establish capitalism on renewed foundations" (Polanyi 1948, p. xvi.). At the end of his Full Employment and Free Trade (1948), he made it clear that "In the controversy between Laissez Faire and Planning my outlook leans distinctly towards the former” (Polanyi 1948, p. 149.). By going into details, he stressed that he "wholeheartedly accept the guidance of the 'invisible hand' for the mutual adjustments of productive units" (ibid) and "repudiate the mood of millenist planning" (ibid), but also he reminded his readers that the Keynesian theory revealed that "tariffs and price agreements do not create mass unemployment, and that their abolition would not restore Full Employment” (ibid, p. 148.) either. He thought that lack of social consciousness was the "greatest deficiency” (Polanyi 1937b, p. 11.) of the prevailing liberal economic system. Polanyi was on a mission to improve public understanding of economic ideas to establish an "enlightened public” (ibid, p. 12.) capable of directing its own economic life. For his mission to reform liberal economics based on Keynesian insights, he needed to find ways to reach out for the wider public. The next subchapter shows one of these ways by exploring how Polanyi’s economic films were connecting the social worlds of economists, film experts, economics tutors, and others.
1.2. Bridging Different Visions: How Polanyi’s Economic Film Fostered the Cooperation Between Different Social Worlds

The concept of boundary object was developed by Star and Griesemer in their article published in 1989. In this paper, boundary objects were described as “anchors” or “bridges” connecting different intersecting social worlds and satisfying the information requirements of each (Star-Griesemer, 1989). Boundary objects have special attributes that help actors reconcile the different meanings of different social worlds. I argue that Polanyi’s film might be seen as a boundary object connecting the social world of economists, managers, film experts, economics tutors, and others. I show how these actors might be seen having a diverse range of visions of his film and how his film inhabited multiple social worlds. By looking at the correspondence of Polanyi and his allies one might get a glimpse to these social worlds.

1.2.1. Polanyi’s vision

Polanyi’s mission was to reform economic liberalism through economics education. He realised that one weakness of “extreme liberalism” (Polanyi 1940g, p. 24.) was its inability to cultivate and maintain a kind of social consciousness. Polanyi deemed this problem crucial and started to develop - and urged others to join him developing - new ways of increasing public understanding of economic ideas. One of his ideas about how to do so was to develop economic films. He hoped that his Unemployment and Money: The Principles Involved (1940n) would create “a nucleus of educated people who would acquire an understanding of these matters” (Polanyi 1937b, p. 13.) in certain centres, from which “a calm light would spread out” (Polanyi 1936, p. 4.). And, if the society would devote itself to the study of economics, then “a social consciousness would arise, encompassing all our activities” (Polanyi 1936, p. 5.) could save economic liberalism and with it “our civilisation” (Polanyi 1936, p. 4.).

The film thus had a key role in Polanyi’s economic thought and social agenda. It was seen as a link between economic ideas and the economy. This implies that human minds carrying economic ideas provided the main building blocks of the economy in the Polanyian view, suggesting that his economic thought was evolutionary in some way. Nevertheless, his film was treated as an engine of his social agenda to save liberalism and Western civilisation. In one of his letters to Kittredge, Polanyi wrote that Mr. Harold Shearman, the education officer of Workers’ Educational Association made arrangements to show his film at their annual meeting where “it was decided to undertake an experiment of a larger scale” (Polanyi 1942a, p. 1.). He also informed Kittredge that a number of “experimental courses” (ibid) based on the film were prepared and conducted by economic tutors of the W.E.A. and that he will shortly “consider further steps” (ibid) with Shearman while more experimental courses were still being “carried on by tutors who have become interested more recently in the method” (ibid).

Polanyi acknowledged that his efforts are “struggling with mounting difficulties” (ibid) and he mentioned two problems: the increasing difficulty to obtain a projector and that “everywhere staffs are reduced to the point that all available forces are exhausted by routine work and no extra can be undertaken” (ibid, p. 2.). In the last part of his letter, he explained why he had to carry on despite the unfavourable circumstances and why his “method” (ibid, p. 3.) is so important:

“You may ask, perhaps, why in these circumstances I press for a further development. It is because I am convinced that the method which I propose ought to be utilised now to facilitate the education of an enlightened post-war opinion which will approach the problem of unemployment not in the spirit of despair which endangers the stability of
free institutions, but with concrete ideas about the possibilities for an intelligent attack on this social evil. I think that may make all the difference." (ibid, p. 3.)

1.2.2. The Rockefeller Foundation administration’s vision

Polanyi needed a diverse group of allies to realise his agenda. The work of the officials or managers of the Rockefeller Foundation was particularly important for him. Polanyi received financial support as well as advice on how to build a network around his film from the Foundation. The two most significant officials involved were Tracy B. Kittredge and Ruth Pedersen. They might also be seen as allies helping Polanyi in the creation and management of his film as a boundary object because much significant work was done by them in the United States.

Tracy Kittredge called Polanyi’s attention to Professor Pollard (Educational Film Institute) and Professor Slesinger (American Film Centre) and suggested ways of contacting them. Two years later, Kittredge gave a report at the request of Polanyi about the American screenings, stating that the film has been shown at the following venues during the last six or eight months: University of Wisconsin (by Prof. J. Oren Phipe), University of California (Prof. J.B. Condliffe), Princeton University (Prof. Oskar Morgenstern), Yale University (Prof. Kenneth Spang), University of Minnesota (Prof. Harold Jensen), Institute for Economic Education (Miss Curtis). Kittredge also clarified that when the film was not being used it was in the custody of the Film Library of the Museum of Modern Art. (Polanyi 1942b, p. 1.)

Ruth Pedersen, another official of the Rockefeller Foundation, wrote to Jacob Marschak (an economist, and an acquaintance of Polanyi) regarding his inquiry about "the use of the Polanyi film" (Polanyi 1940l, p. 1.) for his Monetary Policy course next semester: "the one print available is being shipped to Professor Condliffe within the next few days" (ibid). She added that "what other plans he may have for future showings are not yet certain, although he did mention the possibility of using it around Eastertime. Professor Condliffe thought that after these initial showings, and in the light of the discussions of the film, some plans might be formulated for its wider use" (ibid). Pedersen also noted that "there is, however, a negative of the film which might be developed at a future date when a definite policy has been determined as to the methods of putting it to wider use" (ibid).

It seems that officials of the Rockefeller Foundation primarily handled Polanyi’s film as one of their ongoing projects. They were mainly engaged in finding and informing as many concerned stakeholders as they could, and in supporting Polanyi in his efforts to develop and disseminate his film.

1.2.3. The film expert’s vision

For film experts the film inhabited another social world. In a letter of 1938, R. S. Lambert from the British Film Institute provided an account on one of the earliest screenings:

"Everyone was exceedingly interested in the experiment, the original nature of which was much appreciated. In the main, the audience was inclined to be critical of the slow movement of the film, not perhaps realising that, had this been accompanied by a lecturer, they would not have noticed the repetition of the movement of the figures, etc. I noticed that although the audience seemed to find the film slow, they did not observe some of the finer points of the film, which I think justifies you in your method of repetition, to drive home points. Several keen film enthusiasts seemed to think - and I rather agree with them - that from the technical point of view G.B.I. did not acquit itself very well: the movement of the model figures might have been less jerky, and the lettering was not always photographed distinctly. Mr. Beales, of the London School of Economics (who was in the Chair) and I were greatly impressed with the way in which
you built up your theme from a simple beginning, to a complicated yet lucid climax. For myself, I think the latter part of the film is most effective - i.e. the parts which we had not time to show." (Polanyi 1938b, p. 1.)

Figures, lettering and slowness were the key points in Lambert's account. He was an official of The British Film Institute not an economist or a student of economics. He treated Polanyi's film as an application of film technology, as an artifact which was to be seen in terms of standards of contemporary film technology. Techniques of making the film (not photographed distinctly, less jerky movement of model figures) and the mode of the storytelling (slowness, repetition, complicated yet lucid climax) dominated his account from a "technical point of view" (ibid). Lambert said nothing at all about the adequacy of the economic content or about how the audience attempted to understand the elaborated economic ideas and what difficulties they had, if any. The screening was held at the London Film School, so probably the audience here was also more concerned with the film as an instance of using film technology for educational purposes than as a way of visually representing Keynesian ideas. A similar account was provided by Oliver Bell, the Director of the British Film Institute who saw the film more as a "visual notation" (Polanyi 1938f, p. 2.) supporting the audience in understanding economic ideas. He emphasized that as students in adult education are not the most "acustomed" (ibid) to "verbal or numerical notation" (ibid), they would probably "benefit considerably" (ibid) from a visual one. Bell primarily treated Polanyi's film as a new method of teaching which should be used "in association with the more customary methods of teaching" (ibid).

1.2.4. The economics tutor's vision

Polanyi corresponded with some of the economics tutors directly, but mainly received feedback from them through Shearman who was the educational officer of W.E.A. Raybould, a tutor, wrote to Polanyi that he is writing an article for the December issue of Adult Education which "should be concerned entirely with an account of the way the film was used and the opinions expressed by the users of its suitability for W.E.A. class work" (Polanyi 1942g, p. 1.). He wrote that "there will be no comment or criticism, that is, on the content on the film: readers will be referred to Mr. J. H. Williams' earlier article" (ibid) in Adult Education "for an account of the nature of the film" (ibid). Shearman was the middleman, for a time between W.E. Williams (editor of Adult Education) and Raybould. The latter gave an account to Shearman about his experience with Polanyi's film "with Army and civilian groups" (Polanyi 1945b, p. 1.). He considered that a "single showing I think is useless - or worse than useless; confusing. Even several showings are not much use. I think, unless steps are taken, such as I attempted by means of questionnaires, to get students to spot and understand every single step in the quite complex argument." (ibid)

Another tutor, Hughes Lewis, wrote that his work with the film was not an "unqualified" (ibid) success, but he acknowledged this was "not a fair test" (ibid) because he was not able to attend himself and the tutor who deputised for him "had only the briefest pre-view to familiarise himself with the line taken" (ibid). He wrote that it took the deputy tutor "all his time to follow it himself" (ibid) and that "it was well above the level of intelligence and knowledge of the audience and they went away mystified" (ibid). Lewis experimented with a tutorial class who studied economic history and planned another experiment with one "which had spent some time in the study of Monetary Theory" (ibid). In another letter, Raybould claimed to know why the film has not been more widely used, stating that "too much intensive study of it - not merely looking at it - is required to get out of it all that's in it." (Polanyi 1945c, p. 1.). Raybould thought "that Polanyi's film is quite essentially austere, so to speak, in its dependence on sheer diagram, and in its very closely-knit structure" (ibid) which he did not deem a weakness, but an uncommon trait of instructional films which was unexpected by tutors using educational films.
G. D. H. Cole, a tutor of Nuffield College, contended that in the case of controversial subjects such as most economic questions "I know I should strongly dislike having my argument made for me, and I should have thought that most Tutors - at any rate when they had got past the novelty of experiment - would also dislike having their course shaped for them in this way. This, of course, would not apply, where the subject was non-controversial in the sense that competent Tutors would agree about the substance of what needed saying: but comparatively few economic questions belong to this category, and I see a considerable danger in any standardisation of economics teaching, such as the wide use of this type of film would seem involve" (Polanyi 1943a, p. 1.). This "danger" (ibid), Cole claimed, should be "much less if silent rather than sound versions were used" (ibid) but it could not be "altogether eliminated" (ibid). Polanyi's film and similar ones were thus seen, as, among other things, a 'threat' to the authority and expertise of economics tutors.

1.2.5. The Worker's Educational Association's vision

Harold Shearman's (The Worker's Educational Association) was the educational officer of the W.E.A. who soon became an important ally to Polanyi. He became a middleman between Polanyi and the tutors of the W.E.A., collecting and summarizing feedback as well as giving advice on possible further steps to Polanyi. At Polanyi's request, he shared his opinion on the "reason for the lack of extensive use of the film" (Polanyi 1945a, p. 1.). Shearman thought that "generally speaking our tutors, and the profession in general in this country has not yet become interested in visual aids to any important extent" (ibid). Thus he discerned a slow development which he saw as "handicapped by the difficulty of getting equipment in wartime" (ibid). Shearman also told Polanyi about similar American experiments with films on collective bargaining and the problem of race prejudice, but stated that "the technique they were using was, however, very different from yours, and was more related to the Disney Cartoon" (ibid, p. 2.).

Polanyi informed Shearman about publishing Full Employment and Free Trade (1945f) and he stated that he had "made some use of the film symbolism in the illustrations to this book and have mentioned the film itself as a reference" (Polanyi 1945d, p. 1.). Polanyi hoped that "this may possibly reopen the issue of a wider use of the film for economic teaching as distinct for the use as a background for elementary talks" (ibid). He mentioned that if he "see[s] any interest developing in that direction" (ibid) he would organise a meeting with Shearman and Raybould.

1.2.6. A possible vision of the army

In 1942, even the army showed some interest in Polanyi's film. Basil A. Yeaxlee wrote to Shearman that "from the recent conversations I have at the War Office I rather think there might be a place for a simpler form of the film in the Army programme in the future. It might be as well not to get too far in with the M.O.I. for the time being" (Polanyi 1942d, p. 1.). Arthur Koestler, Polanyi's friend, joined the discussions and established contact between Shearman and Arthur Calder-Marshall of the Ministry of Information Film Division (Polanyi 1942e, 1. p.). In one of Shearman's letters, he informed Polanyi that he told Raybould that "we did approach the Ministry of Information and they would not bite. They might be responsive to the idea of filming the White paper". But I am afraid it would be propaganda for their policy." (Polanyi 1945c, p. 2.) Shearman implies that while the cooperation would probably foster the further development of Polanyi's film, it would hamper the evolution of his related sociotechnical vision. He saw a considerable tension between Polanyi's vision of the film and what he thought to be the army's vision.
Polanyi was not so suspicious about cooperation with the Ministry of Information. He wrote to John Jewkes that "I would be delighted to assist the Government in using my film or a new film based on a similar technique to explain its intentions for the prevention of general unemployment" (Polanyi 1944a, p. 1.). He went into details, stating that "there is a standard size sound print available in London which could be shown at the theatre of the Ministry of Information and I would be delighted to come down to London and take part in the discussion" (ibid). Polanyi even noted that some of his ideas about "a new version based on the first three reels, but considerably simplifying and abbreviating the material" (ibid) could be produced. Moreover, he suggested that the "technique could be touched up to a somewhat higher degree of potency, for example by the introduction of colour which is now quite commonly used for cartoon films" (ibid) to reach out for theatrical audiences. Polanyi would have also included "a demonstration of Governmental intervention" which was absent from the available version (ibid).

1.2.7. The economists' vision

Most of the economists who saw the film saw it in Manchester, Paris (Lippman Conference, 1938), or New York (Condliffe screening, 1940). Polanyi stated that "while offering various criticisms of details and sometimes expressing warnings as to the danger of over-simplification, the economists have, on the whole, approved the film" [Polanyi 1938g, p. 3.]. Since Polanyi’s agenda was primarily to convert Keynesian ideas into “a matter of common sense” (Polanyi 1948, p. v.), he wrote a letter to Keynes giving a report on the development of his film, as well as on future plans for it. He wrote to Keynes that "I am inclined to agree with Jewkes that something quite important might be done now by a novel and striking popular illustration of elementary monetary facts. I am not suggesting, of course, that this is certain to be feasible by my method but I see a good chance for it, and I believe therefore that I am justified in putting this matter before you" (Polanyi 1940a, p. 1.). He also asked Keynes’ advice and offered to present him the newest version of the film which, he hoped, they could discuss. The answer from King’s College was short and straightforward: “I have much else to do and I must, therefore, regretfully reply to your letter that I cannot spare the time to take an interest in your film” (Polanyi 1940b, p. 1.). Eleven days later another fragment arrived from Keynes: "Though I was not able to take an interest in your film, may I say how much I liked your recent letter to the New Statesman” (Polanyi 1940c, p. 1.). Economists in general were more concerned about written accounts, than the usage of “visual notation” (Polanyi 1938f, p. 2.) or ‘film technology’ for economics education. Keynes for example used only one diagram in The General Theory of Employment, Interest and Money (1936). And it was not even created by him but R.F. Harrod who convinced Keynes to include it in his magnum opus (O’Donnell, 1999). He seemed to be conscious about the problem of public understanding of economic ideas, but certainly was not so much convinced about using film technology to make it better.

1.2.8. The Rotarian vision

Polanyi arranged a screening of his film at a Rotarian club. After the screening, one of the organisers, Peter Thomason gave Polanyi a written account on the event, which might suggest that the Rotarian vision was close to the Polanyian one:

“As you know, Rotarians study carefully anything bearing the betterment of the individual, the community, and the nations; and towards their new efforts on Reconstruction they are really needing such instruction as we were all privileged to receive last Saturday. The good done does not stop at that day, for "The Polanyi Film" will for some long time come up in club discussions. It is helping us to get more of our Membership unafraid of the serious study of Economics” (Polanyi 1943b, p. 1.).
Although this is only a single letter from a Rotarian, one might find similarities between the vision of Polanyi and the Rotarians in general, because the Rotarian mission statement also focuses on working for the improvement of society.

1.3. Approaching and Shifting Economics

Trevor Pinch and Frank Trocco defined "boundary shifters" (Pinch and Trocco 2002) as "people who cross boundaries and in so doing produce a transformation" (Pinch and Trocco 2002, p. 314.). Their new approach was introduced to be able to address the liminality of objects and of human identities built around these objects. Pinch and Trocco explained that "not only do people change identities, transgress boundaries, and move from one world to the other" (ibid), but "they also apply the knowledge, skill, and experience gained in one world to transform the other" (ibid). In this subchapter, I show how Polanyi built his economist identity by transgressing boundaries. Polanyi violated expectation about what economists should do. As he moved from physical chemistry to economics, he used his knowledge and skills gained in chemistry to transform the world of economics and economists. The first section of the subchapter focuses on how Polanyi had been building an economist identity, that is, how he began to see himself as an economist, and how others began to see and treat him so. The second section discusses two boundaries he made efforts to transgress: the boundary of orthodox practices of visual representation in economics, and the boundary of the social role of economists. The third section shows how Polanyi applied his skills, knowledge and experience from the world of laboratory chemists to transform the orthodox representation of Keynesian ideas.

1.3.1. Bound for England, bound for economics

Polanyi first encountered economics in a systematic manner during the economics seminars of Jacob Marschak in 1928. Although he was working as a chemist at Kaiser Wilhelm Institute in Berlin, his interest in and engagement with economics swiftly increased. One year later, he found himself organizing an economics discussion group and building a network of economists. Some of his new friends were contributors of Deutsche Volkswirt, and he shortly followed them by publishing an article in 1930 on the role of government. The next boost to his interest in economics occurred when he left Germany and took the position as the head of the physical chemistry laboratory at the University of Manchester. He made an early friend in John Jewkes, an economist with whom he could regularly discuss economic matters.

Polanyi might be considered, in a sense, a middleman between Keynes and Hayek. He was a wholehearted liberal, a founding member of the Mont Pélerin Society, a friend of Hayek and at the same time a restless promoter of Keynesian ideas. He is among the first to write a popular book of Keynesian economics. His mission to save liberalism was centered around increasing public understanding of Keynesian economic ideas. While he had no degree in economics, his seeing, doing and being practices has become more and more those of an economist. He attended conferences, wrote for economics journals such as Economica and tried to read the most important books in the field. By analysing his extensive correspondence in the thirties and forties, we can witness how Keynes congratulated him on his article in the New Statesman, how Hicks asked him to show him how he "solve the integral equations" (Polanyi 1943c, p. 1.) he used because it got beyond Hicks' math and how Joan Robinson released her "volley of arrows" against one of his papers on patents. He became an advisor to Hayek who wanted to establish a "quaterly liberal journal" (Polanyi 1939a, p. 1.), and a friend of Lionel Robbins, the head of the Economics Department of London School of Economics, who helped him finalizing his most important economics manuscripts. It must not have been easy to share practices and engagements with both 'extreme liberals' and Keynesians. In one of the letters
from Joan Robinson, Polanyi was seen as more of a promoter of the laissez-faire camp: "In general I think I differ from your mental background, for I don't believe that, at this time of day, "back to free competition" is a practicable solution" (Polanyi 1944d, p. 1.). Interestingly, Keynesians and Polanyi as a member of this group were also accused by developing theories which necessarily implied an "unconscious capitulation to totalitarian notions" (Polanyi 1946a, p. 1.) and building a system which "has only proved its practicability, in the milieu of a totalitarian society" (ibid). Aside from these extreme instances, Polanyi was really successful in not having been seen as 'too liberal' by the Keynesians, and, respectively, not having been seen 'too Keynesian' by his antikeynesian friends. However, it must be noted here that he made very clear that he considered himself Keynesian, and thus his good relation with both parties was not a result of slipping back and forth between the camps or of making inconsistent statements. Polanyi relied instead on his great interpersonal skills and his indisputable commitment to liberal values.

His shift to economics was seen so significant that Blackett asked Polanyi's wife, Magda, "is Misi really not interested in chemistry any more?" (Polanyi 1938c, p. 2.) Another letter from Magda recalled another talk with Blackett and noted that "he [Blackett] thinks that political activity is the most important - even more important than the film [my translation from Hungarian]" (Polanyi 1938d, p. 4.). This suggests that Polanyi's enthusiasm for his economic film was not seen as desirable by everyone, for example by his wife. Despite the fact that Magda's letter explained that Blackett calmed her with saying that "they love versatile and unenglish men here" (Polanyi 1938c, p. 3.), she was worried about the threat her husband's new passion might pose to his position at the university. She wrote that "I'm afraid I have to better keep an eye on you in the future, so that you will not lose your job"[my translation from Hungarian](ibid, p. 2-3.). Fortunately her worries seemed to prove unfounded.

Polanyi wrote article after article on economic topics in the thirties and forties, and his popularity was greater than ever. Still, Polanyi was extremely careful in his discipline-shifting activities. He knew that without a degree in economics and an established network of fellow economists he was in a sensitive situation. Regarding his study of various economic topics, he often adopted a humble tone and from time to time noted that he is "not a professional economist" (Polanyi 1942a, p. 2.) or that he is not an "authoritative economist" (ibid). His study of economics can be seen as reaching its peak by the publication of his Full Employment and Free Trade in 1945, and his appointment of the chair of social studies at the University of Manchester in 1948.

1.3.2. Boundaries of visual representation in economics

With his film, Polanyi left the beaten path regarding practices of representation in economics. By analysing the books and articles of Keynes, Hayek, Robbins and other contemporaries, we can find only a few diagrams or other forms of visual representation. As was noted earlier, Keynes' magnum opus, The General Theory had only one diagram that wouldn't have made it into the book if Harrod had not drawn and convinced Keynes to include it in his book.

Polanyi broke with the convention in economics to prefer verbal notation and underplay its visual counterpart. Certainly there were different practices of visual representation in economics, but these were not seen as devices capable of reaching out for an audience which their verbal counterparts couldn't. The third chapter explores the origins and development of Polanyi's visual representation of economic matters in detail, and therefore it is only to be noted here that Polanyi deemed visual representation more important than most contemporary authoritative economists.

Polanyi should be seen not only seen transgressing the boundary of how but also for whom economists represent economic phenomena. For the successful revamping of visual representation of social matters, he saw a change as necessary in how the community of
economists understood their social role, that is, how they think their everyday activities affect the whole society. Polanyi was convinced that economists formed a "secluded community from which only rumours, in the form of popular fallacies, spread out into the masses" (Polanyi 1936, p. 2.). He thought that "the present methods of economic instruction have failed to produce a widespread understanding of the subject" (Polanyi 1938g, p. 1.) and he advocated for new methods which make economic ideas more easily understood for people "without any mathematical or economic training" (ibid, p. 6.).

He recalled a dialogue with an economist who was "rather in favour of a secret language which would obviate the spreading of popular fallacies from economic studies" (Polanyi 1936, p. 2.). In both Polanyi's account and in the account of the unnamed economist, unskilled or inadequate engagement was seen as the cause (or among the major causes) of the spread of economic fallacies and misconceptions. While Polanyi saw the solution in more and better engagement, the unnamed economist suggested curtailing the number of engagements to a minimum.

It must be noted here that the social role of economists was also part of the divide between Keynes and Hayek. While Keynes was often on the air and published brief articles in popular newspapers, Hayek was convinced that economists should only deal with theoretical problems and leave practical issues to other professionals. Polanyi thought that social consciousness "is a historic force more fundamental for the present century than even the national idea and that the struggle for it will dominate public life until it has found reasonable satisfaction" (Polanyi 1937c, p. 32.). He believed that economists should take an important role in meeting this need. Social consciousness needed to be developed and cultivated mainly by economists who, according to Polanyi, even failed to see that this was needed and should be addressed. This discussion about how and for whom economists should represent economic phenomena covered an internal disciplinary problem of economics. In raising the issue of public understanding of economic ideas, Polanyi challenged the relation of an expert community and the wider public from a practice-oriented approach.

1.3.3. Transforming the language of economics

Polanyi used his skills and experience from the social world of laboratory chemists to transform the world of economics. His boundary shifting included writing Full Employment and Free Trade (Polanyi, 1945f), a Keynesian interpretational book in a language of laboratory chemists. In this book he phrased the key relations and central messages in a language unknown to most of the Keynesians and even Keynes himself. Polanyi wrote in the Preface that the book "is not concerned with elaborating the Keynesian theory further, but with its conversion into a matter of common sense" (Polanyi 1948, p. v.). He drew a parallel with the atomic theory of chemistry of John Dalton (1809) and the work of Cannizaro (1858) who "set out the whole matter once again - without any important addition - in a new, more straightforward fashion" (ibid). He wanted to do the same with the Keynesian ideas. In a letter of 20th December 1945, Polanyi wrote to Keynes about a "slight attempt at expanding economic and social policy on the basis of your work" (Polanyi 1945e, p. 1.), and stated that his recent book is "too obvious" (ibid) for Keynes and recommended only the "chapter on Russia and the story of John Dalton and Cannizaro in the Preface" (ibid).

Traces of his experience as a physical chemist can be found in the entirety of his book. He uses the following terms to describe economic phenomena: "percolates" (Polanyi 1948, p. 3.); "stream of money" (ibid); "flow of money" (ibid); "draining away" (ibid, p. 9.); "sucking pump" (ibid, p. 10.); "squirting pump" (ibid); "draining" (ibid); "swamping" (ibid); "sucking effect" (ibid); "excess of sucking" (ibid); "rate of sucking" (ibid, p. 11.); "rate of squirting" (ibid); "squirting' effect" (ibid, p. 20.); "squirting" (ibid); "two pumps" (ibid, p. 21.); "gap of a sucking" (ibid); "sucking" (ibid); "self-accelerating" (ibid, p. 25.); "gathering momentum"
He revisited Keynesian ideas and at the same time made them more comprehensible by using familiar terms from laboratory chemistry. By introducing "sucking" (Polanyi 1948, p. 21.) and "squinting" (ibid, p. 11.), for example, he was able to express more properly the change in the flow of money. Both these terms suggest that the examined phenomenon goes from one space to another (i), and that is has a directing force leading the change (ii). Polanyi’s terms might be seen suggesting that the economy is similar to a system of communicating vessels.

Developing the metaphor further, we might see that in such a model money is the main ‘liquid’ getting sucked and squirted from one container to the other representing economic sectors. Terms like “economic machinery” (ibid, p. 46.), “financial machinery” (ibid, p. 107.), “governmental machinery” (ibid, 136.), “budgetary machinery” (ibid, p. 48.) suggest that these were seen as consisting of multiple subparts, each working for a common purpose.

Other transformations from physical chemistry to economics might also be traced in his shift. As the head of a chemical laboratory, Polanyi used his staff and equipment to build ‘economic machines’. These machines were using chemical apparatus to represent economic processes. As far as we know, they built three of these machines, and at least some of them were using unique components created by Polanyi’s glassblower Martin Schmalz who was hired and moved to Manchester from Berlin. Other known associates participating in building this apparatus were Ralph Gilson and Syar. The narration of his Unemployment and Money: The Principles Involved (1940n) film interestingly did not include most of these terms, although a few can be found (“trickling” (13:31); “drained away” (26:04); “drainage” (33:55)) that possibly would not have made it into the script without his chemical experience.

Interestingly, when Polanyi’s cousin, Ödön Pór took on the task of translating Polanyi’s Full Employment and Free Trade (Polanyi, 1945f) to Italian and came up against a difficulty in the translation he intended to dissolve it by using a physical term for an essentionally economic phenomenon. In a letter of 30th August, 1947, Pór wrote to Polanyi that “the difficulties of the translation will be many.F.i., the word “gap” has no exact equivalent in [Italian; I may use a technical term (from electricity) “sfasato”, “sfasamento””(Polanyi, 1947b, p. 1.). Sfasato is the simple past form (passato prossimo) of the verb sfasare and means disturbing or altering something either in a physical (e.g., electric phase) or in a moral sense. Sfasamento is (electric) phase displacement, and marks a phase difference between two periods. Another letter from Pór called attention to the growing entanglements of natural and social sciences in the life of both Pór and Polanyi by emphasizing its strangeness: “We are all crazy: your line is chemistry and physics and you write on finance; I am an "economist" and am "inventing", making and selling patent medicines.”(Polanyi, 1947a, p. 1.).

1.4. Crossing and Rebuilding Economics

Some of Polanyi’s efforts might be seen as doing boundary work for a kind of liberal economics, and against “extreme liberalism” (Polanyi 1940g, p. 24.) and “economic planning” (Polanyi undated2, p. 6.). Polanyi identified four weaknesses of “crude liberalism” (Polanyi
1940g, p. 24.) which he used to compare "extreme liberalism" (ibid) and "economic planning" (Polanyi undated2, p. 6.) on one hand, and to build boundaries against these perspectives from a new kind of liberalism, on the other. The success of his boundary work relied on how effectively he could convince the public about the importance of the new kind of liberalism and dissuade it from its two rivals. Such a process could only be effective if it could properly address diverse people living in different social worlds. I have demonstrated that Polanyi's film should be seen as a boundary object because it connected the social worlds of economists, film experts, administrators, government officials, economics tutors and others. It can be seen as an anchor that enabled different groups to work together though they assigned different meanings to the film. I argued that Polanyi can be seen as a boundary shifter because he changed his own identity from a physical chemist to an economist. He transgressed boundaries marking how and for whom economists should represent economic phenomena, and used his skills and experience from his life as a laboratory chemist to transform another world, the world of economics. His film and his boundary work for a new kind of liberal economics both helped him establish an economist identity. His film promoted his recognition and increased his plausibility as someone engaged in economics. His boundary work made him a pioneer in proposing this new kind of liberal economics which would have shortly brought him the label economist if the stream proved to be successful.

The "bridging" or "anchoring" capability of his film as a boundary object was also strengthened by his boundary work and his boundary shifting. While his efforts to build boundaries circumscribing "extreme liberalism" (Polanyi 1940g, p. 24.) and "economic planning" (Polanyi undated2, p. 6.) and establishing a new kind of liberal economics certainly did not offer a 'tabula rasa' for him to establish such a new stream, it undoubtedly provided him some kind of freedom from certain disciplinary conventions. Boundary objects connect different social worlds and thus they need to be comprehensible for different groups of people. The creation and the management of boundary objects is easier when conventions, regulations and constraints are fewer. I have argued that by proposing a new kind of economics Polanyi cut through the complexity of prevailing disciplinary constraints as he needed to match the standards of the emerging stream, not the prevailing ones, which fostered the creation and the management of his film as a boundary object. Polanyi, as a boundary shifter was building an identity as an economist who transgressed boundaries defining how and for whom economists represent economic phenomena. He used his experience from the world of laboratory chemists to transform the world of economists. His novel ways of interpreting and representing Keynesian ideas with metaphors and terms from chemistry might encouraged people to see him as an 'outsider' or 'rebel' not fitting into the mainstream. The latter attribute perhaps made it harder for him to be perceived as a Keynesian by the Keynesians, but perhaps also fostered the perception of his film as a 'better' way of visually representing economic ideas. It likely fostered the perception of him as an economist in the eye of other social groups.

His boundary shift, his transformation from being a physical chemist to being an economist, was supported by both his film as a boundary object and his rhetorical work for a new kind of liberal economics as boundary work. He could use the 'bridge' between the different social worlds his film provided him to make new contacts and find new partnerships to develop his economist identity. Film experts, managers, administrators and economics tutors corresponded with him about his film. By analyzing these letters one can discover how Polanyi's engagement in economics increased in the thirties and forties. His boundary work can also be seen as supporting his boundary shift as breaking with disciplinary conventions which, if successful, might have made it easier for him to be seen as an economist. A change in what counts as doing economics can affect who is considered to be an economist.
The first part of this chapter showed how Polanyi’s efforts counter both “crude liberalism” (Polanyi 1940g, p. 24.) and “economic planning” (Polanyi undated2, p. 6.) and establish a new kind of liberal economics might be seen doing boundary work. The second element demonstrated how his film as a boundary object connected different social worlds and facilitated cooperation between these. The third part of this chapter explored how Polanyi changed his identity from being a physical chemist to being an economist. He was seen here transgressing the boundaries defining how and for whom economists should represent economic phenomena, and using his skills, knowledge and experience as a laboratory chemist to transform the world of economics. The chapter concluded by showing the relations between his boundary work, his film as a boundary object, and his transformations as a boundary shifter.

II. Films for Freedom: Polanyi’s Sociotechnical Imagining to Save Liberalism and the Society

The first chapter has focused on Polanyi’s boundary work against “extreme liberalism”(Polanyi 1940g, p. 24.) and “economic planning”(Polanyi undated2, p. 6.); it showed how his film might be seen as a boundary object connecting the social worlds of different people, and demonstrated his boundary shift from being a physical chemist to being an economist. The chapter has shown how Polanyi’s criticisms of prevailing economic alternatives, his work in connecting different social worlds and his change from chemist to economist are connected.

The second chapter seeks to analyze Polanyi’s vision of the social role of visual presentation of social matters; it explores whether his sociotechnical vision of his film can be seen as a sociotechnical imaginary (Jasanoff - Kim, 2015). The second chapter consists of four subchapters. The first presents the origins of Polanyi’s sociotechnical vision, using fragments of his correspondence from his first consistent accounts about the social transformation or re-arrangement he intended to realize with his film. The second subchapter explores Polanyi’s attempts to embed his sociotechnical vision in diverse bounded communities. Communities of economists, film experts, Rockefeller administrators and economics tutors are analyzed here as making contact not only with Polanyi’s films, but also with his relevant vision. The third portrays the resistance coming from different communities against Polanyi’s sociotechnical vision. The chapter concludes by describing how Polanyi’s vision moved from one sociopolitical setting to another; it seeks to find out whether his vision became a sociotechnical imaginary and influenced social policies.

2.1. Making the Economy Visible: Origins of the Polanyian Vision

Polanyi started to think about a project using motion picture technology to teach economics in 1929 (Scott and Moleski 2005, p. 163.), nine years before his first film premiered in 1938. During the long years of development, he was exchanging ideas with economists, social thinkers, film experts, administrators and many other people. Some of them saw his film as a way to draw attention to vital social issues and as a means to lauch wide-scale social change similar to Polanyi’s vision; others saw it more as a readdress of Keynesian ideas with an emphasis on visual representation. Only a couple of people were involved in the early phase of development when the film project was merely a pack of conjoined ideas. One of them was Oscar Jaszi, who was a former Hungarian minister, radical liberal politician and social thinker.
who fled from the Red, and then the White Terror and emigrated to Vienna (Austria), and then to Oberlin College (Ohio, USA). An analysis of the Jaszi-Polanyi correspondence (from 1933-1948) shows Jaszi was quite an important figure for Polanyi in his shifting towards economics, and social sciences in general. Their letters covered essential social and economic issues of their time, and are particularly important for unpacking Polanyi's socialization in the social sciences; they have bearing on the origins of Polanyi's vision about his economic film. In a letter of 1935 Jaszi wrote that:

"I assign great importance to your film plan. I am curious about how would you like to illustrate such a complex process? If succeeds, it would be undoubtedly a really important achievement. Circa 20 years ago Franz Oppenheimer was occupied with a similar plan. He wanted to illustrate the creation of the Mehrwert as an application of his geocentric theory. Another partial experiment in this field is a board game designed and patented by Norman Angell (I did not see it), which illustrates the circulation of money and the distribution of gold stocks. Maybe it would worth it to see..." [my translation from Hungarian] (Polanyi 1935a, p. 1.).

The name of the game was not included in Jaszi's letter, but it seems highly probable that he was writing about Norman Angell's The Money Game. It was published in 1928 by J. M. Dent & Sons Ltd. (London), five years before the economist Angell won the Nobel Peace Prize in 1933. It seems conceivable that Jaszi heard about the American edition which was published in 1929 by E. P. Dutton (New York) because he was living in Ohio after 1925. The full title of this board game was The Money Game: How to Play it: A New Instrument of Economic Education, and it was primarily concerned with teaching the fundamentals of banking and finance to those without any related formal training. The 'newness' of such an instrument was its great emphasis on the visual representation of economic matters by using thematic illustrated cards. These visualizations are shown in the next chapter, but in this chapter we are more interested in why such a board game was designed by Angell and what possible common points can be found with the Polanyian sociotechnical vision.

Angell gave the title of his Nobel lecture Peace and the Public Mind. His speech was mainly about politics, peace and public opinion. One paragraph seems particularly relevant to quote here:

"Surely it is not beyond the wit of our educationalists to develop, through education, the particular skill which enables the ordinary man, the ordinary voter, to apply such commonplace truths to the guidance of the policies for which he is responsible and which he imposes upon his government. Not more knowledge but better use of the knowledge which we now have, is perhaps the main educational need and the main educational problem which confronts us." (Angell 1935)

While there is no definite recording confirming that Polanyi checked The Money Game or other works of Angell, the Polanyian stance on the role of visual representation of social matters, and Polanyi's insights on the popular education of economics has important commonalities with Angell's ideas. I would not go so far to say that Polanyi was working on an Angellian educational problem, or from an Angellian approach, or that Angell was working on a Polanyian program. It feels a lot safer to say that they both attributed great importance to public opinion; they both saw a threat in the spread of fallacies and misconceptions among 'ordinary men' or 'common laymen', and both suggested a reform in education based on the "better use of knowledge" (ibid) or "its conversion into a matter of common sense" (Polanyi 1948, p. v.). Further common points can be found by visiting Angell's other works. He wrote Europe's Optical Illusion (Angell 1909) which was not primarily concerned with what Europeans physically see in an illusory way, but with what they do not adequately comprehend. The relation between seeing and understanding social phenomena was something Angell was playing with, using metaphors to help his readers in some cases, and creating actual physical representations to make things visible in others. His book The Great Illusion (Angell 1910)
served as an inspiration for the French film *La Grande Illusion* (1937). Regarding Jaszi’s reference to Franz Oppenheimer, it is unclear what Jaszi meant by Oppenheimer’s plan to illustrate some aspects of his Mehrwert theory.

Another notable correspondent in the early phase of the development of Polanyi’s film was John Grierson from the Film Unit of the General Post Office. In a letter of 13th December 1935, Polanyi wrote to him that:

“I am sending you the film manuscript and also a few pages (”Notes on a Film”), in which you will recognize the suggestions made by you yesterday: Democracy by enlightenment through the film...What I wish you to judge is the symbolical technique of present social problems. If this technique is good it should open an important course of action” (Polanyi 1935b, p. 1.).

Even though Polanyi was primarily interested in Grierson’s opinion on the “technique” (ibid), it seems that he was also engaged in the development of Polanyi’s related sociotechnical vision. "Democracy by enlightenment through the film” (ibid) succinctly epitomizes what was Polanyi’s vision about, and Grierson seemed to be more interested in this, than the “technique” (ibid).

In a letter of 4th September 1937, Polanyi wrote to Charles V. Sale, an official of the Rockefeller Foundation, that he is expecting "the first crude version by the end of October" (Polanyi 1937d, p. 1.), and the final version by the “first half of November” (ibid). Polanyi invited a small group of interested people to his house on the 6th of November to show "the first few hundred feet" (Polanyi 1937a, p. 1.) of the film, so he was keeping the deadlines or was lagging behind only a few weeks. In this letter, Polanyi noted that R. Jeffryes, "who is making the drawings for my money film and is, I believe, the leading maker of diagrammatic films" (ibid) will also participate. Jeffryes also made the illustrations for Polanyi’s *Full Employment and Free Trade* (1945f), thus he can be considered an important ally to Polanyi in his efforts to develop his ideas about the visual representation of social matters. Eventually, Polanyi’s first film titled *An Outline of the Working of Money* was premiered at the Manchester Statistical Society on the 9th of March 1938. In 1945, Polanyi wrote that “a suitable method of presentation may speed up understanding decisively” (Polanyi 1948, p. xvi.), and “I have made for this purpose a diagrammatic film which I have myself demonstrated and explained to nearly a hundred popular audiences in the last six years” (ibid). This is a remarkable number of screenings, and many more were organized and managed not by Polanyi, but others. But how did Polanyi himself articulate his vision on his film to his peers?

A couple of his early economic writings were primarily concerned with developing his vision on how visual presentation of social matters, and particularly with how his film could raise the social consciousness of the society, save liberalism, and, in consequence, Western civilization. This chapter examines whether this vision might be considered a sociotechnical imaginary. In *Dreamscapes of Modernity* (Jasanoff - Kim, 2015), Jasanoff defined sociotechnical imaginaries as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff-Kim 2015, p. 4.). This chapter therefore seeks to show how Polanyi developed his sociotechnical vision, what communities if any held Polanyi’s vision about his film, whether shared understandings of social life and order helped or impeded it, and whether it was publicly performed and institutionally stabilized. This subchapter explores the origins of Polanyi’s vision from the first traces till, as Moodey put it, Polanyi “stopped” (Moody 2015, p. 1.) realizing and promoting his vision in 1945.

He first wrote about the idea of using moving picture technology to represent economic phenomena in 1929. In the next few years, he wrote notes on his film idea and sent them to Oscar Jaszi, Toni Stolper, Hugh O’Neill, Henry Clay, John Grierson and others. His vision about how visual presentation of social matters might raise social consciousness and save liberalism,
as well as Western civilization appeared most clearly in his *Visual Presentation of Social Matters* (Polanyi, 1937f), *Notes on a Film* (1936), *On Popular Education in Economics* (Polanyi, 1937b) and his *Historical Society Lecture* (Polanyi, 1937c). Polanyi wrote that "a correct popular understanding of economic matters would, I believe, being itself a remedy to the greatest deficiency of our economic system, which lies in its lack of social consciousness" (Polanyi 1937b, p. 11.). He was convinced that the "demand for social consciousness in economic life" (Polanyi 1937c, p. 32.) is "a historic force more fundamental for the present [20th - author's remark] century than even the national idea and that the struggle for it will dominate public life until it has found reasonable satisfaction" (ibid). For this struggle, Polanyi suggested a way through a complex education reform changing what and how economics was being taught. He described analogically the origins of his vision in the following passage:

"A complex structure that cannot be seen cannot be understood. If it cannot be brought bodily before the eyes we must be given a picture of it. Nobody would try to explain the inside of the human body without dissection or an anatomic atlas, or the working of a steam-engine without a diagram. One cannot teach chess without a chessboard or geography without maps. The social body is not present to our eyes, it extends over wide areas; its anatomy is as complex as that of the human body, its working is more intricate than that of a steam-engine and the rules which it obeys, the situations which arise in it are more varied than those of chess. Clearly, it is hopeless to grasp the life of this body from descriptions given in speech" (Polanyi 1936, p. 1.).

He suggested developing a sort of 'chessboard' or 'map' of economics to help non-economists to understand its laws. Polanyi proposed that we must "grasp the life" (ibid) of the social body not by "descriptions given is speech" (ibid), but by visual presentation. He thought that the task is to "put up a working model of our economic mechanism, a machinery incorporating in lucid symbols the interaction of the economic forces, showing the flow of goods, the fabric of credit, the various interdependencies and possible equilibria" (Polanyi 1936, p. 3.). He wrote that:

"if I had my way this Society would devote itself to the study of economics as an experiment to create a nucleus of educated people who would acquire an understanding of these matters. Such an experiment would be a first step towards popular education in economics. It would qualify the Society for the further task of discovering how such popular education on a wide scale might be attempted" (Polanyi 1937b, p. 12.).

He argued that in "centres where our model would be exhibited and studied a calm light would spread out, imparting to everyone a more or less simplified version of the central truth and conveying to all the reassuring knowledge of its existence in our midst" (Polanyi 1936, p. 4.). Polanyi believed that "a correct popular understanding of economic matters" (Polanyi 1937b, p. 11.) would be "a remedy to the greatest deficiency of our economic system, which lies in its lack of social consciousness" (ibid). Polanyi hoped that the visual symbolism of social matters that he proposed would be simple enough to be understood by a wide array of people. By elaborating the "new economic ideas" (ibid, p. 12.) and simplifying "their outlines" (ibid), he hoped "to make them comprehensible to the intelligent layman" (ibid). After that, he imagined the ideas could be "carried further among people and serve as guidance for the reorganization of popular social forces" (Polanyi 1937c, p. 12.), thus saving liberalism and eventually Western civilization.

2.2. Embedding and Disembedding Attempts

Polanyi needed different communities to accept his vision, sharing his understanding and helping his imaginary to be publicly performed. One of these communities was the community of economists. By suggesting the use film technology to teach economics, he penetrated the
'terrain' of economists without being one. He made proposals about what and how should be taught in a community of experts in which he did not even have "membership". He recalled a conversation with an economist as a typical one:

"An economist to whom I suggested that a more popular expression should be invented for economics replied that he would rather in favour of a secret language which would obviate the spreading of popular fallacies from economic studies. This economist did not recognize that these spreading fallacies were a symptom of a need for enlightenment, of a craving for social consciousness which must be satisfied if this civilisation is to survive." (Polanyi 1936, p. 2.)

Polanyi developed his vision in such a way because he thought that "fundamental features of economics could be made widely appreciated by the public only by discovering an adequate visual symbolism for their presentation" (Polanyi 1940e, p. 1.). He was convinced that economists had an inadequate idea about what their discipline should look like, and what the desirable relation between economics and the public is:

"Their discoveries have not reached the public; they form a secluded community from which only rumours, in the form of popular fallacies, spread out into the masses. They have, as it were, learned to play chess without a chessboard; they carry a board in their heads, which they have made up of words, and in words they are now playing on it; a public which has never heard of chess watches this admirable feat with puzzled attention. Sometimes a word of the players is re-echoed as a wild slogan, then again there is silence around." (Polanyi 1936, p. 2.)

Economists in Polanyi's account, were seen 'carrying a chessboard in their heads', a chessboard Polanyi was determined to extract, refine and show to the public.

In addition to economists, Polanyi also needed the community of economics tutors to share his vision and be engaged in relevant activities. His imaginary needed to be publicly performed on a much larger scale than what Polanyi could muster alone. The many economics tutors were seen as a link of vital importance in the dissemination of Polanyi's ideas about the visual presentation of social matters. Polanyi knew that he needed allies to be able to attempt "popular education on a wide scale" (Polanyi 1937b, p. 12.). After he received the first letter from Harold Shearman, the education officer of the Workers' Educational Association in May of 1941, they exchanged letters regularly, and were seen to 'join forces' in organizing film screenings. The Association seemed to share Polanyi's vision about his film. Shearman did not just organize "demonstrations" [Polanyi 1938g, p. 3.) but he helped Polanyi in conducting "complete educational experiments" (ibid) by collecting others' feedback and giving his own remarks. Shearman quickly become not just one of the key figures in the dissemination of the film but a key player in the spread of Polanyi's sociotechnical vision. The idea of using the new technology to raise the social consciousness of people was something the Workers' Educational Association could see as compatible with its own agenda. But the W.E.A. was not the only ally of Polanyi.

Another important ally was the Rockefeller Foundation. It gave financial support for the development of the film and managed the American distribution. But did its administrators share Polanyi's vision? The Rockefeller people were not only supervisors monitoring the spending of a grant, but were partners actively engaged in finding new opportunities for Polanyi's film. The letters Tracy B. Kittredge and Ruth Pedersen sent to Polanyi make clear that they rather handled several components of the film's distribution as one of their projects, although they did not care much about Polanyi's sociotechnical vision to raise the social consciousness of people to save liberalism and Western civilization. The letters were focused on giving feedback on past screenings, organizing new ones and link Polanyi with key players in the "distribution of educational films" (Polanyi 1940d, p. 1.) No language in these letters mirrored Polanyi's vision declared most clearly in his Visual Presentation of Social Matters
Economists were neither particularly interested in Polanyi’s vision or in his film per se. They were particularly concerned about the content of the film, evaluating what is included and why, and reflecting on whether something important was missing.

Film experts saw the film mainly as an instance of using film technology, focusing more on how and not on what is represented and why. In a letter from R. S. Lambert of The British Film Institute giving feedback to Polanyi on a screening at the London Film School, Lambert considered it important to note that he “explained the purpose of the film” to the audience. His account, however, converged around “figures” (Polanyi 1938b, p. 1.), “repetition” (ibid), and “movement” (ibid) and did not mention the possible or desirable social effects of the film or how members of the audience saw it.

Were there other people who shared Polanyi’s vision? Ervin Gomperz wrote the following to Polanyi in a letter of 17th March 1938: “I’m glad that the film is such a success and that this new idea of presentation raised attention. After the bigger European war the world will be in severe need to be able to manage its fate based on knowledge and not mindless passions” [my translation from Hungarian] (Polanyi 1938a, p. 1.). The sociotechnical vision on the film focuses around its desirable social effects, and does not view the film merely as a technical device but a way to realize a desirable future. This social aspect is hinted at by Gomperz.

Analyzing Polanyi’s correspondence with Hogben, one might conclude that Hogben shared certain elements of the Polanyian vision, more precisely the importance of social consciousness and the role of popular education. In a letter of 23rd November 1939, Polanyi wrote the following:

“I am not regarding Marxism among scientists as a "bolt from the blue". It is as you say, a symptom of their unsatisfied social conscience. The craving of intellectuals to participate in mass enthusiasm has produced in the past twenty five years many forms of deprivation, but I have never felt inclined to excuse these on grounds of their relation to social conscience...

It is in the field of economic problems that I would be most hopeful for an exchange of views with you. My outlook as a scientist is probably not very different from yours and I think that a talk on your objections to Robbins’ liberalism might clarify important points. I too object to his orthodoxy, but rather because I side with Keynes against him. My main objection to your views concern[s] your references to "plenty". I cannot see that there could ever be a superfluity of man made goods; that it should ever be other than wasteful not to economise with such goods. But if so, "economics of plenty" are meaningless. This question and others closely related to it, are of supreme importance just now....

I agree on your emphasis on education and have done some work in an attempt to invent a new Film technique for economic education. A pamphlet concerning this experiment, which has been carried on energetically during the last eighteen months is sent on with this letter. The general aims of this work are hinted at on page 19." (Polanyi 1939c, 1-4. pp.)

It is to be implied here that Hogben also deemed it important to bring science to the masses, that is, to represent science in a more comprehensible way for people without years of disciplined training. Hogben wrote Mathematics for the Million (1936) and Science for the Citizen (1938), popular science books intended to reach out to a wide readership, several years before Polanyi’s Full Employment and Free Trade (1945f). It should also be noted here that Hogben developed an auxiliary language Interglossa and published it in Interglossa: A draft of an auxiliary for a democratic world order (1943); his intention was to make a social effect. In this case not visual representation but a verbal one is planned to contribute to a process of
democratization. In both cases, ordinary people were expected to be engaged in activities they were not accustomed to. In Polanyi’s vision, ordinary people were expected to participate in film screenings and related discussions and to develop a kind of visual fluency, in Hogben’s they were expected to learn a new language. This is without doubt not an easy task, even if we consider that Interglossa was just an auxiliary language with purely isolating grammar. While certain elements in Hogben and Polanyi’s social thought, and in their vision around their scientific achievements were quite similar, other elements were sharply different. In a letter of 1st July 1941, Hayek expressed his unfavourable opinion on Hogben and a few others in a quite blunt manner to Polanyi:

“I attach very great importance to these pseudo-scientific arguments on social organisation being effectively met and I am getting more and more alarmed by the effects of the propaganda of the Haldanes, Hogbens, Needhams, etc, etc...I think this last specimen is really quite contemptible, but like all the sixpennies it will probably be read by hundreds of thousands. I am seriously thinking of writing to Nature to point out how much scientists discredit the reputation of science such escapades.” (Polanyi 1941b, p. 1.)

It seems that what is popularization of science for some, can be seen as propaganda by another. The boundary between making scientific achievements comprehensible and making comprehensible things scientific seemed to be blurred. Hogben once wittily summarized his attitude to several things as the following: "I like Scandinavians, skiing, swimming and socialists who realize it is our business to promote social progress by peaceful methods. I dislike football, economists, eugenicists, Fascists, Stalinists, and Scottish conservatives. I think that sex is necessary and bankers are not." (Kunitz - Haycraft, 1950, pp. 658–59.). Despite Hogben’s hostile attitude towards economists, and bankers who run the monetary machinery Polanyi seemed to make Hogben think their visions are less different than they previously thought. Hogben wrote: "I feel more than before that we differ mainly on emphasis and agree far more closely than e.g. I do with Haldane, Levy and others" (Polanyi 1939d, p. 1.)

Polanyi’s attempts to reconcile differences and embed his vision were quite remarkable. Despite being a liberal and a supporter of laissez faire, he managed to receive the above Hogben letter stating that “we differ mainly on emphasis” (ibid) from a socialist who advocated basically “a wide range of public enterprise” (ibid, p. 2.).

Others were not so easy to convince. In a letter of 29th July 1941, Polanyi wrote to Max Born that "Socialists like yourself who wish to renew society on the economic side, while keeping mental freedom intact, should join us" (Polanyi 1941c, p. 1.). In his answer of 31st July, Born complained about the "ethical inferiority of the profit system" and the harmful direct consequences "of permitting private profit to interfere with international relations" (Polanyi 1941d, p. 3.) He insistently tried to convince Polanyi about his suggested economic policy, and did not focus on the similarities but the differences.

Polanyi knew that he needed influential allies capable of helping him embed his vision. And John Maynard Keynes was among the most influential possible allies. In a letter of 6th February 1940, Polanyi tried to convince Keynes about his vision:

“During the last three years I have been working at a presentation of monetary circulation and its disturbances by a diagrammatic film. By my first effort I produced a film two years ago which I used for a number of experimental lectures. Last year the Rockefeller Foundation gave the Economic Research Centre Section here £1,000 for the making of a new version of my film. This is now being completed and will be finished in a fortnight or so. Recently the suggestion arose of using the technique thus developed and part of the actual material to make a short and popular film to be shown in ordinary cinemas for the enlightenment of the general public in the elements of War finance. I wrote about this idea to Jewkes and have just had his reply in which he urges me to proceed as quickly as possible with this plan and suggests that I should try to interest you
in it. I am inclined to agree with Jewkes that something quite important might be done now by a novel and striking popular illustration of elementary monetary facts. I am not suggesting of course, that this is certain to be feasible by my method but I see a good chance for it, and I believe therefore that I am justified in putting this matter before you.

I would, of course, also very much like to obtain your advice for the film which is now being completed and which might also help enlightenment in the present emergency if it can be rapidly distributed widely enough to adult classes. I could show you the film which I made two years ago in Cambridge wherever a 16 mm. projector is available but if you were inclined to go to the Studio in London (G.B. Instuctional, Lime Grove, Sinopherds Bush) could show the material of the new film as far as completed and this would, in every respect, be a more effective way of discussing the problem.

If you agree to these suggestions, please make your choice of a day without further correspondence with me because I have no unchangeable appointments during the next fortnight” (Polanyi 1940a, pp. 1-2).

Apparently Polanyi’s proposal did not go down so well, because Keynes wrote the following brief letter dated two days later: “Dear Professor Polanyi, I have much else to do and I must, therefore, regretfully reply to your letter that I cannot spare the time to take an interest in your film” (Polanyi 1940b, p. 1.). Polanyi shared his vision with Keynes with a hope of getting help in embedding his sociotechnical vision in the most important economist community. He offered to go to Cambridge to demonstrate and explain the film himself which would have been a great opportunity for embedding in the Marshall Society and Cambridge University. Unfortunately, Keynes did not show an interest in his film.

One might wonder why Keynes refused to cooperate with Polanyi. Possibly, he was interested in the project, but did not like to be asked for involvement only at the stage that the project was "being completed" (Polanyi 1940a, p. 1.). Second, we must not forget that Keynes was a 'star' economist even in his time, and his advice was sought by a lot of people including members of governments.

Polanyi’s letter, one might notice, was not written in an appropriately humble tone. Perhaps it should have been if he had hoped to get a more supportive answer. Keynes was treated like a genius from his college years when he was mentored by Alfred Marshall himself, and he was ready to embrace such a role without hesitation. He became a policy-advisor and a popular writer who did not refrain to debate with ministers and other important public figures and was regularly approached by presidents and prime ministers for counsel. He was also considered to be among the best economists in academic circles. A more humble tone might have been more persuasive in this case. The timing is another important issue to be raised here. Why did Polanyi approach Keynes for the first time only after he had already been working on his Keynesian films for three years, and was tinkering with the idea to develop such films even a couple of years earlier? From a Polanyi letter of 19th April 1944, to Karl Mannheim we can discern how Polanyi progressed in learning Keynesian economics:

"Nor is my support of Keynes a recent afterthought. I was keenly interested in the Treatise on Money and the Tract on Monetary Reform and when the "General Theory..." came out in 1936 I was already engaged in a film presentation of the Trade Cycle which was than immediately linked on closely to the new Keynesian masterpiece." (Polanyi 1944b, p. 1.)

According to this letter Polanyi read all of the mentioned writings from Keynes by the end of 1936, only three years after he arrived in Manchester to direct a physical chemistry laboratory. Apparently, Polanyi wanted to established himself first as being a somewhat competent person in economics before approaching Keynes. The next subchapter focuses on the resistance against Polanyi’s sociotechnical vision. Attitudes of economists, economics tutors and others are to be analyzed here in details.
2.3. The Silence of the Tutors, the Negligence of Keynes and an Imagined Resistance

Polanyi's idea about how to raise the social consciousness of common laymen by visual representation of social matters was not welcomed by everyone. Polanyi recognized the threat to his vision posed by economics tutors:

"The modern theory of monetary circulation and unemployment which is due to J. M. Keynes (1935) has not yet been sufficiently absorbed by a large number of tutors. They either do not understand it, or only very incompletely. They have very often a very uneasy grasp of it, based on a highly abstract approach which was the original form given to the theory by Keynes. They do not feel secure enough of their subject to venture into a novel, bold and forceful demonstration of it. They get insufficient help from authoritative Economists, who are often unwilling to extract the major issues which they take for granted from the many sidelines in which they are professionally interested. There is also a good deal of hang-over from previous bitter controversies with Keynes which prevents his ideas from being accepted and enunciated in a straightforward fashion.

As I am not a professional Economist I am not able to give prospective users of the film the authoritative assurance concerning its argument which they fail to receive in the proper form from other quarters...In England there is the additional difficulty that Jewkes and other friends among Economists are fully occupied with Government work and cannot do anything outside it" (Polanyi 1942a, pp. 2-3.).

Since a "large number of tutors" (ibid) did not understand Keynesian economics properly, Polanyi was worried that they were not secure enough with the material to use novel kinds of demonstrations and devices to explained it to their audience. He also noted that Keynesian insights are not beyond dispute in the economists community, and tutors who are not convinced about the adequacy of these ideas are probably reluctant to enunciate them as well. As a matter of fact, Polanyi was aware of the possible maleficient impression his position might make on tutors. He was not a professional economist, he had no degree in economics and was not a member of certain elite economist communities. He was a physical chemist from Hungary who was currently working for the University of Manchester, which was not as influential as Cambridge University where the 'Keynes Circus' and the Marshall Society residied or London School of Economics where Robbins and Hayek developed laissez-faire economics.

He argued that since most of the authoritative economists were occupied with government work because of the war, and, because this move towards the popularization of Keynesian ideas had to be taken as soon as possible, he had to take the helm and start to develop these films himself even though in normal circumstances there could have been more competent people to do so.

Another possible threat to Polanyi's vision besides the inadequate grasp and the rejection of Keynesian ideas by economics tutors was the tutors' opinion on the argument expressed in Polanyi's film. In a letter of 13th February 1943, from G.D.H. Cole to Shearman one can find this concern in the most explicit form:

"Thank you for sending me on the film pamphlet. To my mind, this shows the extreme difficulty of applying the method to any subject which is of a controversial character. I know I should strongly dislike having my argument made for me, and I should have thought that most Tutors - at any rate when they had got past the novelty of experiment - would also dislike having their course shared for them in this way. This, of course,
would not apply, where the subject was non-controversial in the sense that competent Tutors would agree about the substance of what needed saying; but comparatively few economic questions belong to this category, and I see a considerable danger in any standardisation of economics teaching, such as the wide use of this type of film would seem to involve.

Of course, this danger would be much less if silent rather than sound versions were used; but it would not be altogether eliminated.

On the other hand, I can see great use in pictorial presentation of essential date which are objective and are not matters of opinion. Of course, you may say that there is now a substantial measure of agreement among economists about the problems dealt with in this particular film. I agree that there is, but not so that the agreed points can be treated apart from those which are not agreed, or at least, so I should have thought” (Polanyi 1943e, p. 1.).

The unwilling silencing of the tutors was thus seen as an undesirable effect of using the film, and Polanyi knew that this could easily impede the distribution and use of his film, and his vision. The sound of the film was seen coercing the silence of the tutors. The tutors felt alarmed and hurt by relying less on their expertise. According to Cole, they did not like the premade arguments. By using these they had less opportunity to explain things the way they wanted to. It was also noted that there was no exact line between controversial and non-controversial points in economics and this must be taken into account if the film was to be spread to a wider audience.

Polanyi also perceived resistance from economists to his vision to use film technology to raise the social consciousness in the society. Part of this resistance was seen as coming from the nature of the discipline:

“The layman's approach is guided by the same instincts which would arouse the interest of the general public. These instincts are different than those of the professional worker who seeks to make a substantial contribution to the subject and who must, therefore become overwhelmingly interested in one section of it rather than in its general outline.” (Polanyi 1937b, p. 13.)

Besides disinterestedness, economists during World War II were seen fully occupied with government work, and lacked the time to elaborate new economic ideas or search for new methods of economic instruction.

A letter of 16th November 1943, by Hicks helps us understand another possible source of resistance about Polanyi’s vision, and that is the influence of the Balogh school on the British climate of opinion:

“Here one is brought at once up against what I might call the Balogh School (which is evidently becoming extremely influential). These people maintain that for a country like Britain a policy of “full employment” is impossible except behind the barricade of thoroughgoing exchange control, which means little less than the nationalisation of foreign trade. Personally, I am too much of a liberal not to find this conclusion exceedingly hateful. But I cannot honestly refuse to see the strength of their case. And I should find it hard to write about the subject at present without making concessions which I don’t yet want to have to make.

The way I look at it is like this. If the Americans make as bad a mess of their affairs in the nineteen-fifties as they did in the nineteen-thirties, then I am convinced that the Baloghs will be irresistible” (Polanyi 1943d, p. 1.).

In this letter, Hicks even refused to give an “authoritative backing” in the form of an introduction to Polanyi's upcoming book Full Employment and Free Trade (1945f) because he felt he could not write from such an approach as Polanyi did. He summarized the perceived
difference in the economic situation and the milieu of the American and British public discussion on economic policies as follows:

"If you and I were living in America, and you came to me with a proposal to write such a pamphlet for an American audience, I should welcome it with enthusiasm - if indeed I hadn't done it myself before you had a chance to get in! But in this country there is a stone of stumbling which always holds me up. You are proposing almost to avoid it - but really one can't avoid it, for it is the essence of our problem [Hicks talks about the question of foreign trade]. And yet what is one to say about it? I don't know; or perhaps I do know, but the only thing I myself could honestly say would be totally unsuitable for a pamphlet such as this" (Polanyi 1943d, p. 1.).

It seems that Hicks did not embraced the teachings of the Balogh school and did not fully agreed with Polanyi either on his suggestions on how to end the economic downturn. What is important to note here, from my point of view, is what he thought about the difference between what could be written down without consequences in America and in Britain. Even though he found the conclusion of the Balogh school "exceedingly hateful" (ibid) and he deemed "it hard to write about the subject at present without making concessions" (ibid), he did not express his worries against this "extremely influential" (ibid) school in public. Hicks expressed that in America he would have welcomed Polanyi's proposal "with enthusiasm" (ibid) because the suggested policies "wouldn't do America any harm" (ibid). It seems that the difference in the economic situation influenced the theoretical milieu, that is, what is more and what is less comfortable to say when someone is expecting to maintain or come to be seen as an economist in the country.

In his answer to Hicks, Polanyi wrote that this is exactly the reason why they need to team up to realize Polanyi's vision:

"I was happy to receive your letter which seems to me to offer a definite opening for the project of a publication under your aegis. I will now write out the plan of the argument which I propose to put forward and I hope that you may find that it is in no way in conflict with the attitude expressed in your letter. On the contrary I think that from the views which you hold and which I very largely share, it follows that the only real hope lies in convincing the English speaking world as a whole of the rational foundations of monetary policy for the prevention of unemployment. And this, I urge, we should try to do now..."

As I see it, the influence of Balogh is by no means limited to stating the case for financial defence measures as and when the need arises, but it is more an attempt to stampede economic policy into a socialist direction on pleas of a general and unconditional kind" (Polanyi 1943e, p. 1.).

Polanyi wrote that "convincing the English speaking world as a whole" (ibid), not the British economists or members of any other expert communities. He wanted to reach out for the general public, the 'common layman' as he phrased it, who seeks to understand the economy without advanced skills in mathematics and training in economics. He intended to convince Hicks to write the introduction to his book to get more attention and to have the book taken more seriously. The spread and the embedding of Polanyi's vision to raise the social consciousness of the society by using film technology met a barrier in the perceived attitude of the economist community towards a way of increasing public understanding of economic ideas. The next subchapter explores what other barriers Polanyi's vision faced and whether it became an extended sociotechnical imaginary.
2.4. Physical and Disciplinal Barriers: How Polanyi's Vision Struggled for Extension

Polanyi had a few opportunities to extend his vision by fostering its development to become a sociotechnical imaginary. First, the officials of the Rockefeller Foundation did not only give Polanyi advice on how to disseminate his film, but connected him with people who could have been key players in making his vision a nationwide or worldwide phenomenon. In a letter of 17th May 1940, Tracy B. Kittredge wrote the following to Polanyi:

"I have received further information from New York as to groups in the United States which would appear to be appropriate agencies with which you should discuss arrangements for the distribution of copies of your film in the United States. Professor Pollard, of New York University, is associated with the Educational Film Institute of that institution. He has known for the past year of your experiments in the production of diagrammatic films illustrative of the functioning of economic processes. They appear to have received one of the preliminary copies of the first edition of your film. The Institute is taking a special interest in films on economic subjects.

My Colleagues in New York suggest that it would be useful for you to take up directly with Professor Pollard the question of arranging to receive copies of your film and to arrange for their distribution in the United States.

Professor Pollard is cooperating with Professor Slesinger of the American Film Centre. As you may know, the American Film Centre has been in touch with the Film Centre group in London in making cooperative arrangements for the distribution of educational films" (Polanyi 1940d, p. 1.).

Polanyi thus was given a relevant contact in a local university (Prof. Pollard from New York University) who could help him get in touch with someone from an institution doing business all over the United States (Prof. Slesinger from American Film Centre). Further analysis of Polanyi's correspondence implies that the suggested plan that would have possibly extended the Polanyian vision was not realized. In a letter of 2nd July 1940, Polanyi gave the following update on the availability of his film to Grierson:

"I thank you for your cable confining the possibility of showing my film to experts in Canada in the first half of July. Unfortunately I have still no news of the arrival of the film in New York and can, therefore, proceed no further in this matter before the summer vacation during which, I understand, everything comes to a standstill in Canada and the United States" (Polanyi 1940f, p. 1.).

Physical copies of the film and even information on them could only travel quite slowly. The mobility of Polanyi himself was encumbered by the circumstances of war, especially the increased fear of foreigners, emigrants and 'aliens' not born and raised in their country of residence. Such attitudes are reflected in a letter of 1st September 1940, from Eugene Wigner to Polanyi: "When your first telegram came, I can assure you that Taylor and also Eyring did everything that was in their power to assure an invitation for you. The matter foundered at that time on the anti-foreigner feeling of the rest of the Chemistry department" (Polanyi 1940h, p. 2.). J.B. Condliffe had difficulties in getting a copy of Polanyi’s film. In a letter of 16th September 1940, he wrote the following: "Thank you for your letter of August 26th and for the cable which preceded it. I have not yet heard from Mrs. Jewkes, but, of course, I shall be very glad to see her as soon as she is free. The Rockefeller Foundation still has the film which they are studying themselves according to a letter I have just had from Miss Walker" (Polanyi 1940i, p. 1.). In a letter of the 9th of October, Kittredge made suggestions to Mrs. Jewkes about organizing a screening when Prof. Condliffe is there and inviting others:
"I think it may be possible to arrange for a showing of Professor Polanyi's film here at the Film Center during the time Professor Condliffe may be here. It will be possible, also, I think to arrange to invite a group of the economists in or near New York who might be interested in the possible use of the film as an aid to teaching and explanation of economic processes. I shall wait to hear the approximate time Professor Condliffe may be here before making any definite arrangements" (Polanyi 1940j, p. 1.).

In a following letter of the 23rd October 1940, Kittredge seemed to organized this meeting: "Professor Condliffe expects to be in New York on November 7th and 8th and we are planning to have a showing of Professor Polanyi's film at that time with a number of economists and other interested persons invited" (Polanyi 1940k, p. 1.). The showing must have been successful since we know from another letter that Prof. Condliffe asked for a copy to use it in his class after the screening:

"Dear Dr. Marschak,

Regarding your inquiry about the use of the Polanyi film for your course on Monetary Policy next semester, the one print available is being shipped to Professor Condliffe within the next few days. He is arranging to show it to various groups of economists on the Coast who will be meeting during the Christmas holidays. What other plans he may have for future showings are not yet certain, although he did mention the possibility of using it around Eastertime. Professor Condliffe thought that after these initial showings, and in the light of the discussions of the film, some plans might be formulated for its wider use.

There is, however, a negative of the film which might be developed at a future date when a definite policy has been determined as to the methods of putting it to wider use" (Polanyi 1940l, p. 1.).

Because the copy was being shipped to Prof. Condliffe, none was left for further borrowing and the request of Dr. Marschak could not be met. It seems relevant to recall here that Polanyi first encountered economics during the seminars of Marschak in 1928, twelve years earlier. Marschak must not be so happy about these news as he wrote a letter to Mrs. Striker, Polanyi's niece, in which he informed her about his difficulties getting a copy from the Rockefeller Foundation.

From a statement of expenditures for the grant received for the "completion and duplication of films illustrative of the functioning of economic processes" (Polanyi 1941g, p. 1.) dated the 3rd of April 1941, we can see how the grant was distributed between different types of expenditures. It is most striking that Polanyi’s "travelling expenses" (ibid) were more than seven times higher than the sum of "publicity expenses" (ibid). Perhaps if Polanyi had invested more money in publicity for his film his vision could have been extended on a larger scale. But one must not forget that the marketing and public relations industry was less developed in the 1940s than it is nowadays. The most efficient ways to reach out to the masses were advertisements in the dailies and putting on the air (radio broadcast) that intended to be shared with the general public. Polanyi seemed to do this right because he received several inquiries about his film, even though his vision was not extended to become a sociotechnical imaginary in the Jasanoffian sense. In wartime, everything was subordinated to the war machine and resouces including the attention of the people and the opportunity for being engaged in anything unrelated to the war were scarce. Polanyi seemed to be aware of this because he made efforts to implement his film in the "Army programme".

In a brief letter of 20th June 1942, by Dr. Basil A. Yeaxlee to Shearman, we find the beginning of the discussions about whether Polanyi’s film or some version of it could be included in a programme of the War Office: "from recent conversations I have held at the War Office I rather think there might be a place for a simpler form of the film in the Army programme in the future. It might be as well not to get too far in with the M.O.I. for the time being" (Polanyi
A few weeks later, Arthur Koestler, Polanyi’s childhood friend joined the discussion by establishing a contact between Shearman and Arthur Calder-Marshall:

"After consultation with Shearman I have established contact between him and Arthur Calder-Marshall of the Ministry of Information Film Division, and the last I heard from Calder-Marshall was that he was waiting for arrangements to see the film and then see what could be done about it. But you probably know this already as Shearman told me that he is keeping you au fait." (Polanyi 1942e, p. 1.)

In a letter of 18th April 1944, Polanyi wrote to Professor Jewkes what he thought about making a film for the government:

"I would be delighted to assist the Government in using my film or a new film based on a similar technique to explain its intention for the prevention of general unemployment. There is a standard size sound print available in London which could be shown at the theatre of the Ministry of Information and I would be delighted to come down to London and take part in the discussion. My next visit to London otherwise would be on or around the 19th and 20th of May, but I can come earlier if desired for the purpose in question. I have thought over the possibilities connected with the film and it seems to me that the best success would be obtained from a new version based on the first three reels, but considerably simplifying and abbreviating the material. It is possible that the representation could be reduced to only two reels even though it would include a demonstration of Governmental intervention which is now absent.

Such two reels I believe could certainly be distributed widely to non-theatrical audiences, and there is just the chance that theatres could also be included if the technique could be touched up to a somewhat higher degree of potency, for example by the introduction of colour which is not quite commonly used for cartoon films.

The print I have referred to is in the keeping of Gaumont-British Instructional Limited, Shepherds Bush, and could be obtained from Mr. Woolfe on presentation of the enclosed letter. I can also let you have a 16 mm. sound print which is in my possession here if you would prefer that" (Polanyi 1944a, p. 1.).

Polanyi did not seem to be afraid of the cooperation with the government in wartime. He rather saw it as an opportunity to develop further his film, and to realize his related sociotechnical vision. Polanyi suggested it was possible to "simplify and abbreviate the material" (ibid) and to add new parts demonstrating "Governmental intervention" (ibid). These possible changes were considered because Polanyi wanted to react to the feedback of his peers. On the one hand "slowness" (Polanyi 1938b, p. 1.) and "repetition" (ibid) in certain parts of the film were noted by film experts. The lack of the representation of governmental intervention, on the other hand, was something economists might have brought to his attention, and also it was something the government might have asked for if a new version was made. In a letter from Shearman to Polanyi, including some earlier remarks from Raybould there is a brief comparison of Polanyi’s film and films of the Ministry of Information, as well as a few suggestions for further development based on the actual economic policies of the time:

"I have now received another letter from Raybould, who says:-

"As to why the film hasn’t been more widely used. I may be wrong, but I think this may be due to the fact that, even by people who are accustomed to using films for teaching purposes, it isn’t appreciated. Too much intensive study of it - not merely looking at it - is required to get out of it all that’s in it. I don’t know much about instructional films: I’ve done very little with them since I finished school teaching, when I used Empire Marketing Board films and so on a good deal; but my impression, from looking through catalogues occasionally and seeing M.o.I. films now and again, is that Polanyi’s film is quite exceptionally austere, so to speak, in its dependence on sheer diagram, and in its very closely-knit structure. I don’t think these are defects - on the
contrary; but if film-minded tutors come to 'Money and Unemployment' expecting it to be understood in the shorter time and with the less amount of active analysis and thinking required in many documentary and semi-instructional films, I can imagine that they'll be disappointed.

"If there's any truth in this opinion as to why the film hasn't been taken up more, the only suggestion, and that I'm afraid not a very practicable one at the moment, that I can offer to improve matters, is that perhaps at a conference of economics tutors arrangements might be made, not merely for the film to be demonstrated, but for a discussion to be held on the conditions of its successful use with classes.

"As to possible developments from the basic idea: all that I can suggest at present is that in view of the greater interest in employment policy which has appeared in the last two or three years, it might be useful to make a popular film concerned not with diagnosis but with prescription. I should think it might be possible to devise a film based on the notion that the basic cause of past fluctuations in employment has been fluctuations in total expenditure, arising primarily out of the instability of investment, and that in principle the way to stability of employment is through stability of total expenditure, towards which the Government might contribute either in the White paper way by offsetting slumps in private industry, or in the Beveridge way by maintaining a high Government demand, or in the Socialist way. It should be possible in such film to combine graphs illustrating the fluctuations of investment and employment with shots of people doing the kinds of jobs which the Government might commission or commence to maintain employment in the future."

I have told him that we did approach the Ministry of Information and they would not bite. They might be responsive to the idea of "filming the White paper". But I am afraid it would be propaganda for their policy" (Polanyi 1945c, p. 1-2.).

Raybould seemed to suggest to develop films based on the White Paper or the route Beveridge proposed. Polanyi was probably not so happy about these suggestions as he was explicitly against these economic policies and thought that they were not useful to ease the economic downturn.

Conclusions

After analyzing the development of Polanyi's vision about his film the time seems appropriate to recall Jasanoff's definition (see the first chapter) and consider which of its elements make us think more about Polanyi's film project as a sociotechnical imaginary and which less. Polanyi's vision on the social effects of the dissemination of his film was more than an individual vision. Economists, tutors, administrators, film experts and others were engaged in activities related to his film, even though only a few of them held his sociotechnical vision. Oscar Jaszi, Ervin Gomperz, Peter Thomason seemed to embrace the Polanyian vision, and perhaps even Hogben (one of the opposers of the free science movement, and therefore an antagonist to what Polanyi and his close allies represented) seemed to share elements of his vision.

Polanyi's vision was not institutionally stabilized. Attempts were made to join the Army Programme and to reach out to the American Film Center and other notable institutions, but these failed due to wartime conditions and an inability to win the most notable economists to the cause (e.g., John Maynard Keynes). Polanyi's vision was publicly performed by himself in written and oral form, and in a few cases by others who used his film and explained the reasons behind it.

The future Polanyi imagined through the dissemination of his film which would bring the related social changes was undoubtedly a desirable one. He wanted to save liberalism and
Western civilization through it; his vision was a constructive response to the perceived undesirable possible futures provided by both orthodox laissez-faire and planning. But Polanyi’s vision was not a sociotechnical imaginary in the Jasanoffian sense because it never was institutionally embedded. All other Jasanoffian ‘requirements’ seems to be more or less satisfied. Polanyi’s vision ‘stopped’ being developed after his *Full Employment and Free Trade* (1945f) was published and his interest turned to philosophy. The next chapter focuses on Polanyi’s visual presentation of economic matters and seeks to discover some yet unnoticed patterns in the visual representation of economic phenomena in the 1930-40s.

III. Polanyi’s Visual Representation of Economic Matters

3.1. Visual Physical Analogies of Economic Laws in the 1930-40s

The previous chapter showed that Norman Angell’s *The Money Game: How to Play it: A New Instrument of Economic Education* (1928) might have been an inspiration to Polanyi, because Oscar Jaszi suggested Polanyi to look at it in 1935, before Polanyi started to transform his idea into a film. The style of the visual representation of the board game and the attached description help in judging whether Polanyi might have relied on this project in the development of his own approach to the visual presentation of social matters. The following visualizations are from the cards of Angell’s *The Money Game*:

![Fig. III/1. Cards from Norman Angell’s *The Money Game: How to Play it: A New Instrument of Economic Education* (1928). From left to right and top to bottom: flourmill, sawmill, pottery, brickfield, wagon works, coal mine, harvester and trawler.](image)

The description framed a situation in which an engineer is shipwrecked on an island with limited resources and with natives unfamiliar with the nature of money. There are three different kind of games to be played: in the first, the islanders are selling machine parts to the engineer who wants to buy them to repair his ship. The winner is the player who holds more notes than the engineer can cover with his gold. In the second, the engineer is selling goods to the islanders who have to compete with each other by bidding. The winner is the player who...
collects the most goods. In the third, the engineer become a financier who lends money to the islanders who bargain with each other. Every game is set on an isolated island, that is, a fictional closed economy without the possibility of foreign exchange. To adapt more to the contemporary economic discourses of the 1930s, it might also be described as a "national economy" without foreign relations. The visual representation on the back of the cards seems to strengthen this interpretation:

Fig. III/2. A standard card back from Norman Angell's The Money Game: How to Play it: A New Instrument of Economic Education (1928).

Polanyi's visual representation in Unemployment and Money had a few similarities with Angell's visualizations. First and foremost, both employ the cartoonish style of representing people and the economy. Second, both focus on the presentation of dynamism. People are working, factory chimneys are emitting smoke, trawlers are ploughing the waves vigorously. Even though Angell's visualizations could not move (unlike the ones in Polanyi's film), part of the representation emphasized a process going on and not a distinct, static state of the (re)presented thing. But such Angellian visualization of economic processes was not the only one that might have influenced Polanyi.

On the 21st of January 1937, Polanyi received a letter from Charles V. Sale (see the above discussion on Sale). Sale attached the letter he received from James D. Mooney (President of General Motors Overseas) on the 15th of December. In this letter, Mooney informed Sale that he and "a young engineering graduate" (Polanyi, 1937a, p. 2.) worked on the "physical analogy" of economic laws" (ibid, p. 1.) he and Sale had discussed a few times. Mooney wrote that "the "tank and float" (ibid) idea as outlined in the "New Capitalism" (ibid) was not adequate for "broadcasting or dissemination of the idea" (ibid) thus it needed to be carried further. He expressed his concern to "carry the message" (ibid) on a large scale, for which he thought he needed "sufficient basis of experiment, of "scientific data"" (ibid). He planned to collect such data by going back to the beginning, and, this time "perform each step physically and in a strictly scientific way"(ibid).

The apparatus Mooney imagined was "more substantial" (ibid), "more readily controllable"(ibid), and "more sensitive" (ibid) in order to make the experiments repeatable. He also imagined the transformation of his "experiments" to motion pictures: "I visualize the apparatus itself as the focal point of any presentation, and therefore, in its construction, proper arrangements to facilitate the taking of comprehensive motion pictures of the apparatus in action will be kept in mind"(ibid).

Mooney expanded his vision by stating that "I feel that motion pictures of the apparatus, accompanied by synchronised spoken explanation, and reinforced if necessary by simplified charts and diagrams in "moving cartoon" style, offer the best means of large-scale presentation" (ibid, pp. 1-2.). He stated that "the apparatus will be constructed with that purpose in mind" (ibid, p. 2.). Sale also attached an extract from John Evelyn's The History of
Chalcography which he sent to Mooney too. Charles V. Sale (Rockefeller Foundation) seemed to be an important advisor of Polanyi and Mooney in the development of visual representation of economic phenomena. But Sale’s letter is more important for analyzing Polanyi’s film than it first appears to be. Careful study of the letter reveals the hidden sketch below by Polanyi on the back of one page:

![Sketch](image_url)

Fig. III/3. Polanyi’s sketch on the back of a letter from 1937. Probably the first visual draft of the essence of his film *Unemployment and Money: The Principles Involved* (1940). Source: The Michael Polanyi Papers, Box 3, Folder 8.

It is undoubtedly a visual representation, and it is probably influenced by what Polanyi has just read in Sale’s (and Mooney’s) account. Also the style and the medium of the visual presentation suggest that it was created shortly after Polanyi received the letter from Sale with the date of 21st January 1937 on it. To find out what is being represented or what Polanyi intended to represent here one must look for traces in his film *Unemployment and Money: The Principles Involved* (1940).

The following explanation is highly speculative because we cannot know for sure what Polanyi meant by each of the letters in his diagram since he did not provide a legend. $B$ probably meant the banking sector; $i$ is income, $e$ is expenditure. $S$, what is flowing into the bank sector, seems to be savings; $a$ is probably aging, $p$ is profit, and $c$ is an additional unit of capital. $F$ possibly stand for factories representing the corporate sector or full employment depending on whether it signifies where people are being employed or what is the maximum level of employment. The formula on the right side of the paper claimed to show what determines the amount of money in the circulation in a given time (from 0 to time $t$). It suggests that the integral of (additional unit of capital ($c$) - aging ($a$)- savings($s$)) shows the amount of money in circulation and that it is the most important association being represented in this diagram.

Since Polanyi had been playing with the idea of making an economic film from 1929, it is clear that he did not borrow or modify Mooney’s idea, but developed his own. This does not mean that Mooney’s diagrams or ideas did not influence Polanyi in his mission to construct a comprehensible visual representation of social matters. Mooney’s vision was mirrored in a couple of apparatus he designed and patented from the 1930s, thus a more detailed analysis could be given to make a ground for the comparison of Mooney’s and Polanyi’s ideas of visual representation of economic matters.

Mooney’s first ‘apparatus’ was patented in 1934. It was called “apparatus designed to illustrate the laws of economics by physical analogies”. The description of the situation to be changed was similar to what Polanyi saw as the main problem of economics education. Mooney stated
that "economic laws have heretofore been taught and demonstrated abstractly, aided by tables and charts showing, for example, price variations with time and with other factors". New means must be found to 'illustrate' such 'laws'. Mooney thought that with his method the economic laws could be "taught concretely so that the mind obtains a physical picture to aid what have hitherto been largely, if not entirely, abstract conceptions." He emphasized that "the laws determining the flow and pressure of liquids are in many respects analogous to the laws of economics, and are, by this invention, utilized in the construction of apparatus for demonstrating economic laws by concrete, visual physical analogies."

Mooney added to the description for the patent that "usually, for lack of adequate statistical data with which to calibrate the apparatus the latter will give qualitative rather than strict quantitative relationships." Mooney summarizes his method as one with which "one can take economic laws, translate them into algebraic expressions, and then express the algebra in a physical analogy." He was convinced that "one can draw out the relationships of interest from the physical analogy into algebraic". The following tables summarize Mooney's patents concerned with the visualization of economic processes in the thirties and forties; they highlight what and how Mooney thought they represent.
<table>
<thead>
<tr>
<th>Selected visual representations from the patent</th>
<th>Mooney's explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram 1" /></td>
<td>&quot;Apparatus designed to illustrate the laws of economics by physical analogies&quot; (Mooney, 1934)</td>
</tr>
<tr>
<td><img src="image2.png" alt="Diagram 2" /></td>
<td>Despite abstract demonstrations and conceptions it is &quot;taught concretely so that the mind obtains a physical picture&quot;.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Diagram 3" /></td>
<td>An apparatus could be constructed to demonstrate economic laws by &quot;concrete, visual, physical analogies&quot; because the &quot;flow and pressure of liquids are in many respects analogous to the laws of economics&quot;.</td>
</tr>
<tr>
<td><img src="image4.png" alt="Diagram 4" /></td>
<td>Economic laws → algebraic expressions → expression by physical analogies.</td>
</tr>
<tr>
<td><img src="image5.png" alt="Diagram 5" /></td>
<td>Sheet 1 (Figures 1 to 3) of Mooney's apparatus patented in 1934, ref. 1,989,878. Shows the variation in gold price of a single commodity with variations in supply and demand and in paper price with changes not only in supply and demand but also in the ratio of gold to currency and credit.</td>
</tr>
<tr>
<td><img src="image6.png" alt="Diagram 6" /></td>
<td>Sheet 2 (Figures 4 to 6) of Mooney's apparatus patented in 1934, ref. 1,989,878. Shows the relationships of supply and demand for a plurality of commodities.</td>
</tr>
<tr>
<td><img src="image7.png" alt="Diagram 7" /></td>
<td>Sheet 3 (Figure 7) of Mooney's apparatus patented in 1934, ref. 1,989,878. Shows a diagrammatic view of an apparatus illustrating the law of supply and demand as it relates to world markets.</td>
</tr>
</tbody>
</table>

Tab. 1. Visual representations and the related explanation in Mooney's *Apparatus designed to illustrate the laws of economics by physical analogies* (1934).
Mooney claimed it is not easy for the "average person" to "visualize what happens" when the family budget changes.

He recalled his description of his ref. 1,989,878. patent from 1934 by offering to illustrate and teach "concretely so that the mind obtains a physical picture" instead of relying on "abstract conceptions."

A new element in Mooney's narrative was his aim "to provide a three-dimensional graphic scheme".

Mooney also slightly modified his liquid metaphor putting a greater emphasis on "hydraulic" aspects. His machines representing "hydraulically" the order of satisfying different types of needs, and, at the end of the patent he declared more explicitly that it is "a hydraulic device for illustrating economic principles".

Sheet 1 (Figure 1) of Mooney's apparatus patented in 1941, ref. 2,297,011. Mooney claimed this "is a perspective view of the apparatus as a whole".

Sheet 2 (Figure 2) of Mooney's apparatus patented in 1941, ref. 2,297,011. Shows the "diagrammatic elevation of the purely hydraulic parts of the apparatus".

Sheet 3 (Figure 3 to 4) of Mooney's apparatus patented in 1941, ref. 2,297,011. A vertical (Figure 3) and a horizontal (Figure 4) section through one of the pistons on the line.
<table>
<thead>
<tr>
<th>Selected visual representations from the patent</th>
<th>Mooney’s explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td>&quot;Apparatus for illustrating economic laws&quot; (Mooney, 1947)</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td>Mooney’s visual representation moved from the conventional physical- and chemical-analogy-based representation towards a more &quot;cartoonish&quot; style.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td>He furthermore emphasized the importance of &quot;giving the mind physical pictures&quot;.</td>
</tr>
<tr>
<td><img src="image4.png" alt="Image" /></td>
<td>Legends were added to &quot;explain what is happening&quot;.</td>
</tr>
<tr>
<td><img src="image5.png" alt="Image" /></td>
<td>More comprehensible explanations of the relation between the explanandum and the explanans were given: the &quot;rise and fall of prices&quot; were represented by the &quot;rising and falling motion of a float which supports the dead weight of an inventory receptacle.&quot; The &quot;large amount of liquid fills the receptacle&quot; was represented &quot;large inventories of goods&quot;, etc.</td>
</tr>
<tr>
<td><img src="image6.png" alt="Image" /></td>
<td>Sheet 1 (Figure 1) of Mooney's apparatus patented in 1947, ref. 2,488,423. Shows a front elevation of the apparatus as a whole.</td>
</tr>
<tr>
<td><img src="image7.png" alt="Image" /></td>
<td>Sheet 2 (Figures 2 to 3) of Mooney's apparatus patented in 1947, ref. 2,488,423. A &quot;diagrammatic front elevation of the apparatus showing the liquid circulation means&quot; (Figure 1), and the &quot;wiring diagram&quot; of the valve-actuating motors (Figure 3).</td>
</tr>
<tr>
<td><img src="image8.png" alt="Image" /></td>
<td>Sheet 4 of Mooney's apparatus patented in 1947, ref. 2,488,423. An enlarged view of part of the mechanism (Figure 7), a section on the line (Figure 8), and the circuit diagram (Figure 9).</td>
</tr>
</tbody>
</table>

Selected visual representations from the patent | Mooney’s explanation

"Apparatus for illustrating relation between economic profit and loss" (Mooney, 1948).

Using "physical analogies" to illustrate business economics remained the same, just as the pivotal role of visualization ("demonstrating the economic laws hydraulically")

Mooney emphasized that he reduced "the number of operating parts visible to the eye" in order to "reduce distracting features to a minimum."

Practical issues were addressed such as put the apparatus more "than chest high".

"Pistons", "cylinders", "rods", "valves", and "shafts" dominated the technical description. The word "pump" was not mentioned, not even once.

Sheet 1 (Figure 1) of Mooney's apparatus patented in 1948, ref. 2,526,260. Shows "one of the prior art economic cross-over or break-even point charts".

Sheet 3 (Figure 3) of Mooney's apparatus patented in 1948, ref. 2,526,260. Shows a front elevation.

Sheet 6 (Figure 9) of Mooney's apparatus patented in 1948, ref. 2,526,260. Shows a "perspective diagrammatic view of the main valve-control shaft, piston-rod shafts, intermediate 'jack-shafts, and the connecting chains and sprockets'."

Tab.4. Visual representations and the related explanation in Mooney's Apparatus for illustrating relation between economic profit and loss (1948).
<table>
<thead>
<tr>
<th>Selected visual representations from the patent</th>
<th>Mooney’s explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td>&quot;Apparatus for illustrating economics by physical analogies&quot; (Mooney, 1949)</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td>Providing a &quot;simple graphic means&quot; for representing the effect of income taxes on residual cash.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td>This invention contains &quot;a series of manually operated valves&quot; to vary the flow, that is, similar to the Polanyian stance on it is to provide &quot;simple graphic means for representing the effect of income taxes on residual cash and changes in the volume of the latter with variations in disbursements, taxes and other factors.</td>
</tr>
</tbody>
</table>

In this patent, unlike the previous ones "aprons" and "apertures" were key terms in the description of the claims. The term "pump" was present in Mooney’s description, but never as "sucking pump" or "squirting pump" which were used by Polanyi as key terms in his *Full Employment and Free Trade* (1945).

Sheet 1 (Figure 1) of Mooney’s apparatus patented in 1949, ref. 2,526,261. Shows a perspective view of the apparatus as a whole.

Sheet 2 (Figure 2 to 3) of Mooney’s apparatus patented in 1949, ref. 2,526,261. Shows a front elevation of the left hand part of the apparatus, and a section of a detail on the line.

Sheet 4 (Figure 5 to 6) of Mooney’s apparatus patented in 1949, ref. 2,526,261. Shows a front elevation of the right hand part of the apparatus, and a section on the line.

Tab.5. Visual representations and the related explanation in Mooney’s *Apparatus for illustrating economics by physical analogies* (1949).
Mooney's first patent concerned with the illustration of economic processes was his *Apparatus designed to illustrate the laws of economics by physical analogies* (Mooney, 1934). He intended to "provide means whereby such laws may be illustrated, and taught concretely so that the mind obtains a physical picture to aid what have hitherto been largely, if not entirely, abstract conceptions" (ibid). Mooney aimed to use "physical factors" (ibid) to represent supply, demand and a couple of other economic phenomena. He built his apparatus primarily on the similarity between the "flow and pressure of liquids" (ibid) and the "laws of economics" (ibid).

In Mooney's second referred patent, *Apparatus for illustrating economic principles* (1941), he claimed "to provide a three-dimensional graphic scheme whereby the budgeting, conscious or unconscious of a family may be illustrated and taught concretely so that the mind obtains a physical picture to aid what have hitherto been largely, if not entirely, abstract conceptions" (ibid). It is clear that this description is almost the same as the one in his previous patent, but this time he sought to develop a "three-dimensional graphic scheme"(ibid) instead of just giving a more simple depiction. In this patent, he gave us an account on the "distribution of the family income" (ibid) by representing "hydraulically" (ibid) the order of satisfying different types of needs. At the end of the patent, he declared more explicitly that it is "a hydraulic device for illustrating economic principles" (ibid).

In the next patent, *Apparatus for illustrating economic laws* (Mooney, 1947), Mooney's visual representation takes a significant shift. The more 'cartoonish' visualisation, the implementation of certain figures (people working at a factory with chimneys - representing the supply of the national economy, people buying at a shop - representing the demand of the national economy, etc.) suggests that Mooney moved from the conventional way of visually representing phenomena in physico-chemistry, and looked for other opportunities. Mooney wrote that "the object of the present invention is to provide improved means for giving the mind physical pictures to aid in grasping abstract conceptions" (ibid). He also introduced legends to "explain what is happening" (ibid) and he wrote that these "being visible continuously while the machine is operating" (ibid) made it unnecessary to remember "what the demonstrator said a few minutes earlier" (ibid). He gave an explanation of how the physical analogies should be interpreted. He wrote that the "rise and fall of prices" (ibid) were represented by the "rising and falling motion of a float which supports the dead weight of an inventory receptacle" (ibid). The "large amount of liquid fills the receptacle" (ibid) representing "large inventories of goods" (ibid). The movement of the float operated a "group of switches connected to various indicator or signal maps which serve to direct the observers attention to one or other of a series of legends describing the nature of the action taking place" (ibid). It now only shows that the "float is moving"(ibid), but also the "direction" (ibid) of the movement. Mooney called his invention "a device for illustrating economic laws" (ibid) using "lamp circuits" (ibid) and "indicator circuits" (ibid) to show economic phenomena. It also contained a pump which Mooney said was "of the centrifugal type as that type delivers water at a constant pressure rather than at a constant volume" (ibid).

In his *Apparatus for illustrating relation between economic profit and loss* (Mooney, 1948), Mooney was "illustrating business economics by physical analogies and using such analogies as an aid to the solution of business problems" (ibid). He criticized the conventional way of representing the "division of income into various types of expenses" (ibid) with "circular charts" (ibid) and "column charts" (ibid). Mooney wrote that these are showing the relationship "between a fixed set of conditions" (ibid), but "in actual practice conditions never are fixed and variations in conditions produce most important results" (ibid). The aim of this invention was to help the "average person" (ibid) to visualize what is happening when "various items of the family budget are increased or decreased" (ibid). Some similarities in the role of visualization of economic phenomena can be found to Polanyi who was determined to raise the "social consciousness" of "common layman" with his economic machines and films. In this patent, Mooney illustrated the income of the family with a "transparent graduated tank containing..."
The height of the liquid corresponded to the income of the family. Mooney compared multiple economic agents with different income levels (“$800-a-year man” (ibid), “$1200-a-year man” (ibid), “$1800-a-year man” (ibid), “$5000-a-year man” (ibid)) to show the “purchasing capacity” (ibid) for different kinds of products. Polanyi took a similar marginal perspective when he showed in his *Unemployment and Money: The Principles Involved* (1940n) how changing conditions foster the opening of new “units” or the closing of old ones. Mooney wrote that the income tank was to be supplied with a “suitable fluid” (ibid) such as “colored water” (ibid). The implementation of the color of the fluid might be seen as a way to increase the level of sensation for the “average person” (ibid). While the first part of the description suggests that this apparatus is to represent “income of the family” (ibid), the claims at the end talk about “income of a person” (ibid).

His next relevant patent, *Apparatus for illustrating economics by physical analogies* (Mooney, 1949), was an invention for “illustrating economics by physical analogies” (ibid), this time with a specific emphasis on illustrating “the effect of subtracting from gross income, first disbursements, such as labor and materials, second taxes” (ibid), and “the division of the residue between such items as new tooling, replacement of machinery and equipment, expansion of facilities and dividends” (ibid). This invention contains “a series of manually operated valves” (ibid) to vary the flow. It is to provide “simple graphic means for representing the effect of income taxes on residual cash and changes in the volume of the latter with variations in disbursements, taxes and other factors” (ibid). In this patent, “aprons” (ibid) and “apertures” (ibid) are key terms in the description of the claims for illustrating economics by physical analogies. The term “pump” is also present in Mooney's descriptions, but never as “sucking pump” or “squirting pump” which were terms used by Polanyi as key terms in his *Full Employment and Free Trade* (1945f).

### 3.2. Shifting Symbols, Fluid-like Motions and Educational Concerns

Unfortunately, only a little is known about Polanyi's economic machines. He focused more on his film project which he cultivated long before he received Mooney's letter from Sale. In this subchapter, I intend to present Polanyi's *Unemployment and Money: The Principles Involved* (1940n) in terms of its style of visual representation. My account primarily follows a chronological order and analyzes the key elements in Polanyi's film making comparison. I give additional context when it is needed for better understanding. Polanyi's film starts with a diagram on unemployment since the beginning of the Great Depression. It is shortly followed by the interventions of the state in the economy (“currency restrictions”, “immigration laws”, “tariff barriers”) before a brick wall. This analogy might be interpreted as suggesting these restrictions impede the natural course of economic processes by an unnatural obstacle, but also as visually representing the tools for defending what is inside from what is outside. The narration states that the causes of the economic downturn could be found in the nature of money. First, Polanyi introduced houses described as “representing the homes of the community”. By watching the film further, we shall think about these “homes” as the national sector of households.
Fig. III/4. Visual representation of homes of the community in Polanyi's *Unemployment and Money: The Principles Involved* (2:09).

People are represented by cartoonish figures moving from one place to another. One group of peoples are moving to "jobs and care of properties" which suggests that Polanyi was conscious that people are not only wage-earners, but they are engaged in "caring" for their other factors of production (land, capital) in "attending their business interests".

Fig. III/5. Visual representations of workers in Polanyi's *Unemployment and Money: The Principles Involved* (2:20, 2:21).

If we take a closer look at the moving symbols Polanyi called "workers", we notice that there are five different representations for only one represented. I argue that this goes against the principles of ISOTYPE, stating that "the good teacher is able to keep out all unnecessary details" (Neurath, 1936, p. 27.) and "puts into his picture only what is necessary" (ibid, pp. 28.), or, in other words: "one [symbol - my addition] has to be like another so far as it gives the same details, and to be different from another only so far as the story it gives is different" (ibid). Polanyi seems to break both of these rules of art since the different clothing of his workers is not necessary for his argument and is not is explained by him. The five symbols are all representing the same thing, the "worker", but by using alternative visuals which makes Polanyi's visual representation unlike ISOTYPE.

Another group moves towards shops representing "housekeepers" and brings back "parcels of goods" to the households. This is a similar but less eye-catching example. "Housekeepers" are represented by two different symbols. The narration, the verbal notation explains us that they are the same "housekeepers" going into the shops, and then go back to their homes, but there are two different symbols, one for 'coming' and one for 'going' housekeepers.
Before they reach the shop, they have an empty basket in their right hands and a coin representing money in their left, while after 'doing the shopping' they have no money in their left, and a full basket representing the recently bought "parcels of goods" in their right. It seems that two symbols are being used to represent the "housekeeper", though this is not beyond dispute because one might represent 'housekeeper-with-money-and-without-goods', and the other 'housekeeper-without-money-and-with-goods'. While using two symbols for representing the coming and the going of the same thing is not unknown to ISOTYPE (see cars), even the slightest change is expected to be avoided in what is being represented.

The end of the working day is signed by another move of the first group ("workers"). This process was described as "daily routine" and all the same until "pay-day". Pay-day is different because workers receive their income as "wage", "profit", or "interest" and bring it back to their households. This money is said to be spent by the "housekeepers". Money is seen "going around" not just as an analogy of moving from one group to another and back, but also literally on the screen delineating a circular movement.

Because "the money eventually goes around", it completes the "money circle". The next step (from 4:36) goes into the details about where the workers "earn their livings". The economic sectors of "fields and mines" (4:49), of "factories and offices" (4:53), and of "shops" (5:02) are introduced by the following representations:
In the first, “food and raw materials of the industry are produced”; in the second, “finished industrial goods are made and distributed”. The third is “shops” that sell the produced materials, “waiting for customers” and “manage the business”. Shops are also described as places where the “homeworkers” - previously described as “housekeepers” - go to “make their purchases”.

The money spent in shops is said to go into the “factories and offices”, and a part of it goes to the “fields and mines” from the “factories and offices”. The economic circulation was depicted by delineating a circular movement in the following way:

Money is seen as “accumulated” in shops, factories and “primary producers”. This money is being paid to the workers who bring it home at the end of each payday. This money will be spent by the “housekeepers” at the shops, thus “from income expenditure is made”. At this point (8:07), a really important thing is happening in the film. The narrator says that the model used so far “must be further simplified”, and the four symbols of the “houses of the community”, the “fields and mines”, the “factories”, and the “shops” are revisualized before the eyes of the audience.
The symbols are transformed into image-texts (Mitchell, 1986) before our eyes having a completely different visual representation, but the new images intended to preserve the same content. The three distinct sectors have been drawn together, and once more "simplified" under a common label, "business units", and visually represented by a rectangle. Houses are also revisualized as one rectangle and are renamed as homes. These shifting symbols and the process of revisualization suggests that representations are not completely determined, and could and should be changed to adapt to the needs of the audience. This approach is unlike the Vienna method because it embraces shifting symbols, while the Neurathian ISOTYPE aimed to use only one representation for one represented thing on principle.

Next, a single section of "homes" and a corresponding section of "business units" are to be analyzed. That is, Polanyi's film leaves the macroeconomy behind for a while and focuses on the causes and effects of the economic-related decisions by one economic agent.
Fig. III/11. A breaking of the macroeconomic perspective in Polanyi's visual narrative: a shift to the causes and effects of economic micro-decisions (by one segment of "homes" and "business units") in Polanyi's *Unemployment and Money: The Principles Involved* (8:30).

The "business unit" is described as containing a "pile of money", its "business capital", which is part of its "equipment". The functioning of the business unit is represented by a moving flywheel (8:42); the process of producing a good is represented by changing the contours of a parcel of goods from dashed lines (8:46) to continuous lines (8:47).

Fig. III/12. Visual representations of the functioning of the business unit with a moving flywheel, and the process of producing one parcel of good with changing contours from dashed to continuous lines in Polanyi's *Unemployment and Money: The Principles Involved* (8:46; 8:47).

Such parcels are shown to "accumulate inside the business unit" until the end of the week. On friday (payday), a pile of money is shown to be moved from the business unit to the home. The time of day is represented by the common symbol of the moon.

Fig. III/13. Visual representations of the accumulation of money in one business unit, and the cash flow from the business unit to home in Polanyi's *Unemployment and Money: The Principles Involved* (9:08).

Then this money is spent by being exchanged for products at the business unit.
The picture above shows how "one day’s expenditure goes to buy one day’s production". From the money being spent, a new "production parcel" will be produced during the day. This process is shown to be repeated until "eventually all the money gets back again to the business unit." The money "circulates from homes to business units and back again"(11:10). Another major revisualization then occurs before the eyes of the audience. The narration says the "symbols can be further simplified" by making the circulation continuous. Then it is said that it would be "simpler" to represent the flow of coins "even". An "imaginary flow" is being introduced as the coins are moving continuously from the business unit to the home, and from the home to the business unit (11:42). Then the narrator says it will be "more convenient for later purposes" to make "the circular flow into a square" (11:59), and then "fuse the coins into a belt"(12:04). The separated pieces of coins are subsequently enmeshed into a continuous flow to form the "money belt".

Fig. III/15. Periodic circulation of money from a business unit to a home unit (11:10); continuous circulation of money from a business unit to a home unit (11:42); continuous "squared" circulation of money from a business unit to a home unit (11:59); and continuous circulation of "fused coins" (12:14) in Polanyi’s Unemployment and Money: The Principles Involved.
The analysis of the two major revisualizations summarized in Figure 5 and Figure 10 suggest that Polanyi gradually developed his model from the cartoonish style of presentation moving towards a more abstract and complex one. This might be explained in terms of the aim of the film, that is, to introduce people with poor analytical and mathematical skills to Keynesian economics which was not easy to grasp first even for economics tutors (see the discussion in the earlier chapters). Common symbols relying more on the visual similarities between the represented and the representation were replaced by new ones designed to lead the audience step by step towards understanding the Keynesian macroeconomic model and its consequences. Polanyi aimed to teach his visual language in multiple stages and seemed to be aware of the learning curve of his audience and was taking it into account in the introduction of his visual language. This was not a feature of Mooney's physical analogies for economic laws or the representations of ISOTYPE. Both rely on symbols fixed 'once and for all' (see Mooney's patent descriptions on what is being represented by what, and the ISOTYPE principle irreconcilable with how Polanyi used multiple representations for the same represented).

In the next step, the model is expanded from analyzing one business unit to cover multiple business units on the upward stream of the money belt, and to cover multiple homes on the downward stream, that is, a return to the macroeconomic perspective.

![Fig. III/16. Visual representation of the "money belt" of multiple home and business units in Polanyi's Unemployment and Money: The Principles Involved (12:43).](image)

Polanyi seemed to be sliding from a macroeconomic perspective to a microeconomic one and back again. In the beginning of the film, we are introduced to a macro-model (0-8:30); then the scope of our analysis is more micro-economic (8:30-12:43), until the appearance of the money belt of multiple home and business units (12:43).

Then the bank was added to the system (13:00). Polanyi used the term "saving" to describe when people put money into the bank, and used "spending" for money being taken from the bank. The narration says that if the two flows of saving and spending are equal, they "have no effect on the general circulation of money" (13:41). Then experiments claimed to show the "excess of saving" and the "excess of spending". Additional savings or as Polanyi called it, "excess of saving " is represented with a darker grey color than 'normal' savings (14:08). Then it suddenly gets recolored and can no longer be differentiated from any other savings (14:10).
What remains is an increased level of savings flowing into the bank. It is also said by the narrator that this increased level of savings reduces the expenditure (14:19). Next, it is shown how this decreased level of expenditure affects the whole circulation (15:09). The change of the thickness of the flow represents the change in the quantity of savings.

It is said that by reducing savings there will be no more decreased expenditure. Then comes the "reverse experiment". Additional spending is represented with the same darker grey color we saw in the previous "experiment" (15:20), and then gets recolored to signify that it cannot be differentiated from any other kind of spending anymore (15:26).
The money collected in the bank through "excess savings" is being put back into circulation in this way, and, eventually affects the whole circulation. The narration says that the money belt "remains constant" when the two flows are equal (16:01). Polanyi also extended his model to show what is happening inside the bank. The "accumulation of money received", the "deposits" are being shown in a tank-like figure. When the narration says savings is in excess of spending, the level of deposits is shown to rise steadily (16:39-16:44) which is represented by a fluid-like filling-up process in the tank (16:44). When spending exceeds savings, the level of deposits is decreased steadily (16:52-16:58) and this is represented by a fluid-like depletion of the tank (16:58).

In the next section, a comparative perspective is used to show what is happening with different business units when one factor is being modified. "Wages", "rent and interest" and "profit" get a new visual representation (17:35) and a new actor, the manager who has costs and profits (17:50), is introduced.
Fig. III/21. Visual representations of wages, rent and interest and profits (17:35), and the introduction of the manager (17:50) in Polanyi’s *Unemployment and Money: The Principles Involved*.

Profits are shown to be different for managers of different business units. The difference of profits is shown to be comparable and commensurable. This might be seen as another change of perspective from macroeconomics to microeconomics.

Fig. III/22. Visualization of comparability and commensurability of managers’ business units (18:06, 18:41) in Polanyi’s *Unemployment and Money: The Principles Involved*.

We get back to the general circulation and are introduced to what is happening with the business units when receipts decrease. We shall see that two of three business units still have profit, but one does not.

Fig. III/23. The manager of a business unit points to the level of profit to help the eye of the audience what to observe (18:52) in Polanyi’s *Unemployment and Money: The Principles Involved*. 
The 'faceless man' representing the manager points to profits (18:52). It must be noted here that when the 'manager ' got introduced to the discourse it was represented with an arm next to his body. This means that the visual representation of the economic actor was modified to emphasize what is 'the most important' to see. It might be interesting to note here that one of Polanyi's correspondents, Barbara Hammond criticized this symbol of the manager in a letter of 3rd February 1941, with undisguised scorn by writing that a “nice little film with little nazi figures trotting about seems wanted” (Polanyi, 1941a, p. 1.). Obviously this figure had nothing to do with nazis. It had his left hand raised (not the right), and he pointed towards profits, not making a nazi salutation. This fragment from Ms. Hammond's letter might make us think she was a careless observer, but it might also make us think about the political and ideological milieu this film was embedded in.

In case of the third business unit profits are seen "disappeared altogether". The narrator asks "what is to be done?" and emphasized it with a question mark. But shortly after answered it ("close it down!"), and strenghtened his answer with an exclamation mark on the screen.

Fig. III/24. Visual representation of decision-making of a manager (19:06, 19:08) in Polanyi's Unemployment and Money: The Principles Involved.

The closing down of the unprofitable business unit is shown as a process of recovering its "business capital" by "selling out its stock". The narration says that "there is less money to flow through the home, and here unemployment arises". Unemployment is represented visually with an empty rectangle (19:39).

Fig. III/25. Visual representation of Unemployment in Polanyi's Unemployment and Money: The Principles Involved.
In reflation the manager of the closed business unit reacts to the increased profits of other business units, and "restarts the business". When the money from the additional business capital reaches home unit "unemployment ceases". Such disappearance of unemployment is represented by a process of steadily decreasing black rectangular till no black 'filling up' material remains, that is, unemployment disappeared. The process takes 6 seconds of film from reaching the home unit to completely end unemployment.

An additional unit of "employable population" is being added. The businessman "observes" the "level of receipts" (21:30), then plan a new factory (21:41), and eventually goes to the bank with "this plan in his mind" to "get the capital he needs" (21:51).

Fig. III/26. Visualization of observation, planning and banking activities of a businessman in case of increased level of employable population in Polanyi's *Unemployment and Money: The Principles Involved*.

The figure representing the manager moves to the tank representing the bank. The needed capital is provided by the bank from the deposits. The way the empty tank representing the needed amount of capital is being filled up might reminds us to the flow of liquids. Machine works is being introduced here as mediator between the new investment and homes. As more people are being emloyed they have additonal expenditure represented by a darker shade of grey (22:15). Then the whole circulation but the relevant stream is being recolored to darker grey, making the relevant flow pop out (22:41).
The general circulation is revisited. Additional receipts, incomes, expenditure and savings affect the whole model. "Windfall profits" are introduced. The narration says that "such is the passage of money while new capital is being invested". When "construction is completed the investment flow ends" and the businessman "takes possession of his new business unit" (25:09). The latter is represented by the representation of the businessman holding the representation of the business unit in his arm.

Fig. III/28. Visualization of how the businessman takes possession of his business unit in Polanyi's *Unemployment and Money: The Principles Involved*.

Then the focus shifted from the businessman to the bank asking "where is the money which was spent from this container?"(26:57), and then showing it (27:03).

Fig. III/29. A visual aid to figure out the way of the recently spent money in Polanyi's *Unemployment and Money: The Principles Involved*. 
The arrows appear one after another, not all at the same time to represent the direction of the flow. The way the arrows appear, the type of the arrows and the exclamation mark all emphasize what is happening with the money.

The next section focuses on the "finances of the new business unit". The ageing of the equipment is being showed by a steady darkening of the color of the wheels.

![Fig. III/30. Visualizing the ageing of equipment in Polanyi's Unemployment and Money: The Principles Involved.](image)

In the next few seconds the wheel diagram is moved from left to right on the x axis, and in so doing steadily changes its color from white to dark grey (28:05). X axis is the age of the equipment, y axis is the value of the equipment. "Ageing " and "renewals" are connected and represented visually with wheels of different color (28:42).

![Fig. III/31. Visual representations of the process of ageing, and the relation between ageing and renewals in Polanyi's Unemployment and Money: The Principles Involved.](image)

Empty tanks and empty 'communicating vessels' show where the viewer might expect the flows in the upcoming seconds (32:49). Then the interrelations are shown one after another with a successive, steady change of the relevant money flows (36:50), and eventually "full employment is being reached." (37:30).
Fig. III/32. Visual representations of the system before being fulfilled with money, during it is being fulfilled with money, and when its reach full employment in Polanyi’s *Unemployment and Money: The Principles Involved*.

The film ends with flashing the *barriers* again written on the brick wall background we have seen at the beginning, then the text *assured employment* flows in written on a sun-like figure to outshine the barriers (38:50), and possibly to emphasize the role of the film in Polanyi’s mission of enlightenment.

Fig. III/33. Visual representation of assured employment outmatching the barriers in Polanyi’s *Unemployment and Money: The Principles Involved*.

### 3.3. Similarities and Differences of the Neurath and the Polanyi Method

We know that Polanyi was aware of the “*unit symbol* method of Neurath” (Polanyi (1937a), 3-4) and the “*Neurath figures*” (Polanyi (1937d), 4) used in the Austrian press and schools. Some (Orosz, 2014) even claimed that Polanyi was the creator of “*animated infographic*” by using ISOTYPE with moving picture in his *Unemployment and Money: The Principles Involved*. This section is aimed to avoid painting with a broad brush, and provides details of Polanyi’s visual presentation in order to show that certain aspects of the visual representation of Polanyi’s film are definitely unneurathian and unlike ISOTYPE. It seems rather safe to say that Polanyi was
playing with the Neurathian method, although some elements of his visual representation of social matters suggest he developed his own method by borrowing certain elements from the 'unit symbol method' of Neurath.

The aim for the development of the Vienna Method was to establish "one international picture language (as a helping language) into which statements may be put from all the normal languages of the earth" (Neurath, 1936, p.17.) Such a "debabelization" effort has similarities and differences with the Polanyian vision. Both visiona planned to reach out for and connect as many people as possible through their implementation, and both deemed visual representation would have a key role in doing so. However the labels, texts and the narration of Polanyi's Unemployment and Money (1940n) suggest that Polanyi primarily made the film for an English-speaking audience, not an international one. One might think that this film might have been only the start of a bigger campaign and Polanyi could have planned to 'transform' or replace most of his verbal notations and include only visual ones when he goes for an international audience, but no archival material found so far suggests that. On the contrary, a really different path of future development seems to be taking shape in his Memorandum on Economic Films (1938g). In this essay, Polanyi wrote that "various versions of these films will have to be prepared for the different levels of academic and popular instruction" [Polanyi, 1938g, p. 4.], and he planned a related manual for each level "suggesting the arguments which can be based on the film" [ibid]. His aim was "the establishment of a library of economic films, amplified by slides and manuals which would be available for instructional purposes" [ibid] which could be more easily seen as efforts to diversify rather than to unify. Polanyi's vision regarding his film embraced the idea that the "real hope lies in convincing the English speaking world" (Polanyi 1943e, p. 1.) which was unlike the 'debabelization' element in the Neurathian agenda.

By emphasizing the importance of verbal arguments in addition to visual representations, Polanyi hit a tone uncommon for most of the proponents of ISOTYPE. The Viennese emphasis upon "education by the eye" (Neurath, 1936, p. 22.) or "teaching by pictures" (ibid, p. 26.) might seem in line with Polanyi's vision at first glance, but one must go into the details of both to have a better comparison. First, let us consider the role of teachers in both. In Neurath's International Picture Language: The First Rules of ISOTYPE (1936), the role of teachers was revisited. The book claimed that "teaching by the eye is much more dependent on good teaching material, and much less dependent on the powers of the teacher than other forms of teaching"(ibid). This "makes it possible for the least able teachers to do good work" (ibid). Teachers needed to take part in the development of "teaching pictures" (ibid, p. 27.) as "a good teaching-picture may only be produced with the help of a good teacher" (ibid). Polanyi also included tutors of economics in his vision to develop and disseminate his film using visual representation of economic matters. He wrote that "they do not feel secure enough of their subject to venture into a novel, bold and forceful demonstration of it" (Polanyi 1942a, p. 2.). As authoritative economists were "fully occupied with Government work and cannot do anything outside it" (ibid, p. 3.), Polanyi took the helm to launch his programme helping tutors of economics to deal with Keynesian economics.

Neurath stated that "a specially important part in the ISOTYPE system as it is at present used is taken by the pictures giving 'statistics' or the relation between amounts of different things - 'amount pictures', or 'number-fact pictures'" (Neurath, 1936, p. 30.). Let us now consider whether the visual representation of Polanyi's film is doing this or not. Polanyi visually represented saving, spending, expenditure and other flows of money in his film. When a change occurs in a money flow, it is being represented visually by a change in the width or the amplitude of such flow. Exact values are not included in the main part of his film; the relations between "different things" are shown in ordinal rather than cardinal way. But this does not make Polanyi's visual representation unneurathian. A lot of ISOTYPE sheets of social, economical and other factors do not use exact values either, but show ordinal relations. There
are a couple of "fact-pictures" representing only the relation of things without using any 'real' value, for example the following:

Fig. III/34. Diagrams from Otto Neurath's *International Picture Language: The First Rules of ISOTYPE* (1936, p. 96.).

The legend on the left page explains how the visual representations on the right should be understood. It seems that for representing certain phenomena Polanyi was doing a similar thing to what Neurath did, in a way. Polanyi used the following technique to visually represent that a flow is 'bigger' than the other, or that a flow is being increased or decreased:

Fig. III/35. Visualizations of the "bigger" flow representing increased quantity and the "smaller" flow representing decreased quantity of flowing money in Polanyi's *Unemployment and Money: The Principles Involved*.

We shall also explore whether the visual representations Polanyi used as a physical chemist might have something in common with his visualizations of economic processes. By taking his writings in physical chemistry related to the transition state theory and potential energy surfaces, we find that these are full of diagrams and graphs. In the *Mechanism of chemical reactions* (Polanyi, 1949), Polanyi analysed the activation energies of three reactions, and wrote the following: "It is not possible in this case to draw a complete diagram of the atomic arrangement in the initial and final states, for the production of a pair of ions from a neutral pair of atoms necessarily involves a far-reaching reorganization of the solvent molecules, and we can picture only the ions, not their solvation shells" (ibid, p. 9.).

In this article we find a model of the transition of tert.-butyl chloride for the reaction Cl⁻ + (CH₃)₃C.Cl = Cl.C(CH₃)₃ + Cl⁻ taking into account the van der Waals radius of substituents.
The explanation under the figure is particularly interesting for us: "The hydrogen atoms are shaded to show the penetration of the Cl particles" (ibid, p. 8.). The shading represents a transition here. Polanyi could have illustrated the chemical reaction by two pictures, one showing the initial state before the reaction, and one showing the final state after the reaction, but he decided to include only one picture. The emphasis was on the process of transition, not the distinct states.

Taking a look at the above diagrams from Über einfache Gasreaktionen Polanyi and Eyring published in 1931 an even larger emphasis on the process of transition can be found:

These diagrams mirrored the transition state theory (TST) developed by Herzfeld (1925), Tolman (1927), Polanyi and Wigner (1928), and Pelzer and Wigner (1932). TST is based on "quantum mechanical calculations of the potential energy surfaces of a reacting system" (Keszei, 2003, p. 67.). The focus is on how reactant molecules take "reaction paths", that is, how the transition of the process chemical reaction takes place. These diagrams, I argue, have
something in common with Polanyi's economic visualizations, and that is the emphasis on the process of transition. I do not want to read too much into this similarity, just to raise two points: the tendency for making transitions visible was present both in Polanyi's illustrations of physical chemistry, and his visualizations of Keynesian economics (i); the entanglements of Polanyi's physical chemistry with his economics were not limited to liquid metaphors for money, therefore calling and treating it like "fluid economics" might be misleading.


Michael Polanyi was doing his boundary activities and was developing his sociotechnical vision in a time of great economic and political turmoil. The Great Depression of 1929-33 brought not only unprecedented social hardships but an era of re-thinking the relations between science and society. Voices calling for subordinating science to social aims were getting increasingly stronger as people sought to find answers to their most urgent social problems. Polanyi's embedding in the wider social and political context between 1933 and 1948 can be explained along at least four strands. First, it must be mentioned that Polanyi grew up in a family with strong ties to European socialist movements. His entanglements with different shades of socialist ideology is to be explored here with a particular emphasis on how dynamics in the family affected his political leaning and vice versa. Second, Polanyi took an active part in the debate around the social role of science in the 1930-40s, and fought against the "planners" like Hogben, Bernal and a few others promoting an idea of science subordinated to social aims. Polanyi argued for the autonomy of science and wrote his most notable early books in the fields of social philosophy and philosophy of science reflecting his "battles" with the planners. Third, Polanyi somehow managed to be seen both as a member of the laissze-faire and the Keynesian camp which had certain political implications. And last, but not least, Polanyi was conscious about his uneasy situation in the United Kingdom. He thought that active political involvement would have been perceived differently because he was a foreigner. Therefore he made attempts to develop his economic thought in a way in which it was seen more as economic theory than as economic policy. He was thereby able to make social effects without taking personal political risks. His sociotechnical vision could have been phrased as a political agenda to reform society through education, but a political movement based on this idea might have caused more trouble than it would have solved in the sharp-edged political-ideological milieu of the 1930-40s. If people had been less reluctant to accept Polanyi's stance about what is wrong with the prevailing system, and more reluctant to accept his criticism of socialist planning, he could have found himself in a role he did not want to take on.

4.1. The Shades of Socialism on Polanyi's Family Life

Polanyi's mother, Cecile cultivated an interest in socialist movements from a young age. She left Lithuania because she was in touch with radical socialists who were persecuted by the authorities. In Hungary, Cecile's literary saloon became a focal point of the intellectual life of Budapest, attracting many famous socialist and a few non-socialists. The socialist thoughts discussed in the saloon could have made an impact on Michael Polanyi, especially in the early years when it was held at their home. But unlike his brother, Karl, he took another road towards liberal philosophy and economics and left behind his background richly interwoven with socialist teachings. It must also be noted here that Cecile's saloon was also open to liberals, most importantly Oscar Jaszi who later became a minister of national minorities.
(1918-1918) in the Karolyi-government. It was Jaszi, "who, with the occasional tough, combative article, declared war on scientific narrow-mindedness and political 'reactionism'" (Litván, 2006, p. 19.) in the *Huszadik Szazad* [Twentieth century] and founded a journal on social issues with an emphasis on reaching out for a wide readership. Polanyi continued corresponding with Jaszi mainly on social and economic issues after the latter emigrated to the United States to teach at Oberlin College.

Michael's brother, Karl was considered to be among the best and brightest socialist economic thinkers, even though he was not really interested in politics but sought to cultivate economic thought which strongly relied on a socialist basis. As Nagy pointed out (Nagy 1994, p. 83.), there was an estrangement in the relationship between Michael and Karl Polanyi from 1935, after the publication of Michael Polanyi's *USSR Economics: Fundamental Data, System, and Spirit* (1935). Karl was reluctant to admit that there were serious problems in the economy of the USSR, and that the official data did not mirror the real economic situation. Others, such as Gulick have argued that there was no real "golden age of common belief" (Gulick, p. 212.) in their relationship, not even in their earlier years because they had "different world-views" (ibid). Gulick also pointed out that it would be a mistake to simply view the tension between Michael and Karl Polanyi as the tension between liberalism and socialism in general (ibid). Both cultivated a somewhat unique economic and social thought which does not completely fit into the mainstream of their relevant ideological courses (ibid, p. 213.). The "dark age" of their relationship endured till circa 1957.

4.2. On the Relation of Polanyi and his Political Adversaries

Polanyi was an active participant in the debate around the autonomy of science which was also a scene of the clash between liberalism and socialism. Polanyi corresponded with Hogben, Bernal and others from the opposing camp. On the one hand, Polanyi was particularly good in discussing matters, even with his ideological rivals. In a letter of 30th November 1939, he seemed to have convinced Hogben on a few things, or at least managed to get him to see their understandings not differing as much they previously thought: "I feel more than before that we differ mainly on emphasis and agree far more closely than e.g. I do with Haldane, Levy and others" (Polanyi, 1939d, p. 1.).

On the other hand, in a letter of 28th October 1941, Polanyi wrote to Blackett that "I am much worried by the hostile tone of your talk to me today. We have always disagreed, yet maintained an entirely genuine link of sympathy. I begin to doubt whether you still believe in this un-Marxist distinction" (Polanyi, 1941e, p. 1.). He sent his "little book" about Soviet Economics (*USSR Economics*) to Blackett, along with a fragment from his correspondence with Colin Clark, author of *A Critique of Russian Statistics* (1939) who admitted to Polanyi that "the more I went into it [the Russian material] the more I found myself in agreement with your conclusions" (Ibid). Polanyi expressed his worries about Blackett's alternative vision:

"I dare say if you and your friends had been as insistent on finding out the truth concerning the Soviet experiment, as I have been myself, we would now all face the future in a different world of mutual confidence. As it is, there seems to be little tradition left of sober and considerate agreement, and only the desire left to deal a blow. Such is my profoundly sad impression today." (Ibid)

In a letter of 3rd November 1941, Blackett made it quite clear what he thought about Polanyi's political leanings: "I hope that you may some day be able to convince me that you are not "one of the leading anti-soviet intellectuals, but your writings and numerous discussions have led me to this view. If I believe it's true, would you have me not say it?" (Polanyi, 1941f, pp. 1-2.) Although the correspondence of Polanyi and Blackett shows that they were both using an
increasingly hostile tone, Polanyi managed to stay in touch with most of his rivals, including one of the most dauntless English supporters of socialism and the planning of science, J. D. Bernal.

In a letter of 10th September 1938, Bernal wrote to Polanyi, "Have you finished your economic film and is it available for exhibition? The Science Film Group here would very much like to get hold of it" (Polanyi, 1938e, p. 1.). He was among the first people to see the film in London. Polanyi was particularly keen in phrasing his critique on Bernal’s book in an adequate way. He therefore asked for the help of Meredith Evans in cutting off the rough edges: "You have the manuscript of my paper now in the press about Bernal’s book and related subjects. Towards the end of that paper my attack assumes sharp forms. Perhaps you could suggest to me where you think that I could soften it without impairing the essence" (Polanyi, 1939b, p. 1.).

4.3. Keynes, Hayek, and Polanyi in Between

The Keynes-Hayek debate was intensely heated in its first decades, the 1930-40s. Research has shown how the economic thought of Polanyi was related to these two streams, and how Polanyi can help to better understand both of them (Biro, 2015). Polanyi was a friend of Hayek, a founding member of the Mont Pélerin Society, and a wholehearted liberal. In the same time he was among the firsts to write a popular book on Keynesian ideas, and, he did pioneering work in visualizing Keynesian economics for the masses. It must be noted that the struggle between Keynesian and Hayekian economic thought could not be entirely separated from political and ideological conflict. War conditions required theoretical concepts with strong State presence, thus the Hayekian admittance that State should not intervene to the economy because even the most gifted and experienced economic advisors cannot be certain that their proposed agenda will do more good than harm, was not among the most attractive ideas for policy-makers. Not surprisingly, Keynesian economics became more influential in these decades also in the eye of the general public seeking solutions to end the economic downturn.

4.4. A Hungarian on the Boundaries of British Politics

Polanyi found himself in a politically tense situation upon entering the United Kingdom in 1933 which only got more sensitive with the outbreak of World War II. He knew that as a foreigner he was seen as a guest, in a sense, and that one false move or ambiguous statement could cause him to be expelled from the country. In a letter of 6th May 1942, Polanyi wrote the following to Toni Stolper:

"I do not, myself, like to appear too much in public. I feel very happy here and could indeed imagine no more favourable surroundings, no more friendly atmosphere. But I must be very careful not to appear to intervene in public affairs. During a crisis of this kind the nation’s family feelings are stronger than ever and they are anxious to listen undisturbed to the voice of their own tradition.

Besides, quite frankly, I very often feel that I do not possess the instincts for reacting properly in a public discussion in this country. I am inclined to take too literally views which are expressed in an experimental kind of way and are not meant to be discussed in all seriousness. I much prefer, therefore, to keep to the abstract fields of thought and to exercise whatever influence I may have, which is extremely slight, through contacts with friends" (Polanyi, 1942c, p. 2.).

Polanyi seemed to be grateful for the "atmosphere" in England, but he was aware of the wartime situation and its effects on policy-making, and politics in general. The power of the
nation’s traditions, the crescendo of “family feelings” made the involvement of public affairs as a foreigner undesirable. He saw his participation in public debates as risky for one more reason: he lacked of “instincts” necessary for public discussion in the UK. That is, he did not know what to say and how to say it in public debates in the country. He expressed his inclination to refrain from politics and declared his intention to participate only on abstract grounds. One letter make it pellucid what Polanyi thought about the relation of intellectual efforts and public participation in wartime England:

“I feel much honoured by your request for advice in the general question as to whether and how far you should try to advocate reforms in University life. Personally I find it extremely difficult to make any contribution to this kind of problem, because I still feel somewhat uncertain in making the mechanism of the educational machinery in this country. Moreover there are in most cases some previous controversies to be taken into account which largely shape the minds of people who have grown up in them, and are difficult to appreciate by the newcomer.

However, if I may venture to put your question in a more general form: as to the nature of the participation in the life of the community which is open to the “quest for life”, outside his strictly professional functions - the following dividing line seems to me useful. No contribution to thought are resented by our English friends, however widely they may roam; but I think our friends would resent any contributions by us to public action, unless these are demanded by strict professional responsibility. Thus I think any serious intellectual effort, however far-reaching its practical implications, even though touching upon the most decisive questions of international or economic life, would be well received; but a comparatively small active participation in public life, as by opposing the government of the day, or the Regional Commissioner, or even the Vice Chancellor, would probably be felt as an intrusion” (Polanyi, 1942f, pp. 1-2.).

Polanyi revisited his humble eschewal of public discussions in a letter of 9th July 1942 to Max Born, but this time he unpacked what he meant by his missing “instincts” in the other letter by referring to the effects of the controversies on the mind of the people who have “grown up in them”. He thought he had “grown up in” different controversies than most of the people in the United Kingdom, so he could not take these into account in public discussions.

Polanyi suggested a dividing line to Born to help him understand what is probably “felt as an intrusion” and what is not. His construction of the dichotomy was marked by his underlining of two words, thought and action. Thought he expected to be able to roam freely on English soil, while public action, even of least importance, was seen as being taken amiss. We might wonder how this might have affected Polanyi’s endeavors in the 1930-40s. Could this have influenced him to somehow disguise his political efforts in the sanctuary of abstract grounds? What elements of his economic thought can be seen having political implications, if any? Could his efforts to see his contributions more as economic thought and less as economic policy be exposed?

This dissertation on the sociotechnical imagining on Polanyi’s film has revealed possible and desirable social transformations based on Unemployment and Money: The Principles Involved (1940n). Polanyi thought that his economic “ideas might be carried further among people” (Polanyi, 1937b, p. 12.) to form "a nucleus of educated people" (Ibid, p. 13.). He envisioned that “from such centres where our model would be exhibited and studied a calm light would spread out” (Polanyi, 1936, p. 4.) and “a social consciousness would arise, encompassing all our activities” (Ibid, p. 5.). According to Polanyi if the “society would devote itself to the study of economics” (Polanyi, 1937b, p. 13.) we will reach "a true consciousness of our common life" (Polanyi, 1936, p. 3.) and will re-conquer “the foundation of freedom” (Ibid, p. 5.). That means that his sociotechnical vision was, in a sense, an answer to the “craving for social consciousness” (Ibid, p. 2.), which he viewed as a “historic force more fundamental for the present century than even the national idea” (Polanyi, 1937c, p. 32.). He hoped that his vision
might put such "re-organisation of popular social forces" (Polanyi (1937b, p. 12.) into action without being seen as public action (or doing politics), but having the effect of saving liberal economics, and eventually Western society.

**Summary**

This dissertation showed how visualization and saving a particular kind of liberal economics was connected in the sociotechnical imagining of Michael Polanyi in the 1930-40s. The first chapter explored Polanyi's boundary work against both "extreme", "orthodox" or laissez-faire liberalism and socialist planning. Polanyi emphasized the "weaknesses", "misconceptions" and "inabilities" of these "two most pernicious extremes", and in doing so built a plausibility for a reformed liberalism with an ability to gradually enhance social consciousness. Polanyi argued for a new kind of liberalism which he aimed to cultivate. His boundary work for such a reformed liberalism can therefore also be seen as setting the scene for his boundary shift from physical chemistry to economics. He needed allies from multiple social worlds both for reforming liberal economics and for redefining himself as a person competent in economics. His economic film, *Unemployment and Money: The Principles Involved* (1940n), was a boundary object, which, in a sense, connected the social worlds of economists, economics tutors, film experts, managers and others. "Bridging" or "anchoring" these social worlds did not necessarily mean these actors supported Polanyi's sociotechnical vision ("democracy by enlightenment through the film"). On the contrary, threats and alternative interpretations appeared and these had to be managed if Polanyi wanted to realize his vision.

The second chapter traced Polanyi's struggle to realizing his vision from the origins of his film idea (and probably the first visual draft on the back of a letter) until he "stopped" cultivating his sociotechnical vision at the end of the 1940s. Attempts to embed and disembed his vision have been analyzed in detail. I explored how the sound track of the film was perceived as forcing silence and curtailing opportunities, for making personal arguments, by economics tutors. A possible alternative sociotechnical vision of the army (propaganda for selling their own policies) was considered, but no supportive evidence was found. The analysis shows that Polanyi's sociotechnical vision did not become a sociotechnical imaginary in the Jasanoffian sense because it lacked institutional stabilization. The latter could have been provided by either the Army programme (Film Division, Ministry of Information) or the American Film Institute. Both of these groups Polanyi planned to work with but never actually did take a definite step to do so.

The third chapter sought to show that Polanyi's visual presentation of social matters was not something which emerged like Pallas Athena directly from the head of Zeus. A comparison was made between Polanyi's early visual representation in physical chemistry, and with similar projects of others seeking to visualize complex economic processes for the masses in the 1930-40s. Evidents clearly shows that Polanyi was aware of some of these projects (Angell's, Mooney's, Neurath's); while his method seemed to have certain elements in common with aspects of one or two of these projects (cartoonish style, fluid-like motions), he developed a unique way of visually representing economic processes (shifting symbols, multi-level learner-center unfolding of visual argument). These unique elements were shown to be relevant in discussing Polanyi's sociotechnical imagining because they seemed to be implemented with the aim to make the film more comprehensible. "Democracy by enlightenment through the film" required a film which could be understood by a wide array of people, some with and many without a sophisticated level of visual fluency. Polanyi, I have shown, intended to use a style of visual presentation which also taught a kind of visual fluency by gradually replacing cartoonish and common representations (based on visual similarity between the representation and the
represented) with abstract ones (based on a recently learned relation between the representation and the represented).

The fourth chapter examined the political background of Polanyi’s boundary activities and sociotechnical imagining along four strands. First, it was shown that Polanyi grew up in an intense intellectual and political milieu within his mother, Cecile's saloon. There were strong socialist but also liberal influences on him and his siblings in their youth. Such influences moved Karl towards socialist economic theory, and Michael towards finding a way to save liberalism in the economic and political turmoil of the decades of the Great Depression, the Keynes-Hayek Debate, and World War II. Second, political implications of Polanyi’s fight for the autonomy and freedom of science have been treated through an examination of Polanyi’s correspondence with his most notable adversaries from the group of ”planners” (Bernal, Hogben, etc.). Third, this chapter has shown how Polanyi managed to be seen as a member of both the laissez-faire and the Keynesian camps without making inconsistent statements and without radically changing his opinion from time to time. Polanyi’s dexterity was remarkable in an era when it was generally thought to be impossible to attach to both of these opposed camps in a plausible way. And last, but not least the dissertation has shown why Polanyi was consciously balancing on the edge of economic policy and economic theory. He struggled to make societal effects without taking personal political risks as an outsider in the United Kingdom. Polanyi was developing his vision to save liberal economics and Western society and in doing so transformed his own disciplinary embedment from physical chemistry to social sciences.

Bibliography

_____ (1910) The Great Illusion.
_____ (2003) A kémikus Polányi indulása és a tudományfilozófus Polányi gyökerei [Beginnings of Polanyi, the Chemist and Roots of Polanyi, the Philosopher of Science], Polanyiana 2003/1, pp. 49-54.


Mooney, J. D. (1934) Apparatus designed to illustrate the laws of economics by physical analogies, patent number: US ref.1,989,878.

Mullins, P. (1976) Hermeneutical and Aesthetic Applications of the Thought of Michael Polanyi, PhD. dissertation, Theology and Art, Graduate Theological Union, Berkeley, CA.
Polanyi, M. (1935a) A letter of 24th November 1935 from Oscar Jaszi to Michael Polanyi, Michael Polanyi Papers, Box 3, Folder 5, Special Collections, University of Chicago Library.
(1935b) A letter of 13th December 1935 from Michael Polanyi to John Grierson, Michael Polanyi Papers, Box 3, Folder 5, Special Collections, University of Chicago Library.

(1936) Notes on a Film. Michael Polanyi Papers, Box 25, Folder 10, Special Collections, University of Chicago Library.

(1937a) A letter of 21st January 1937 from Charles V. Sale to Michael Polanyi, Michael Polanyi Papers, Box 3, Folder 8, Special Collections, University of Chicago Library.

(1937b) On Popular Education in Economics, Michael Polanyi Papers, Box 25, Folder 9, Special Collections, University of Chicago Library.

(1937c) Historical Society Lecture, Michael Polanyi Papers, Box 25, Folder 10, Special Collections, University of Chicago Library.

(1937d) A letter of 4th September 1937 from Michael Polanyi to Charles V. Sale, Michael Polanyi Papers, Box 3, Folder 9, Special Collections, University of Chicago Library.

(1937e) A letter of 1st November 1937 from Michael Polanyi to E.R. Jacob, Michael Polanyi Papers, Box 3, Folder 10, Special Collections, University of Chicago Library.

(1937f) Visual Presentation of Social Matters, Michael Polanyi Papers, Box 25, Folder 9, Special Collections, University of Chicago Library.

(1938a) A letter of 17th March 1938 from Ervin Gomperz to Michael Polanyi, Michael Polanyi Papers, Box 3, Folder 11, Special Collections, University of Chicago Library.

(1938b) A letter of 4th August 1938 from R. S. Lambert (The British Film Institute) to Michael Polanyi, Michael Polanyi Papers, Box 3, Folder 12, Special Collections, University of Chicago Library.

(1938c) A letter of 3rd September 1938 from Magda Polanyi to Michael Polanyi, Michael Polanyi Papers, Box 3, Folder 12, Special Collections, University of Chicago Library.

(1938d) A letter of 6th September 1938 from Magda Polanyi to Michael Polanyi, Michael Polanyi Papers, Box 3, Folder 12, Special Collections, University of Chicago Library.

(1938e) A letter of 10th September 1938 from J. D. Bernal to Michael Polanyi, Michael Polanyi Papers, Box 3, Folder 12, Special Collections, University of Chicago Library.

(1938f) A letter of 12th December 1938 from Oliver Bell to John Jewkes, Michael Polanyi Papers, Box 3, Folder 13, Special Collections, University of Chicago Library.

(1939a) Memorandum on Economic Films. Michael Polanyi Papers, Box 3, Folder 6, Special Collections, University of Chicago Library.

(1939b) A letter of 21st September 1939 from F. A. Hayek to Michael Polanyi, Michael Polanyi Papers, Box 3, Folder 14, Special Collections, University of Chicago Library.

(1939c) A letter of 23rd of November 1939 from Michael Polanyi to Lancelot Hogben, Michael Polanyi Papers, Box 4, Folder 2, Special Collections, University of Chicago Library.

(1939d) A letter of 30th November 1939 from Lancelot Hogben to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 2, Special Collections, University of Chicago Library.

(1940a) A letter of 6th February 1940 from Michael Polanyi to John Maynard Keynes, Michael Polanyi Papers, Box 4, Folder 3, Special Collections, University of Chicago Library.

(1940b) A letter of 8th February 1940 from John Maynard Keynes to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 3, Special Collections, University of Chicago Library.

(1940c) A letter of 19th February 1940 from John Maynard Keynes to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 3, Special Collections, University of Chicago Library.

(1940d) A letter of 17th May 1940 from Tracy B. Kittredge to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 4, Special Collections, University of Chicago Library.

(1940e) Statement by Professor M. Polanyi on the Main Facts in the Genesis of the Economic Film. Michael Polanyi Papers, Box 4, Folder 9, Special Collections, University of Chicago Library.

(1940f) A letter of 2nd July 1940 from Michael Polanyi to John Grierson, Michael Polanyi Papers, Box 4, Folder 4, Special Collections, University of Chicago Library.
____, (1940g) Collectivist Planning, Michael Polanyi Papers, Box 26, Folder 3, Special Collections, University of Chicago Library.

____, (1940h) A letter of 1st September from Eugene Wigner to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 5, Special Collections, University of Chicago Library.

____, (1940i) A letter of 16th September 1940 from J. B. Condliffe to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 5, Special Collections, University of Chicago Library.

____, (1940j) A letter of 9th October 1940 from Tracy B. Kittredge to Mrs. Jewkes, Michael Polanyi Papers, Box 4, Folder 5, Special Collections, University of Chicago Library.

____, (1940k) A letter of 23rd October 1943 from Tracy B. Kittredge to Mrs. Jewkes, Michael Polanyi Papers, Box 4, Folder 5, Special Collections, University of Chicago Library.

____, (1940l) A letter of 12th December from Ruth Pedersen (Rockefeller Foundation) to Jacob Marschak, Michael Polanyi Papers, Box 4, Folder 5, Special Collections, University of Chicago Library.


____, (1940n) Unemployment and Money: The Principles Involved, G.B. Instructional Ltd.

____, (1941a) A letter of 3rd of February 1941 from Barbara Hammond to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 6, Special Collections, University of Chicago Library.

____, (1941b) A letter of 1st July 1941 from F. A. Hayek to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 7, Special Collections, University of Chicago Library.

____, (1941c) A letter of 29th July 1941 from Michael Polanyi to Max Born, Michael Polanyi Papers, Box 4, Folder 7, Special Collections, University of Chicago Library.

____, (1941d) A letter of 31st July 1941 from Max Born to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 7, Special Collections, University of Chicago Library.

____, (1941e) A letter of 28th October 1941 from Michael Polanyi to Patrick Blackett, Michael Polanyi Papers, Box 4, Folder 7, Special Collections, University of Chicago Library.

____, (1941f) A letter of 3rd November 1941 from Patrick Blackett to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 7, Special Collections, University of Chicago Library.

____, (1941g) A Statement of expenditure (Rockefeller Foundation Grant), Michael Polanyi Papers, Box 4, Folder 6, Special Collections, University of Chicago Library.


____, (1941i) The New Economics, Michael Polanyi Papers, Box 26, Folder 9, Special Collections, University of Chicago Library.

____, (1942a) A letter of 12th January 1942 from Michael Polanyi to Tracy B. Kittredge (Rockefeller Foundation), Michael Polanyi Papers, Box 4, Folder 8, Special Collections, University of Chicago Library.

____, (1942b) A letter of 2nd February 1942 from Tracy B. Kittredge (Rockefeller Foundation) to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 8, Special Collections, University of Chicago Library.

____, (1942c), A letter of 6th May 1942 from Michael Polanyi to Toni Stolper, Michael Polanyi Papers, Box 4, Folder 8, Special Collections, University of Chicago Library.

____, (1942d) A letter of 20th June 1942 from Basil A. Yeaxlee to Sherman, Michael Polanyi Papers, Box 4, Folder 8, Special Collections, University of Chicago Library.

____, (1942e) A letter of 8th July 1942 from Arthur Koestler to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 8, Special Collections, University of Chicago Library.

____, (1942f), A letter of 9th July 1942 from Michael Polanyi to Max Born, Michael Polanyi Papers, Box 4, Folder 8, Special Collections, University of Chicago Library.

____, (1942g) A letter of 1st October 1942 from Raybould to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 8, Special Collections, University of Chicago Library.

____, (1943a) A letter of 13th February 1943 from G.D.H. Cole to Harold Shearman, Michael Polanyi Papers, Box 4, Folder 9, Special Collections, University of Chicago Library.
_____, (1943b) A letter of 13th February 1943 from Peter Thomason to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 9, Special Collections, University of Chicago Library.
_____, (1943c) A letter of 7th November 1943 from J. R. Hicks to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 10, Special Collections, University of Chicago Library.
_____, (1943d) A letter of 16th of November 1943 from R. Hicks to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 10, Special Collections, University of Chicago Library.
_____, (1943e) A letter of 19th of November 1943 from Michael Polanyi to R. Hicks, Michael Polanyi Papers, Box 4, Folder 10, Special Collections, University of Chicago Library.
_____, (1943f) The Reaction from Free Trade, Michael Polanyi Papers, Box 28, Folder 8, Special Collections, University of Chicago Library.
_____, (1944a) A letter of 18th April 1944 from Michael Polanyi to John Jewkes, Michael Polanyi Papers, Box 4, Folder 11, Special Collections, University of Chicago Library.
_____, (1944b), A letter of 19th April 1944 from Michael Polanyi to Karl Mannheim, Michael Polanyi Papers, Box 4, Folder 11, Special Collections, University of Chicago Library.
_____, (1944c) A letter of 10th August 1944 from Karl Mannheim to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 11, Special Collections, University of Chicago Library.
_____, (1944d) A letter of 22nd August 1944 from Joan Robinson to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 11, Special Collections, University of Chicago Library.
_____, (1945a) A letter of 19th March 1945 from Shearman to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 12, Special Collections, University of Chicago Library.
_____, (1945b) A letter of 5th April 1945 from Shearman to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 12, Special Collections, University of Chicago Library.
_____, (1945c) A letter of 18th April 1945 from Shearman to Michael Polanyi, Michael Polanyi Papers, Box 4, Folder 12, Special Collections, University of Chicago Library.
_____, (1945d) A letter of 23rd April 1945 from Michael Polanyi to Shearman, Michael Polanyi Papers, Box 4, Folder 12, Special Collections, University of Chicago Library.
_____, (1945e) A letter of 20th December 1945 from Michael Polanyi to John Maynard Keynes, Michael Polanyi Papers, Box 4, Folder 13, Special Collections, University of Chicago Library.
_____, (1946a) A letter of 1st April 1946 from H. Jakubowicz to Michael Polanyi, Michael Polanyi Papers, Box 5, Folder 1, Special Collections, University of Chicago Library.
_____, (1947a) A letter of 23rd July, 1947 from Ödön Pór to Michael Polanyi, Michael Polanyi Papers, Box 5, Folder 4, Special Collections, University of Chicago Library.
_____, (1947b) A letter of 30th August, 1947 from Ödön Pór to Michael Polanyi, Michael Polanyi Papers, Box 5, Folder 4, Special Collections, University of Chicago Library.
_____, (1949) Mechanism of chemical reactions, Endeavour, 8:3.
_____ (1962) My Time with X-rays and Crystals, Michael Polanyi Papers, Box 34, Folder 17, Special Collections, University of Chicago Library.
_____, (undated) The New Outlook, Michael Polanyi Papers, Box 28, Folder 2, Special Collections, University of Chicago Library.

_____, (undated) The Limits of State Power, Michael Polanyi Papers, Box 28, Folder 2, Special Collections, University of Chicago Library.

_____, (undated) Trade Cycle, Michael Polanyi Papers, Box 25, Folder 10, Special Collections, University of Chicago Library.


