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Entwurf zu dem Glasmosaik Welt der Arbeit (Draft Mosaic World of Work), Franz Seiwert (1932)

ENCYCLOPEDISM FOR DEVELOPMENT:

FROM THE UNITY OF SCIENCE MOVEMENT TO CYBERNETICS

A dissertation submitted to the University of East London
for the degree of Master of Science in
Information and Communication Technology and Development
in the School of Law and Social Sciences

by Fabian Tompsett
(U1050129)

2015

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This version is as corrected 19 May 2020

ABSTRACT

Otto Neurath (1882-1945) developed the approach of encyclopedism as an important tool to achieve the Unity of Science. This is examined in terms of his long term commitment to socialism and international development, understood as a decentralised economy in kind. Neurath's career is compared with that of his fellow Viennese economist Friedrich Hayek. The tension between Neuraths' socialism and Hayek's neoliberalism is analysed in relationship to the emergence of cybernetics. Neurath's commitment to participatory democracy is compared to Project Cybersyn, a cybernetic development project in Chile created on cybernetics principles. Neurath is shown to have an approach which presaged several examples of modern computing and internet practice. This is shown in the context of his involvement with both the Vienna Circle and the Figurative Constructivists. This suggests the cybernetic approach can still inform approaches to socio-economic issues in the field of Information and Communication Technologies and International Development.

ACKNOWLEDGEMENTS

I wish to acknowledge the invaluable help and support of Miriam Mukasa, my supervisor and the financial support and encouragement of my mother, Dizzie Tompsett-Clarke. Thanks to Stefan Lutschinger, of Vienna for introducing me to the Vienna Circle, Richard Barbrook for advice and comments on the draft of the dissertation. I also thank Eric Kindel and Laura Weill of the Otto and Marie Neurath Isotype Collection, Reading University.

I also acknowledge the Wikipedian community of practice, who provided me with a practical example of encyclopedism in action.

DECLARATION

No portion of the work referred to in the dissertation has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Signed: Fabian Tompsett

INTRODUCTION

In 1966 the cybernetician Gregory Bateson identified what he regarded as the two most important events of the first two thirds of the twentieth century: the signing of the Treaty of Versailles in 1919 and the breakthrough of the discovery of cybernetics after the Second World War (Bateson 1972). This research is a reassessment of this time period, but from a different viewpoint. Bateson sees the Treaty of Versailles in terms of Keynesianism, which in 1966 still constituted the consensus of post-war mainstream economics. That is no longer the case. This research will rather explore issues which arose from the Workers' Councils Movement in Germany 1918-1923, and in particular the subsequent activity of Otto Neurath (1882-1945). He was a key figure in the short-lived Bavarian Soviet Republic of 1919. He went on to play a central role in the Unity of Science Movement. He rejected an approach to scientific unification that was based on centralising science around a privileged discourse like physics. His approach was more like creating a mosaic, which he called encyclopedism: an "*all-embracing scientific attitude,* to regard the *mosaic of science* consciously as a whole and assist in its completion" (Neurath 1937|1987). His trajectory will be used to shed light on the concept of participatory democracy as applied by Stafford Beer and Salvador Allende in Chile in the early 1970s.

Neurath was a Viennese polymath born into a Jewish academic family. While still a student he fell under the influence of the German sociologist Ferdinand Tönnies (1855-1936). However he jeopardised the academic career for which he seemed destined through his participation in the Bavarian Soviet Republic. Here he first publicly advocated the use of an economy in kind. After a brief jail sentence following the crushing of the Bavarian Soviet Republic, he returned to Vienna. He initially supported himself through working with the Siedler (settler) social movement in Austria in the chaos following the First World War. This movement arose as a self-help housing movement which subsided when the Vienna Municipal Council had developed its own housing programme. With the support of the Social Democratic municipal government of Vienna, he developed the

Gesellschafts-und Wirtschaftsmuseum (GeWiMu).

This was a museum which sought to compete with new forms of popular culture such as the cinema in order to present data about society in a manner which the general public could readily understand. He developed a form of visual representation of data originally called the 'Vienna Method' and subsequently Isotype. Parallel to this he was the principal organiser of the Vienna Circle. This was a remarkably influential group of scientists, mathematicians and philosophers which flourished in the late twenties and early thirties. It based itself on the approach to science pioneered by Ernst Mach. The unification of science became one of their key concerns. Neurath played a central role in developing this through exile up until his death.

When Neurath died in 1945, the emergent post-war consensus was Keynesianism. However by the mid 1970s this was being superceded by neo-liberalism. A key event which marked the shift to this new consensus is the Chilean coup in September 1973 (Friedman M. 2000). This was engineered by the Central Intelligence Agency (CIA) of the United States of America (USA). It led to the introduction of neo-liberal policies largely thanks to a group of US trained economists called the “Chicago Boys”. With US backing, these policies provided an economic model for development which was copied across Latin America (Becker 1997). By the 1990s this gave rise to the “Washington Consensus” (Williamson 1989), whereby this neo-liberal model became the basis for the shared assumptions of the technocratic and administrative elite of both the USA and the international institutions (World Bank, International Monetary Fund, etc) based in Washington.

This research identifies the emergence of neoliberalism during the period identified by Bateson, from the post war crisis to the development of cybernetics. However contrary Bateson this research focuses on a quite different perspective: It is based on the view that it was the series of mutinies that spread across all belligerent nations in the later stages of the First World War that brought about the armistice. From 1917, these mutinous movements had forced the withdrawal of Russia from the war, the French Army was no longer an effective fighting force and the British Army was also faced with mass insubordination. Bateson's view that the war was brought to a close

by an American public relations expert (Bateson 1972) is too simplistic. Russia had withdrawn from the war following the Russian Revolution, and Germany itself was riven by a revolutionary movement which overthrew the Kaiser. Likewise, the Austro-Hungarian Empire was dissolved as varies nationalist movements asserted their autonomy. A truncated Austrian republic emerged in which the capital, soon known as Red Vienna, became a bastion of Social Democratic Austro-Marxism.

Vienna was not only the birth place of Otto Neurath. Friedrich Hayek (1899-1992), one of the key architects of neo-liberalism was also born there. One feature of this research is that it shows how much Hayek saw Neurath as a threat to his neo-liberal project. From his participation in the Socialist Calculation Debate (Hayek 1935) to his critique of “scientism”, (Hayek 1955) Hayek attacked Neurath's positions both in terms of economics and his involvement in the Unity of Science Movement. These controversies will be looked at by tracing Neurath's participation in a variety of “thought collectives” i.e. distinct “communities of persons mutually exchanging ideas or maintaining intellectual interaction” (Fleck 1935|1979 p.39). Neurath's range of activity was extensive, and the research shall be restricted to his engagement the World Social Economy Conference, the Socialist Calculation Debate and his more tangential involvement with the Figurative Constructivists of the Council Communist movement. This movement emerged following the German Revolution of 1918. It remained distinct from both Bolshevism and Social Democracy advocating a form of participatory democracy independent of state and party bureaucracy, rooted in local councils elected from within factories and work places. Then this report will look at how Neurath functioned as a knowledge worker in the Unity of Science Movement and its textual materialisation as the *International Encyclopedia of Unified Science* (IEUS), a project which was only completed in 1970, twenty five years after Neurath's death.

In those twenty five years Neurath was largely forgotten, although his contribution to the Unity of Science Movement still had an impact. This report will show how Neurath's colleagues, now in the USA, helped in the development of cybernetics. This was important not just for the

development of computers but also, from the mid-fifties, their application in scientific management in industry. Stafford Beer was a leading practitioner of this.

This report will then look at the reappearance of participatory democracy in perhaps the most significant post-war information and communication technology (ICT) development programme: Project Cybersyn. This was implemented by the Chilean President, Salvador Allende, shortly after his election. The cybernetician, Stafford Beer, was hired to implement it. Coming from a career as management consultant with experience working for United Steel in the UK, his experience in Chile transformed Beer and had a significant impact on his subsequent theorising as a prominent cybernetician.

Project Cybersyn was destroyed shortly after the Pinochet Coup had overthrown Allende. Hayek was an apologist for this violent overthrow of a democratically elected government as it allowed him to organise for neo-liberal policies with the Chicago Boys. Both he and Milton Friedman visited Chile at this time to consolidate the neo-liberal project (Friedman M. 2000). The destruction of Cybersyn fits with Hayek's rejection of scientism, an issue which will be explored in depth.

This research has been refined to addressing the following research questions:

Principle question:

To what extent is it valid and useful to consider Otto Neurath and the Unity of Science Movement as pioneers of cybernetics?

Subsidiary questions:

Does cybernetics and the Law of Requisite Variety provide a way of resolving the Socialist Calculation Debate?

Does cybernetics, in the context of modern computing capacity, provide a means of developing an economy in kind as proposed by Neurath and is this a way of addressing the socio-economic problems of contemporary society.

My methodological approach is based on Karen Barad's insight into the entanglement of

matter and meaning (Barad 2007). By combining this with the concept of “text-as-apparatus” (Mills 2007), the texts – both those that were read during the research as well as this text, this dissertation – become the apparatus of this research, integrated into their technological forms whether in hard copy or digital form.

LITERATURE REVIEW

This literature review starts with the anthologies of Neurath's work which have appeared in the english language over the last forty two years. Then the literature as regards five distinct topic areas is reviewed. The first looks at Neurath and International Development which then leads into a review of Neurath and the socialist calculation debate. This in turn leads to Neurath's involvement with politics and in particular the concept of participatory democracy which arose during the revolutions which swept central and eastern Europe brining the First World War to an end. Then the literature concerning Neurath and the knowledge economy is reviewed.

NEURATH IN ENGLISH

One of the consequences of the flight of intellectuals from Austria and Germany with the rise of Austro-Fascism and Nazism, and their subsequent defeat of Germany in the Second World War is that English has become the *lingua franca* of modern scholarly discussion. The suppression of the Vienna Circle was one of the immediate consequences of the Austro-Fascist victory in the Austrian Civil War of 1934. Many of the people Neurath worked with became refugees. Stadler (2007) shows that over two thirds of the Vienna Circle emigrated to the USA or the UK. Of those who remained in Europe Moritz Schlick (Vienna Circle) and Kurt Grelling (Berlin Circle) were murdered by Nazis. One of the consequences of this is that much of Neurath's later writing were written originally in English. In this literature review these shall not be listed individually as they have for the most part been republished in the Vienna Circle Collection.

Empiricism and Sociology (Neurath 1973) was published as the first in series known as the Vienna Circle Collection. However the appearance of this book had little impact on the unfolding discussion of positivism and the social sciences, despite being written by one of the foremost theorists of twentieth century positivism. Paul Roscoe's review of the discussion of positivism in anthropology shows very little such activity before 1971 but that seventeen papers including such discussions had been published by 1975 (Roscoe 1995). In subsequent years there have been a

number of critiques of positivism produced within anthropology such as Poggie *et al. (*1992) and Wax (1997). Both of these involve an unsatisfactory understanding of actual positivism as developed by Ernst Mach and the Vienna Circle. Thomas Uebel (1991) has differentiated the latter from the “received view” of scientific positivism which emerged in the 1950s. Much of the critique of positivism in the late twentieth century shows scant understanding of Neurath and the Vienna Circle, rather dealing with a somewhat vague concept of positivism which can probably be better understood as a sociological reading of post-war American scientific practice entangled with a subsequent development of logical positivism as a dominant form of the philosophy of science in North America. George Reisch has given an account of the role played by Cold War politics in redefining the Philosophy of Science, including the marginalisation of Otto Neurath (Reisch 2005).

Three further collections of Neurath's work were published in the Vienna Circle Collection: *Philosophical Papers 1913-46* (1983), *Unified Science* (1987) and *Economic Writings 1904-1945* (2004). Also two of Neurath's manuscripts were discovered amongst a collection of books about Logical Empiricism which came on the market in Köln. Both of these have since been published: 'Visual Education: Humanisation versus Popularisation' (Neurath 1996) and *From Heiroglyphs to Isotype: A Visual Autobiography* (Neurath 2010). This indicates that the range of material available in English is sufficient for this piece of research and indeed with the publication of the last two texts is more inclusive than what was publicly available during Neurath's life time.

One of the challenges in analysing the work of Otto Neurath is that he was a polymath with both a prodigious and diverse output of material. Thus in line with the structure of my research this literature review will continue in sections related to the five areas of the research.

NEURATH AND INTERNATIONAL DEVELOPMENT

Despite thorough searches for recent research linking Otto Neurath to International Development, no material directly relating to this was found. However his text 'The Current Growth in Global Capacity' published in *Economic Writings 1904-1945* (1931d|2005) indicated that this was an area in which he was involved. This text was originally a contribution to the World Social Economy

Congress held in Amsterdam in August 1931. This event was organised by the International Industrial Relations Institute (IRI), and his paper was published in the documentation of the congress. The organisation was set up primarily by women who had been excluded on the basis of gender from involvement in the International Labour Organisation (Alchon 1992). In Bruce Kaufman's account of the global evolution of industrial relations (2004) he describes the IRI as “a remarkable but scarcely known organization” (ibid p. 212). However his approach is restricted to an interest in industrial relations and he makes no mention of Neurath.

Writing from a quite different perspective Hisayasu Ihara provides a detailed account of how van Kleeck (co-president of IRI) worked closely with Neurath in order to find work for the GeWiMu in the USA. Indeed her contribution to *Isotypes: Design and Context 1925 -71* (Ihara 2013) barely mentions their shared involvement with the IRI. While it gives plenty of information about the support van Kleeck extended to Neurath, Ihara's focus is on the Institute for Visual Education that van Kleeck set up in order to promote Otto Neurath and his “Vienna method”. This was primarily in order to create a viable social enterprise which could sustain a workshop generating sufficient income to afford adequate salaries, cover expenses and maintain a reserve. To this end van Kleeck was able to enthuse a number of private and public bodies with a desire to employ Neurath to handle the graphic presentation of their statistics.

Whilst Ihara's work is many ways very useful in chronicling Neurath's impact in the USA, and the three trips he made there, she does not really explain van Kleeck's support for Neurath. While van Kleeck evidently was greatly impressed by Neurath's “Vienna Method” (or ISOTYPE as it came to be known after his move to The Hague) she does not explain *why* van Kleeck was so interested. Giraud (2014) points out that interest in Neurath's method principally arose from van Kleeck rather than more generally in the Russell Sage Foundation. It only really involved people in van Kleeck's Industrial Studies department, and not the Arts and Social Work department which previously had been responsible for graphic design and mounting exhibitions.

The explanation for van Kleeck's involvement is not to be found in terms of the ISOTYPE

method, but rather in terms of the *ends* to which van Kleeck wished to put it. This can be seen in her work with the IRI, as evinced by the book she co-wrote with Mary Fleddérus: *Technology and Livelihood* (Fleddérus and van Kleeck, 1944). This book subtitled “An Inquiry into the Changing Technological Basis for Production as Affecting Employment and Living Standards” essentially adopts a Neurathian approach to economics. However it does not incorporate any of the techniques of visual education.

This research will aim to clarify the relationship between van Kleeck, Fleddérus and Neurath which would appear to be more firmly rooted in a shared goal of setting in motion some sort of world planning group. The visual education was primarily a means of popularising the need for world social economic planning by providing a more accessible means by which ordinary citizens could absorb statistics. Also, at a more pragmatic level, the social enterprise would provide a promising way of maintaining a workshop that could survive by fulfilling external orders and also offer a resource to support the implementation of the IRI's programme. This occurred in the context of the exhaustion of the funds bequeathed by Russell Sage to his foundation and a realignment of funding more around academic research than the sort of fusion of social activism and academic work which characterised the work of van Kleeck and Fleddérus (Giraud 2014). Finally Neurath theorised visual education as a more emancipatory approach to presenting information enabling the recipient to develop their own understanding of the data. Important as this is within the framework of Neurath's thinking, a deeper examination of this falls outside the scope of this paper.

NEURATH AND THE SOCIALIST CALCULATION DEBATE

In his introductory essay to *Collectivist Economic Planning* (Hayek 1935), Hayek mentions Neurath's *Durch die Kriegswirtschaft zur Naturalwirtschaft,* (1919) as being “in many ways the most interesting” of the discussions of the economic problems of a planned socialist economy. However Hayek says little else about Neurath. (Hayek 1935 p. 30). A central place in Hayek's anthology is given to a reprint of a 1920 work by his mentor Ludwig von Mises, 'Economic

Calculation In The Socialist Commonwealth' (Mises, 1935). Here Mises cites Neurath to support his view that “money can play no role in economic calculation” in the context of socialist commonwealth (ibid p. 108). However, for Mises value is determined by the encounter of a buyer and seller in the market place. The absence of a market place precludes a way of determining value (Friedman J. 1997). A system of economy in kind he dismisses as being “absolutely impossible” because of insurmountable difficulties which Mises believes would arise when trying to carry out the socialist calculation. There is an *a priori* assumption that value still plays a social role even when there is no market to provide any evidence of its existence. This lies at root of Rational Choice Theory. However such assumptions do not hold in a planned economy (Friedman ibid). The issue here is whether:

(a) The state of development of information and communication technology in 1920 could sustain an effective way of managing the complexity which the statistics of an economy in kind would entail.

or:

(b) The problem is deeper seated, i.e. it is due to being formally undecidable that the calculations for an economy in kind would be “absolutely impossible”.

As shall be shown later, this issue is entangled with Kurt Gödel's formally undecidable propositions which caused such a profound impact at the 1930 Königsberg conference organised by the Vienna Circle and their allies in the Berlin Circle (Gödel 1931|1986).

Hayek also reproduces Nicolaas Pierson's *The Problem of Value in the Socialist Society* (Pierson 1935). Writing in 1902, he worked from the assumption of socialism consisting of a series of nation states with their distinct national economies. He asks how international trade will be maintained. He distinguishes between ‘active’ and ‘passive’ trade, whereby countries with surplus capital are active, as they can advance capital in a trade relationship, whereas those who have to borrow in order to trade he regards as passive. Pierson was erstwhile Prime Minister of the Netherlands and also one time Minister of Finance.

The essence of his rejection of socialism is that it does not accord with his understanding of the economic relationships which exist under capitalism. However he does not discuss Marx's concept of the organic composition of capital (Marx 1909). According to Marx's labour theory of value, the more technically developed enterprises within a capitalist economy will consistently be more competitive than the less developed enterprises as they have a higher organic composition of capital i.e. they embody less living labour in relation to the mass of capital valorised by the workers' productive activity. The same analysis can be further generalised to the comparison of different national economies supported by differing average levels of organic composition within their enterprises. Suffice to say, this alternative analysis did not play a major part in the Socialist Calculation Debate. There was no recognition of the Marxist insight that capitalism rewards technological advancement.

An example of this is the significant omission from Hayek's 1935 book of *Fundamental Principles of Communist Production and Distribution* (Appel 1930|1990). The relationship of this text and the political current of Council Communists who produced it shall be explored in relation to the network of activists amongst whom Neurath was immersed.

It is important to see the role played by Neurath in this debate, even though Hayek somewhat casually dismisses him. Neurath's 1919 book was published in April, during the turmoil of the Bavarian Soviet Republic which only lasted about four weeks (Cartwright *et al.* 1996). Neurath was appointed President of the Central Economic Administration which had been put in charge of socialisation. *Durch die Kriegswirtschaft zur Naturalwirtschaft* comprised primarily of his previous writings concerning the War Economy and his emerging understanding of an economy in kind written from 1909 to 1917 (Neurath 1919|1973). These views had been based on his work during the Balkan wars and then the First World War. This had culminated in July 1916 with Neurath being appointed Head of the Army and War Economics Section in the Scientific Commission for War Economics at the Austrian War Ministry. Further he was also simultaneously running the Museum of War Economy set up in the German city of Leipzig, located in Saxony.

Spending each fortnight alternatively at each establishment, Neurath was in a unique position to gain an understanding of the war economy as it existed empirically for the two key Central Power administrations. This included assessing the impact of the various measures adopted to subordinate capitalist businesses to the needs of the respective armies.

This needs to be seen in the context of Eric Ludendorf's “war socialism” (Kreigssozialismus) a form of technocratic-military dictatorship in which the peace-time mechanisms of capitalist society were subordinated to the war effort (Paxton & Hessler 2011). Parallels between this and the regime imposed by the Red Army in Russia were drawn by Alexander Bogdanov who theorised “war communism” prior to the Bolshevik coup of October 1917 (Biggart 1989). Bogdanov was a Russian Marxist who also set out to develop a fusion of Marxism and Machism, within the context of Social Democracy. Indeed Bogdanov was the immediate target of Lenin's polemic against Machism (Lenin 1909|1929) discussed below.

One essay written specifically in the context of the Bavarian Soviet Republic was 'Utopia as a Social Engineer's Construction' (Neurath 1919|1973). Here Neurath writes in the context of the Central European *Zukunftstaat*, (future state) discourse which had combined enticing depictions of a future socialist society with a faith that this could be achieved through the application of science (Calkins 1982). Central European Social Democrats had been faced with Eduard Bernstein's revisionism, which relativised the goal of socialism for the sake of achieving reforms within capitalism. However Neurath evoked this “utopianism” to reassert a social goal existing above and beyond the “horse-trading” of reformist politics. With the declaration of the Bavarian Soviet Republic, for Neurath this was the time for a rallying cry to realise the *Zukunftstaat:*

> “What yesterday was dreamers' work, today already appears as scientific work preparing and shaping the future. We have attained the conviction that a huge part of our order of life can be shaped in a goal-directed manner, and in particular that consumption and production, in quantities, can be determined and regulated, even though for now we cannot or will not extend a social engineering rule over mores and morality, religion and love.” (Neurath 1919| 1973 p.151)

However this was not to be: the Bavarian Soviet republic was violently suppressed and Neurath arrested. Neurath mobilised his academic colleagues for his trial including Max Weber who vouched for Neurath (Cartwright *et al.* 1996, 54). It was not just at the trial that Weber praised Neurath for his work analysing the war economy. In his subsequent posthumously published magnum opus *Economy and Society* he repeated this view but went on to maintain that war was exceptional in that the whole economy cannot generally be geared to a single goal. He argues that precise calculations in kind only exist at an "engineering level" and that the extent to which they have an economic character, this is merely at the level of budgetary calculations. Whatever difficulties exist with monetary calculations, Weber argues, these would become universal with calculation in kind e.g. allocating overhead costs in an enterprise with multiple departments. This fits with his separation of technical and economic problems, the former being identified with the means of achieving a goal e.g. extracting some ore from a mine, and the latter with the choice about whether to allocate resources to that end in favour of a rival expenditure of resources. It is the rationality of economics which has shaped the technologies of production, and although Weber concedes the necessity of a legal framework within which economic choices can be made, he is adamant that these legal aspects should not be considered as falling within his category of economic action (Weber 1922|1968 p. 100-7).

This approach was consistent with Weber's view that natural sciences were concerned with developing scientific laws whereas historical sciences look for knowledge of concrete reality. Natural science fulfils a technical role, rather than addressing value judgements, i.e. economic decisions: "An empirical science cannot tell anyone what he *should* do—but rather what he *can* do." (Weber 1949). But Neurath found himself in a curious position when he accepted the post of President of the Central Economic Administration, and in his court case, he claimed he had avoided any involvement in politics, that he was a mere technician, a social engineer. His friend Otto Bauer in his capacity as the Austrian Foreign Secretary secured remission on Neurath's two year jail sentence observing that his apoliticism was in fact authoritarian in that he did not care whether he

was acting under the Austro-Hungarian Monarchy, the Bavarian parliament or the Bavarian Soviet (Cartwright *et al* 1996).

It was in the 1940s that Hayek published “Scientism and the Study of Society” where he misrepresents Neurath's physicalism in Section V, followed by a more elaborate critique of Neurath in the final section “Engineers and Planners”. This was republished in *The Counter-Revolution of Science* (Hayek 1955) along with an additional eponymous essay which was a more involved attack on socialism starting with Henri Saint-Simon and Auguste Comte, highlighted as the founders of both socialism and positivism. Hayek identifies Neurath and his encyclopedism and Unity of Science Movement as being the twentieth century version of Saint-Simon. The focus of his critique is to present socialism, from Saint Simon on as a counter-revolution, as the origin of totalitarianism. He cites the work of Karl Popper, who’s *Open Society and its Enemies* (Popper 1945) had identified Plato, Hegel and Marx as the originators of totalitarianism. He wanted to add Comte and positivism as additional candidates to bear responsibility for the horrors of Nazism and Stalinism (Hayek 1955).

Hayek focuses his critique of socialism around the *The Doctrine of Saint-Simon: An Exposition,* the first English translation of which was to appear in 1958 (Iggers 1828-29|1958). This was perhaps the first socialist tract discussing the conflict of the two classes, bourgeoisie and proletariat, which it was claimed would lead to the abolition of private property. Hayek's views can be compared with the Putney Debates of 1647. Here, in the middle of the English Revolution, Levellers and Army Grandees debated to whom the franchise should be extended. Henry Ireton had presented the bourgeois view “the liberty of all those that have a permanent interest in the kingdom, that is provided for by the constitution . . . liberty cannot be provided for in a general sense if property be preserved” (Ireton 1647). This is in essence Hayek's viewpoint: his concept of freedom is simply freedom for property owners, only elaborated through seeing the market as the principle organising factor of the property owning classes. Denying that socialism was anything but a myth, Hayek cast it as a cruel illusion which could only usher the return of feudalism (Hayek 1942).

However the next section will look at the concept of participatory politics developed from a proletarian perspective by the Council Communists from their experiences in the Workers' Council movement of the German Revolution.

NEURATH AND PARTICIPATORY DEMOCRACY

We have already touched upon Neurath's politics – or rather his disavowal of politics. This perhaps reveals an enigma which lies at the heart of his life: a life-long commitment to socialism – including a commitment to a particular economic interpretation of what socialism is – combined with an activism wherein he proselytises for a particularly vigorous interpretation of the scientific world conception. While contributing to the debates arising from the activities of the Vienna Circle he was also having a series of articles published in *Der Kampf*, the theoretical journal of Austrian Social Democracy.

He played a central role in the development of the Vienna Circle, drafting *The Scientific Conception of the World: The Vienna Circle* with editorial help from Rudolph Carnap and Hans Hahn (Neurath 1929|1973). As Heinz von Foerster was to observe, the Vienna Circle was not a school of *thought* but a rather school of *thinking* (von Glaserfeld 2002). Their aim was unified science by linking and harmonising the work of individuals in diverse areas of science They aimed at creating a neutral way in which concepts could be brought together through collective effort to create a thin science: “dark distances and unfathomable depths were to be rejected: there is surface everywhere, all experience forms a complex network, which cannot always be surveyed and can often be only grasped in parts” (ibid p. 306).

Neurath positions his call for empirical sociology on a synthesis of Karl Marx and Ernst Mach which is quite distinct from the dominant form of Marxism – Marxism-Leninism – which emerged in Europe following the Bolshevik seizure of state power in Russia. Indeed Lenin had castigated any attempt to unite Machism and Marxism in his 1908 tract *Materialism and Empirio-Criticism* (1909|1927). Neurath's colleague in the Vienna Circle, Philip Frank, had been one of the people attacked by Lenin. The publication of translations of this work in English and German in

1927 by the Communist International provide a context in which Neurath's writings at this time can be considered. He rejected a Hegelian interpretation of Marx in favour of a positivist approach. His was an empirical materialism rather than a dialectical materialism. In *Empirical Sociology* (1931b|1973) Neurath quotes at length from Marx's *German Ideology*[1] ending with:

> "Communism is for us not a *state of affairs* which is to be established, an *ideal* to which reality (will) have to adjust itself. We call communism the *real* movement which abolishes the present state of things. The conditions of this movement result from the premises now in existence" (Marx 1932|1938)

The most extensive book covering Neurath's political and scientific interests is the aptly named *Otto Neurath: Philosophy between Science and Politics* (Cartwright *et al*., 1996). The authors view Neurath's project for unified science as a "Trojan horse of socialism" (ibid p. 179) "Unification of the sciences and socialisation of the economy remained a single task throughout Neurath's Viennese period" (bid p. 177). The whole book argues that Neurath's intellectual and political outlooks evolved "inextricably woven together" (i.e. entangled): his project for a socialist economy in kind required the unity of science, and consequently his optimism about such a unification spurred on his involvement with the IRI.

Johann Dvorak, however, develops a somewhat different viewpoint suggesting that "'Socialization + Workers' Councils' democracy' was Neurath's formula for social planning" (Dvorak 1996, p.240). This detournement of Lenin's dictum "Communism is Soviet power plus the electrification" (Lenin 1920) is perhaps ironic, but it nevertheless reflects the scathing attitude of the Council Communists who produced the *Fundamental Principles of Communist Production and Distribution*: Neurath's views end up producing the same sort of state capitalism as they analysed existing under the Soviet regime in Russia (Appel 1930|1990, p. 15). Their view was that the unification of centralised political and economic power in a single state apparatus will not yield "the association of free and equal producers" (Marx 1866|1996) but rather "a prison-state such as

1 It is important to recall that *The German Ideology* had not itself been published when Neurath's text was published by the Vienna Circle. Written in 1845, these texts had remained in the position of various German Social Democrats with whom, it would appear, Neurath was in contact. Its eventual publication in 1932 by the Marx-Engels Institute in Moscow only occurred after its founder and director, David Ryazanov (1870-1938), had been implicated in the Menshevik Trial of 1931. Ryazanov refused to be described as either a Bolshevik or a Menshevik, simply a Marxist. He was shot in 1938. For a comprehensive discussion see Carver & Blank (2014)

mankind has never before experienced (Appel 1930|1990, p.16)

Before discussing what arose in the German Council Communists movement, this report will first look at the reality of the Russian Revolution: despite creating Factory Committees in the February Revolution, 1917, these passed into the hands of Bolshevik party functionaries. This has been chronicled by Maurice Brinton (1970) who describes how the Bolsheviks recreated a top-down approach to planning through the All-Russian Council of Worker's Control (28th November 1917) followed by the Supreme Economic Council (5th December 1917), of which the left communist Osinsky was the chairperson. A process was taking place by which the participatory democracy of the Factory Committees was subordinated to the Bolshevik Party and the state which they were creating. As Brinton remarks: “each time the adversary appeared in the garb of the new 'proletarian' power. And each defeat was to make it more difficult for the working class itself directly to manage production, i.e. to fundamentally alter the relations of production” (ibid p.23). In his discussion of the function of Bolshevik ideology, Frederick Kaplan shows how although the Bolsheviks originally presented their policies as providing a learning environment for the workers to learn how to exercise management of the productive apparatus, from 1918 to 1920 they successfully subordinated the Factory Committees to the state apparatus and the Communist Party: Workers' control was replaced by Workers' administration (Kaplan 1968).

Dvorak mentions the slogan “The Revolution is not a Party Affair” but fails to identify how it arose (Dvorak 1996, p.239). The slogan was the title of pamphlet by Otto Rühle published in 1920 after he returned from a trip to Russia where he attended the Second Congress of the Third International (Rühle 1920a). In a further text Rühle compares the Bolshevik regime with the war socialism of Erich Ludendorff. (Rühle 1920b). Benjamin Benus (2013) has shown how Neurath was closely related to the Figurative Constructivists, an artistic movement embedded within the Council Communist movement. This research will explore how, despite his firm alignment to Social Democracy, Neurath was linked to the Council Communists and how, within their aesthetic, there are elements which presage cybernetics.

NEURATH AND THE INTEGRATION OF KNOWLEDGE

The concept of “knowledge work” was advanced by Peter Drucker in the period following the Second World war. He discussed the subsequent consolidation of Operations Research (OR) which had addressed the need to recombine knowledge which had been splintered into a multitude of disciplines. (We shall see below how Stafford Beer's involvement in OR paved the way for his development of management cybernetics.) Drucker argued that this could only be achieved through “a philosophical synthesis appropriate to the world we inhabit and see” (Drucker 1957, p.13). He foresees a new integration which leaves aside the Cartesian duality between mind and matter as had already been argued by Ernst Mach and his followers.

Drucker was part of the Viennese intellectual milieu which encompassed the Neurath and the Vienna Circle, indeed Hayek was family friends of the Drucker family (Drucker Society of Austria 2009). However Peter Drucker's remarks about Neurath are confused (1993). Karl Müller (1996) has provided a critique of Drucker's view of Neurath as an advocate of “quantified data”, basing his analysis on Neurath's *Foundations of the Social Sciences* (1944). Müller uses the formulation of Mode I and Mode II of knowledge production found in Gibbons *et al.* (1994). However Müller is more concerned with cataloguing Neurath's intellectual achievements rather than developing an understanding of Drucker's discussion of how the knowledge economy developed and how Neurath's role can be contextualised in those processes.

Etzkowitz & Leydesdorff (2000) have criticised Gibbons *et al. a*rguing that what has been presented as as new feature of the knowledge economy has been a feature of science before the nineteenth century and provide the explanation of the “Triple Helix” of the nation state, academia and industry to explain the innovations in knowledge generation. This criticism is confirmed by looking at the discussion between Neurath and Horace Kallen, initiated by Kallen at the Fifth Unity of Science Conference, held in Harvard in 1939. Neurath adopted his concept of “orchestration” (Neurath 1946). Here Neurath defends the Unity of Science Movement from the accusation of totalitarianism, offering encyclopedism as pluralist alternative to an all embracing system. He saw science as being composed of local systems – this research will follow Fleck in calling these

thought collectives – with a shared set of practices and ontology maintaining their consistency. Neurath was concerned that the different thought collectives should not be hierarchically organised as pyramid, but rather as something more fluid. Neurath also disavows the positivism of Comte, which he castigates for retaining aspects of Catholicism in their creation of positivist religion. He remarks that there is a need to “find some loyal compromise for actual collaboration, without suppressing personal convictions” (ibid p. 236). He also rejects any sympathy for Plato's social theories, including rejecting Fichte's nineteenth century absolutism as an example of the sort of totalitarianism that the encyclopedism of logical empiricism should oppose. In short much of this text is a response to Hayek, for whom Kallen stands in as a proxy.

This research will explore how the differences between Neurath and Hayek were not confined to economics, but also involved differences in how they saw the role of science and the extent to which science could deal with social issues. In the next section the development of cybernetics shall be explored, particularly as advocated by Stafford Beer after his Chilean experience. This constitutes an important challenge to the neo-liberalism of the Washington consensus.

ENCYCLOPEDISM AND CYBERNETICS

This research has revealed little literature concerning Neurath's impact on twenty-first century encyclopedism. Nader Vossoughian (2007) regards the Open Source Movement and Wikipedia as inheritors of projects that Neurath helped establish, but this is merely a comment in the epilogue of his book rather than a point he discusses fully. Olga Pombo develops a very useful discussion of Neurath's encyclopedism which she describes both as an attitude and as a social movement, rather than a mere object like a set of books. However Pombo fails to directly relate this to any extant online encyclopedism, merely commenting that there is a close relationship between the notion of encyclopedia and the internet (Pombo 2011).

Writing in 1996, Walter Tega, discusses Neurath's encyclopedism and compares a dictionary as a disjunct collection of knowledge with an encyclopedia intended as a “network of all possible

links" (Tega 1996 p. 67) i.e. suggestive of hypertext. In 1945 Vannevar Bush described his proposed Memex – an imagined electronic machine which presaged the combination of computers linked to the World Wide Web. He predicted this would allow "[w]holly new forms of encyclopedias" to appear (Bush 1945). Bush was writing "as the Director of the Office of Scientific Research and Development" whose experience managing six thousand American scientists put him in a powerful place to propose a direction for science following the end of the Second World War.

Operations Research (OR) originated in the British Royal Air Force in 1937. In 1940 Bush was the key individual in the US state apparatus who liaised with the British developers of OR. James Bryant Conant was sent to the UK and reported back that there were significant areas where British technology was in advance of that in the USA. The discussion led to the adoption of OR particularly in the US Navy and included assessing the feasibility of the Atom Bomb. Even before the Japanese attack on Pearl Harbour in December 1941, the US military and naval authorities were already considering adopting OR. Bush originally opposed the adoption of OR as he feared that it would reduce science to dependency on the military. However his subordinates, like Conant successfully argued for the adoption of an OR approach and Warren Weaver, later co author of *The mathematical theory of communication* (Shannon and Weaver 1949), was another OR practitioner from 1942 (Shrader 2006). This practical integration across traditionally distinct academic disciplines was to provide the basis for the development of cybernetics in the USA after the end of the Second World War.

Neurath's long term colleague, Phillip Frank, played a leading role in developing the Unity of Science Movement in the USA. In fact it was a shared interest in the unity of science with Percy Bridgman which enabled him to obtain academic tenure in the USA after the Nazi invasion of Czechoslovakia in 1938: Frank had been the Professor of Physics at Prague University. Frank helped organise the 5th Unity of Science of Congress at Harvard in 1939 (Holton 1993). This led to the short-lived Science of Science Discussion Group (1940-41) in which Frank participated (Hardcastle 2003) In 1944 he was involved in setting up the Inter Scientific Discussion Group. Norbert Weiner and Edwin Boring were both early participants. As Warren Weaver was to note in

December 1946, the death of Neurath had left the Unity of Science Movement in disarray (Galison 1998, p.48). This was in the context of Frank's request for financial support in creating an Institute for the Unity of Science. Weaver bore responsibility for dispensing grants from the Rockefeller Foundation, and by the end of 1947 he agreed to fund Frank and his committee which was primarily composed of those who had participated in the pre-war Unity of Science Movement: Charles Morris, Hans Reichenbach and Rudolph Carnap.

Frank set up the Institute for the Unity of Science in Boston. While Gerald Holton has argued that this was like a recreation of the Vienna Circle (Holton 1993), Peter Galison has stressed the impact of war-time American scientific practice – perhaps best summarised as Operations Research – in creating a quite different environment. The inclusion of categories like "Communications Engineering and Theory" took the unity of science beyond anything of which Neurath could conceive. In fact it was through the Institute's Cybernetics and Communications Study Group that Wiener and Arturo Rosenbleuth did much of their work alongside the conferences funded by the Macy Foundation (Galison 1998). This funding was also tied in to the CIA, which was to have an increasing role in the development of cybernetics in the USA as the Cold War unfolded (Kline 2015, p. 185-6) Thus the emergence of Cybernetics can be seen as a diffraction arising from the intra-action of Operations Research and the Unity of Science Movement in the context of the emergence of American Cold War politics

As Slava Gerovitch has shown (2002), the development of a unification of science in the Soviet Union had a more problematic path to take. Dialectical materialism had already been enthroned as the unifying philosophy according to which Soviet science was organised. Each discipline was dominated by an officially endorsed school, often resulting in scientific objectivity being overwhelmed by ideological dogmatism and rigid departmental distinction between disciplines. In a manner reminiscent of Neurath's "science without philosophy" (Haller 1996), Aleksei Liapunov, the most prominent Russian cybernetician, removed philosophy (i.e. dialectical materialism) entirely from his schema illustrating the relations among the sciences. Instead cybernetics played a centralising role. He encouraged Aksel Berg, the retiring Deputy Minister of Defence, to step forward in 1959 to head the Scientific Council on Cybernetics. With Berg as its champion cybernetics prospered and in 1962 Berg proposed an "electronic encyclopedia" which

would not just address scientific and educational issues, but would also be an integral part of the socio-economic planning process (Berg 1962|4). Thus encyclopedism features in the thinking of key actors in the two rival superpowers which were competing in the race to invent the internet (Barbook 2007).

Whilst several studies have highlighted Paul Otlet's role as prefiguring the hypertext (Boyd Rayward 1994, Wright 2014a) no attention has been given to Neurath in this regard. Bearing in mind that Neurath and Otlet collaborated quite closely for a number of years, it was primarily the problems which they experienced in raising funds which prevented further co-operation (Wright 2014b). With Otlet's agreement, the organisation Neurath founded in The Hague used the same name Otlet had developed, “Mundaneum”. It was this organisation which published the initial instalments of the *International Encyclopedia of Unified Science* (Neurath 1936).

This research will look at Neurath's role as a precursor of cybernetics and internet practice, and in doing so will help us better understand not merely the historical and social process which have enabled the modern knowledge economy to be realised, but also to grasp the entanglement of economic, political and epistemological aspects which have given rise to the twenty first century knowledge environment. Encyclopedism has played an important role in the development of the internet: Wikipedia has become the sixth most popular website on the World Wide Web. It has come about through the development of commons-based peer production. The importance of Wikipedia is evidenced by the role it played during the 2014 Ebola epidemic in West Africa. Noam Cohen compares the role of relevant wikipedia pages with the websites published by both the Centers for Disease Control and Prevention, the World Health Organization (Cohen 2014). As Dr James Heilman, of Wikiproject Medicine put it “We don’t need to write for experts, experts have lots of excellent sources.” (quoted ibid).

METHODOLOGY

The problematic anthropological taboo of “going native” has been interpreted to describe embracing “the frameworks of understanding used in the practices we wish to study” (Tkacz 2015, p. 38). Such a perspective looked at in linear terms is paradoxical: it would preclude the very existence of science studies. In fact it could in turn be interpreted as a restatement of Hayek's critique of scientism and his critique of Neurath (Hayek 1955).

This provides a context in which the development of science and of economics can only be seen as being politicised, being embedded amongst complex sociological relationships which encompass such categories as “science”, “economics” and “politics” not so much as abstractions, but through their manifestation as concrete social facts. This area, the province of second order cybernetics, lies outside the scope of this research.

Barbara Tedlock (1991) has described how the emergence of narrative ethnography has legitimised “going native”. This provides a means to facilitate the co-production of ethnographic knowledge in the context of an interactive self/other dialogue. Although Nathaniel Tkacz mobilises Gregory Bateson's notion of frames (Tkacz 2015), he does not relate this to Bateson's cybernetic notion of recursion (Bateson 1972). As Frank Smith (2004) has argued, even reading is itself is a social process of co-production[2].

Karen Barad (2007) has provided a methodology which helps resolve this paradox. She introduces the term “intra-action” in contrast to interaction, which, she claims, “relies on a metaphysics of individualism” (p. 128). This latter implicitly includes Hayek's approach to the social sciences. She validates this in terms of Neils Bohr's “philosophy-physics”, who, she asserts learnt his epistemology by doing science, rather than considering it from outside the frame of

2 As an illustration of this I shall relate my experience encountering two errors in *El Lissitzky: Life • Letters • Texts* (Lissitzky-Küppers 1968). Examining the book for links between Franz Seiwert and El Lissitzky I found two references both containing errors: in the first (p.30), a photograph taken during the First International Congress of Progressive Artists assigns him the wrong forename. In the second (p. 84), an account of how Seiwert assisted Lissitzky in setting up the Soviet exhibition at the Pressa Exhibition mis-transliterates Seiwert's name as “Seifert”. Bringing prior knowledge to my reading of the text I can identify Franz Seiwert as the correct identification of the person on both occasions. The impact of such trivial errors can be magnified when documents are being digitally searched with text strings.

scientific activity. Matter and meaning are entangled, and the human is an emergent phenomenon, rather than an *a priori*.

She speaks of *diffraction* rather than reflection, and provides a chart comparing the two: performativity is contrasted with the representationalism. Rather than perpetuating a series of dualities: any pre-existant subject-object distinction is superceded by this distinction being dissolved through the scientific activity. Knowledge is not a symbolic representation of a real world out there, but rather "a material practice of engagement as part of the world in its differential meaning" (ibid p. 89). Science emerges out of scientific practice. This is a point that Ludwik Fleck makes in his *Genesis and Development of a Scientific Fact* (Fleck 1935|1979). Scientific activity has a social character and he argues that the existing accumulated fund of knowledge is as important as the interactive relationship of scientists within "thought collectives".

This methodology is used because the aim of the research is *not* to produce a biographical narrative of Neurath, but rather to reveal how Neurath's relations to a variety of thought collectives (the Industrial Relations Institute, the Figurative Constructivist movement and the Vienna Circle), enabled him to practice precisely the "orchestration" which he simultaneously theorised in his advocacy of the Unity of Science. Thus it is a revised form of narrative ethnography that is intra-active, where not only does matter and meaning become entangled, but also the methodology and the apparatus: Bohr's "philosophy-physics" is rooted in the Unity of Science Movement that Neurath was active in promoting (Faye 2008). Bohr hosted the 2nd International Congress for the Unity of Science where he presented a key paper in the development of complementarity (Bohr 1937). Jan Faye has argued that this correspondence with both Neurath and his colleague Phillip Frank shows how the Empirical Positivists significantly contributed to Bohr's conception of the Copenhagen Interpretation in opposition to Einstein (Faye 2008). Bohr also contributed to the *IEUS* (Bohr 1938). Edward Mackinnon (1980) has argued that the very nature of complementarity and the Copenhagen interpretation ensure that Bohr's lifelong interest in the Unity of Science was implicit in his philosophy-physics.

This reiterative process of diffraction is used to achieve further integration in relation to the development of cybernetics, the issues of participatory democracy identified in terms of the economy in kind as experienced in the crisis of productive relations of the German Revolution entangled with similar issues experienced in the short-lived Cybersyn Project.

NEURATH AND INTERNATIONAL DEVELOPMENT

This chapter will look at the role of Otto Neurath in the International Industrial Relations Institute (IRI). Following his participation in the World Social Economic Congress in August 1931, he was to play an important role in the organisation. Likewise his friendship with Mary van Kleeck and Mary Fleddérus was to prove very significant for both Otto and Marie Neurath. In her memoires Mary Neurath likened them to guardian angels particularly during their years in the Netherlands, where Mary Fleddérus was based (Burke 2013).

The IRI was an organisation which grew out of the political activism of women who had been excluded from the foundation of the International Labor Organisation in 1919 (Alchon 1992). It attracted participation from women factory inspectors and social reformers including factory owners (Oldenziel 2000). In face of the unemployment following the 1929 stock market crash the IRI organised the World Social Economy Congress in August 1931. This marked a shift away from gender activism, but women continued to play a central role in the organisation, particularly van Kleeck and Fleddérus (Kaufman 2004 p. 213).

Van Kleeck's career was marked by the application of her Christian ethics with a concern for women's and workers' rights, combining social work with scientific management: she was to serve on the Board of Directors of the Taylor Society. She had attracted the attention of Herbert Hoover in 1921 when he was US Commerce Secretary. She had then worked at overhauling how employment statistics should be calculated and conducted research for the Russell Sage Foundation working with the Women's Trade Union League on issues concerning workers' rights. She started work

for the IRI in 1928 and continued until 1948 when the organisation was wound down. As the cold war set in following the Second World War she became an ardent defender of the Soviet Union, something which she reconciled with her lifelong Anglican faith (McClurken n.d.)

Fleddérus had been personnel manager at the Leerdam Glass works, Rotterdam, an organisation which had links with the Arts and Craft and Bauhaus movements (Haanstra n.d.). However she became involved in organising conferences related to scientific management from 1925, becoming co-president of IRI with van Kleeck from 1928 (Alchon 1992). She was also friends with Cees van der Leeuw, a Rotterdam industrialist involved with the Van Nelle coffee company and participant in IRI congresses. Through the engagement of Constructivist architects in the building of the Van Nelle factory in Rotterdam, this constituted another link into the network of the cultural avant-garde of which Neurath was a part.

The IRI constituted a cross-class organisation including other enlightened employers like the Cadburys. The Cadbury family had established the Bourneville Village Trust to implement their approach to Quaker-based garden city planning for their employees living around their chocolate factory. Town planning was one of the themes running through the IRI perspective (Delheim 1987). Shop-floor workers as well as Cadbury family members attended IRI Congresses with an aim to incorporating all views with in the discussions. In fact the range of participants was quite extensive: at the 1931 Congress their were three Fascists from Italy as well as a delegation from the Soviet Union. The Fascists did not play a major part in the Congress however. This was however the first occasion that Soviet officials were to make a presentation about Stalin's Five Year Plan outside the Soviet Union.

Their delegation was led by Valerian Obolensky-Ossinsky (1887-1938), Vice Chairman of Gosplan, the Soviet State Planning Commission. This is the same individual

as Osinsky – the name he used when he joined the Bolshevik Faction in 1905. He participated with the Democratic Centralists in opposing Trotsky's militarisation of labour in 1921. He was also one of the signatories of the *Declaration of the 46* which complained that the Bolshevik Party had become hierarchical with bureaucrats appointed from above with a passive general mass who do not really participate in party life. (Platform of the 46 1923). However by 1931 such oppositional behaviour was behind him (Smolny Collective n.d.). He had a senior role in implementing the First Five Year Plan and was entrusted with presenting the progress of that plan to an audience in Amsterdam.

The Congress took place a few months after the 1931 Menshevik show trial, during which fourteen economists were put on trial for trumped up charges of trying to reintroduce Social Democracy to the Soviet Union. Hryhoriy Hrynko (also known as Grinko), the Peoples' Commissar for Finance 1930-7, made it clear that the First Five Year Plan did not have the abolition of money as a goal, but rather the accumulation of national income and indeed that the abolition of money and of the exchange economy was considered "anti-bolshevist" (Turin 1932). Neurath's was no doubt aware of these developments, and along with the other key people involved in the IRI, he adopted a very open approach to international co-operation. Both Obolensky-Ossinsky and Hrynko would be murdered by Stalin in 1938.

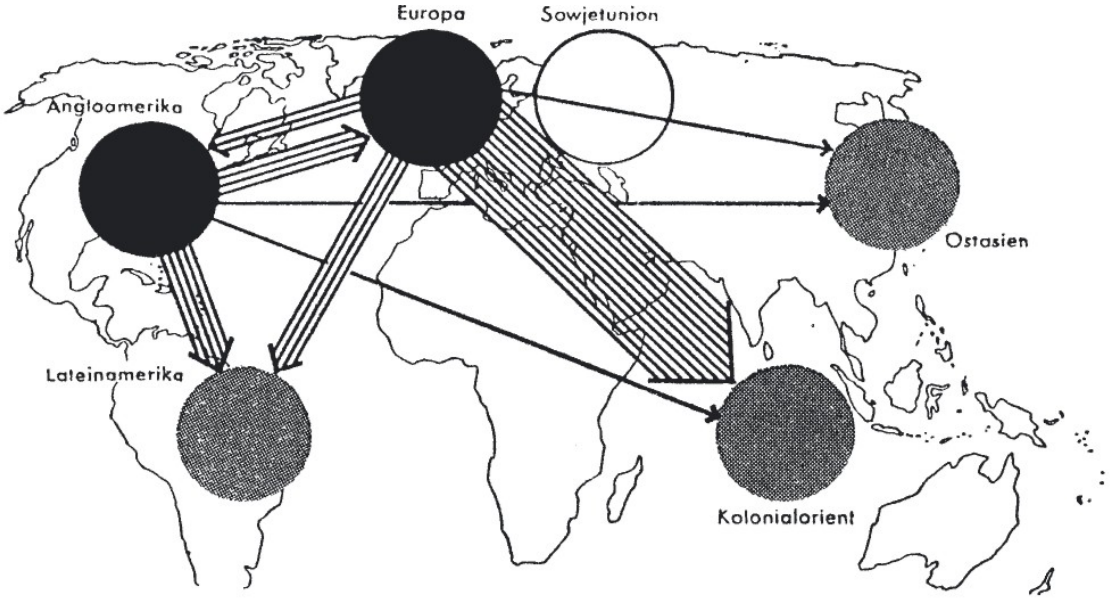
Neurath's contribution to the congress was 'The Current Growth in Global Productive Capacity'. Here he suggested that this congress was "most likely the first ever for social technology" which he then clarifies:

> "We are still at the start of the age of social technology, when social processes will be considered like an engineer considers a machine." (Neurath 1931d| 2005, p.475)

Neurath's contribution was a reassertion of his calculation in kind which he carefully distinguished from the Russian system outlined above. He uses the term

'functional economy' as what he hoped to be a value free term in order to avoid discussion of socialism and the specificity of the Russian economy. He goes on describe his goal as "*to develop a global economic plan purely in terms of conditions of life and production"* (emphasis in the original, ibid p. 487). The crux of the matter is shown in this illustration reproduced here from the work of Gerd Arntz, artistic director of the GeWiMu of Vienna.

Illustration



1: Neurath O. (1931d|2005) Illustration accompanying his presentation to the World Socio-Economic Congress. "The Network of International Finance. Legend: Every line stands for 5.000 million marks in long-term credits to and capital partnerships with the other major region" (Original caption).

Neurath created a good impression with organisers. In her review of the Congress Van Kleeck called for the establishment of a 'World Research Institute', not only to gather statistics but to work out an economic model which would encompass all the technical details of both machines and the human beings who operated them in a scientific manner. This proposed 'World Social Economic Center' would centralise research, rather than undertaking research itself. It would then serve as a planning group to provide feedback to business leaders, informing them of the effects of their policies and educating them about economics and scientific management. Van Kleeck

emphasised the scientific nature of the tasks involved (van Kleeck 1931).

Following the Congress Neurath was able to negotiate with Paul Otlet the establishment of a branch of the Mundaneum in The Hague and indeed create a place of refuge ready for when the GeWiMu and the Vienna curcle were banned following the Austrian Civil War of 1934. He worked closely with Fleddérus and van Kleeck with various initiatives to launch his ISOTYPES in the USA (Ihara 2013) and became a member of the IRI board.

However when the IRI organised a follow-on regional Social Economy conference in New York in November 1934, Neurath was not able to attend. Writing in a report based on the contribution of technicians and economists to this conference, van Kleeck described in greater detail about “Research as the Basis of Planning” (van Kleeck 1935, p.252). This she divided into a twofold inventory:

1. social research “*to insure in advance the consent and coöperation of all who will be involved in the fulfilment of the plan*” (emphasis in the original)
2. technical research into study of economic resources and productive capacity (ibid)

This shows that van Kleeck's support for Neurath was based on shared support for a world planning group based on two elements: Neurath's economy in kind and democratic control of the planning process.

Fleddérus was in the USA when Germany invaded the Netherlands, and at an emergency meeting the next day the IRI abandoned plans for a “World Conference on Natural Resources and Production for Standards of Living” scheduled for 1941 (IRI 1943), a proposed event which clearly indicated that the IRI had taken onboard

Neurath's concepts of an economy in kind linked to living standards. In her their communication with Neurath (Fleddérus & van Kleeck 1944b), Fleddérus and van Kleek sent a copy of their joint book *Technology and Livelihood* which envisaged how new technologies had the potential to create greater security of livelihood, but that livelihood has become insecure for the individual, even in a century of potential abundance" (Fleddérus & van Kleeck, 1944a, p.222). This book also chronicles the progress that the IRI had made in lobbying the League of Nations and the International Labour Organisation, even if the economic downturn of 1937-1940 led to war rather international co-operation (ibid).

This chapter has shown shown the role Neurath played as one ofthe primary theorists of the IRI. Not only was he on the IRI board, but they also adopted his principal economic approach. Further, they also shared his view of their work being scientific and neutral. Their aim had to include all nations regardless of the outer trappings of their particular regime. Following Neurath's death van Kleeck and Fleddérus fell into obscurity because of their refusal to align themselves to the USA's Cold War politics which came to prevail by the late 1940s. Nevertheless, reading them today shows them to be remarkably perceptive of the social problems which would arise not just at the end of the twentieth century but into the twenty-first century. Also their approach to neutrality resembles Neurath's position during his trial in 1919 – that he was an independent social scientist.

This chapter has established Neurath as a significant actor in the sphere of International Development, and highlights the practical orientation of his drive for the Unity of Science: to have a practical impact on the World Social Economy through implementing a global economy in kind. The next chapter will deal with the implications of his concepts of economy in kind.

NEURATH AND THE SOCIALIST CALCULATION DEBATE

The centrality of Neurath's economy in kind to his involvement in international development has been demonstrated. This chapter explores what constitutes 'economics in kind' in greater detail. As such concepts as “capitalism” and “socialism” have been used in such a broad variety of ways, in many respects they have lost any precision which makes them by themselves useful terms, a point Neurath discussed in 1920 (Neurath (1920/1|2004). Reference has been made to Ludendorf's war socialism, and clearly this was a feature of scientific discussion immediately following the First World War, even if an understanding of this has been less prevalent subsequently.

Alexander Bogdanov, for instance, had analysed a similar phenomenon experienced amongst all the warring imperialisms by 1916: the emergence of militaristic “communism of consumption”. The armed forces played an increasing role not just within the state, but also spreading their power across society requisitioning goods not so much for a productive purpose, but one of consumption in a process of destruction (Biggart 1989). Writing as the Bolshevik seizure of power was unfurling in late 1917, Bogdanov denied that this “war communism” was a transitional form of state capitalism leading to socialism as discussed by Marx in Volume III of *Capital.* Marx speaks of “abolition of the capitalist mode of production within the capitalist mode of production itself” (Marx 1894|1959, Chapter 27). But rather than this Bogdanov saw what was happening in Russia as an aberration which arose from the autarky that occurred during the First World War, and which continued in the Soviet Union owing to the continued blockade which prevented Russia being re-integrated into the world market (Biggart 1989).

However, as Biggart goes on to point out, Bogdanov's critique was soon forgotten and through their domination of the Soviet state the Bolsheviks were able to ensure that their conception of state capitalism was soon transformed into a common understanding of what socialism actuality amounted to.. In this context it becomes understandable why Hayek wrote *The Road to Serfdom* (1942) which makes perfect sense as a critique of the forms of “socialism” which emerged in the former Russian Empire following the First World War. In a review of Hayek's book, Neurath challenged this. He used the term “orchestration” to describe a non-authoritarian approach to planning and criticises Hayek's restriction of the options between a free market and totalitarian planning. He suggests a third alternative: a co-operative effort, based on compromise (Neurath 1945), what he called 'International Planning for Freedom (Neurath 1942).

Another Chicago school theorist, Ronald Coase, attended Hayek's public lectures at the London School of Economics (Coase 1988). He introduced quite a different way of looking at things with *The Nature of the Firm* (1937). This arose from considerations of planning in the Soviet Union and particularly Lenin's comment that Russia would be run as one big factory (Lenin 1917). Aware of the claims by Hayek and others that planning an economy as one big factory was impossible, Coase realised that such a viewpoint might mean the function of very big firms was also theoretically impossible. Therefore he embarked on a research trip across the USA to investigate exactly how firms worked (Coase 1988). He soon identified that according to the economic theory of the time sometimes it was assumed that resources were allocated by the price mechanism whilst at other times by the entrepreneur co-ordinator. He then showed how hidden within the market relationship are the costs of maintaining the market as such, and that firms would emerge where entrepreneur-managers can more

effectively direct the utilisation or resources. Furthermore, as technological innovations allow for more effective productivity by bringing producers together, for example in a factory, so the size of firms will increase (Coase 1937).

From this it can be seen that Hayek's condemnation of socialist calculation could not be sustained – both the market and planning constitute an integral whole in an industrial society. In reality a key function of management is making a rational choice within the context of a given situation at a given time. This is precisely what Coase witnessed as he visited car producers such as Ford and General Motors in the USA. It served as an explanation as to why Ford acquired the Fisher Body Plant, rather than simply relying on them as an outsourced supplier (Coase 1988).

This reduces the choice between the market and the firm from a totalising concept governing the whole society to a more granular level, where the manager-entrepreneur-technocrat emerges as the key figure in the way the economy functions. The market is predetermined by the decisions of this social strata as regards whether to seek or make available a variety of goods and service in the market environment or to keep such transactions within the firm.

Thus the distinctiveness of the Soviet Union arises more from its condition of autarky, something which Stalin's Five Year Plans set out to resolve: the first and second five year plans constituted the largest transfer of technology in the history of western capitalism (Buck-Morss 2000). The financial arrangements were made with little publicity, and were in fact funded by the sale of classic works of art from the Hermitage to a corrupt US Secretary of the Treasury, Andrew Mellon. Thus precisely in the twelve month period when Osinsky was attending the World Social Economy Congress in Amsterdam, Mellon spent nearly $7M on Russian art treasures, constituting around a third of total Soviet exports. In 1937 Mellon was obliged to

bequeath the art works to the US National Gallery of Art to avoid a lawsuit for tax fraud (ibid).

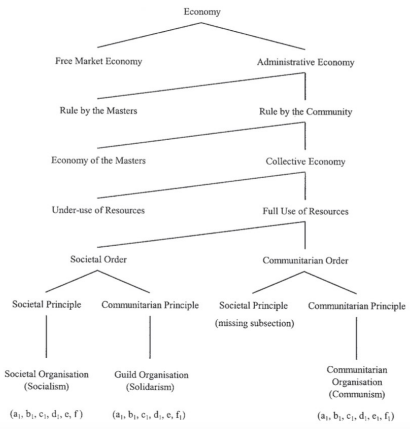
This illustrates Hayek's concern that within the duality of planning and the market that the suppression of the market is rather its occultation, i.e. in the Soviet Union the market becomes removed from view whether through bribery as in the Mellon case, or with the shift from *kupil* (buying) to *distal* (obtaining) in everyday soviet discourse in the early 1930s. This is part of the emergence of *blat* as a generalised favour economy which originated within pre-revolutionary criminal fraternities but came to be a significant factor in lubricating the economy with the imposition of the first Five Year Plan (Ledeneva 1998). It was accompanied by purges of precisely those involved in scientific management and a planned economy through a series of show trials: the Shakhty Trial (1928), the Industrial Party Trial (1930) and the Menshevik Trial (1931) (Beissinger 1988). This would indicate that after the First Five Year Plan the Soviet Union should be seen as a "network economy" rather than a planned economy albeit not in the terms developed by modern theorists like Yocchai Benkler (2006)

But rather than seeing this as a reason for maintaining a market economy, it can more fruitfully be seen in terms of cybernetic theory, i.e. as an instance of Ross Ashby's Law of Requisite Variety (1956) – summarised as "only variety absorbs variety" (Beer 1979): In any system the range of possibilities in a regulatory mechanism must match that produced by what is being regulated. The market price mechanism is an example of this law: in every transaction, there is a buyer to match the seller, which produces a "natural price" at a point generated by the aggregation of the price at which individual vendors are prepared to sell matching that which individual purchasers are prepared to pay (Smith 1776). Beer presents the law of

requisite variety as a natural law (Beer 1979, p.89), just as Smith had presented his economic theory as concerning a natural process. This is in accord with Neurath's view on how science develops: Smiths discovery is not completely dismissed, but rather contextualised as a manifestation within specific circumstances of a more generalisable law.

The perspective of cybernetics provides a useful tool to understand how Neurath grappled with the undoubted problems which arose in coping with the replacement of the market by an economy in kind, i.e. by interpreting his approach to social engineering in terms controlling variety. The example used here is the analysis he developed in the 1919-9121 period, starting from *Die Sozialisierung Sachsens* (1919), an official document published by the Workers' and Soldiers' Council in Chemintz. Here Neurath proposed a "universal statistical survey" as an inventory of all the material resources available to society which would then allow a Natural Calculation Centre (NCC) to develop a plan not as a single economic strategy but as a set of viable alternatives between which a representative body could choose (Tribe 1995). Thus the role of the experts in the NCC was to reduce the variety of choices available to the deliberative body by ruling out those which could not be realised. Later in this report it will be shown how Beer himself tried to achieve the same ends.

Another example of a methodology adopted by Neurath in a somewhat different context can be seen in his analysis of socialisation (Neurath 1920/21| 2004). Here he catalogues eight different dualities or "elementary phenomena" using a notation $a - a_1$, $b - b_1$, etc. thus creating in principle 256 possible alternatives. These can then, however be simplified. In chart x he reduces the 64 possibilities of $2^6 (a - f)$ to 3: societal organisation, guild organisation and communitarian organisation. This on the basis of accepting four presumed choices ($a -$



2: Chart used by Neurath to illustrate his reductive approach using binary categories Neurath (1920/1|2004)

d), and then the four choices generated by *e* and f (Tönnies distinction between societal order and communitarian order and the distinction between societal principle and communitarian principle as an independent variables), is reduced by eliminating. He then reintroduces two more variables g (development or elimination of existing institutions) and *h* (peaceful or violent implementation). This method functions precisely in terms of using a series of binary alternatives to analyse a set of possibilities and then using analytical methods to reduce these to those specific alternatives which are considered useful. Neurath was doing by hand the sort of logical calculations which computers do as a matter of course.

Copper							
Form	No.	Stock at the End of 1918	Increase		Decrease		Stock at the end of 1919
			Import	Transformation from	Export	Transformation from	
Copper in Ore	1	100	50	Mines: 150	30	2.: 100	170
Raw Copper	2	200	100	1.: 100	20	3.: 100; 4: 20	260
Copper in Final Products	3	300	10	2.: 100	10	4.: 40	120
Copper in Waste	4	100	30	2.: 20; 3.:40	30	2.: 20	170

3: Primitive form of spreadsheet which Neurath used to illustrate how the flow of copper, could be traced from ore to final products and waste Neurath (1920/1|2004)

In the period 1913-5 Neurath corresponded with Ernst Mach, and assimilated much of his concern with the "economical organisation of the facts" (Stöltzner 2001). Thus Neurath can be situated between Mach's "economy of thought" and *The mathematical theory of communication* (Shannon and Weaver 1949) which then enabled Ashby to clarify his Law of Requisite Variety (Ashby 1956).

However this report will now move to a deeper discussion the political aspects of which emerged from Neurath's approach to politics and explore a neglected area which arises from the networking skills which are so characteristic of how Neurath operated.

NEURATH AND PARTICIPATORY DEMOCRACY

This chapter establishes how Otto Neurath was networked with German Council Communists political groups in more ways than one, and thus their importance for an assessment of his political involvement. The role of Franz Seiwert, a political and aesthetic comrade of Gerd Arntz, will be highlighted. He played an important role in the formation of the Vienna method/Isotype team in 1929 and indeed helped Neurath's links with El Lissitsky (Benus 2013).

Neurath encountered people close to the Council Communists through his work with the Vienna Circle[3] and their partner organisation the Berlin Circle This was founded by Hans Reichenbach. Clearly simply being someone else's brother does not create sufficient connection for a network: Richard von Mises, also involved in the Berlin Circle, was the brother of Ludwig von Mises, who despite his avowed liberalism supported Engelbert Dollfuss' Austrofascism (Raico 1996). Richard von Mises himself was apolitical. However the same is not true of Hans Reichenbach who was involved in student politics with both his brother Bernard Reichenbach and Alexander Schwab (Biographische Datenbanken 2008). Bernard and Schwab were active in the Communist Workers Party of Germany (KAPD). This was formed in 1919 by activists expelled from the Communist Party of Germany (KPD) because they rejected trade unionism and parliamentarianism. They sought the introduction of socialism through a form of participatory democracy implemented through the workers' councils, an anathema to both Social Democrats and Bolsheviks. Indeed In 1921 they both travelled with Jan Appel to the Third Congress of the Third

3 Karl Korsch has not been included in this discussion as his political trajectory only involved moving from his former Bolshevik viewpoint towards of the Council Communists after 1926.

International as delegates of the KAPD and indeed their experience led to the KAPD breaking with the Third International (Reichenbach B., 1964). They were following in the shoes of Otto Rühle who had attended the Second Congress on behalf of the KAPD the previous year and had been expelled from the KAPD which at that time still wanted to retain links with the Bolsheviks – indeed Bernard Reichenbach was briefly appointed to the Executive Committee of the Third International (Reichenbach B. 1969). Writing fifty years later Bernard Reichenbach was to highlight the practical aspects of the politics of the KAPD:

> "When a factory came to a standstill due to a lack of fuel or raw materials, there was no one to turn to for help. Government, parties, unions, capitalists – no one could do anything to solve the basic problems of transport, fuel, raw materials, etc. Resolutions, declarations, orders, and even paper money, were of little use. Under these conditions, workers would form a council, and set out to solve these problems by themselves." (ibid)

Thus their concerns were with an economy in kind, and Neurath's conception was economically closer to them than the Social Democrat Party (SPD) to which Neurath adhered. It is not within the scope of this research to explore deeper Neurath's relationship with Bernard Reichenbach – they became friends when both were in exile in England (Sandner 2015).

Also no record of any links between Neurath and Rühle were found although they undoubtedly knew of each other: both were active in Saxony during the First World War – Rühle was Reichstag Deputy for Pirna, near Dresden. During the German Revolution in Saxony, Rühle refused to attend the Council for People's Commissioners for Saxony, which only had Independent and SPD delegates. They set aside any discussion of socialisation – as proposed by Neurath – when they met in November 1918. Neurath's proposal had been adopted by the Chemnitz Workers'

Council, who also refused to attend (Lapp 1997). It was after this that Neurath took his proposal to Bavaria.

We shall now look at Figurative Constructivists with whom Neurath became involved. In 1925 the art historian Franz Roh provided the connection with them., leading to the recruitment of Gerd Arntz to the GeWiMU in 1928. He was the graphic artist who proved most effective in realising Neurath's conception of the Vienna Method and later Isotypes working with him from 1929-1940. Arntz himself wrote very little – he contributed a piece about the Vienna Method to *A biz Z* (Arntz 1930). However he was very close to Franz Seiwert, the foremost theorist of the Figurative Constructivists.

Both Arntz and Seiwert were painters and graphic artists actively involved in a movement at once political and aesthetic. They were active amongst the Council Communists, providing frequent illustrations for such activist papers as *Proletarische Revolution* and *Die Aktion.* They rejected any form of party structure including the KAPD. Instead of being governed by a centralised organisation, they envisaged socialism being introduced by a network of self-empowered *Betriebsorganisation,* or "operations organisation" which would directly manage production. This was a conception modelled on the Industrial Unionism of the Industrial Workers of the World (IWW) which had had around 150,000 members in 1917 (Chester 2014, p. xii). In 1922 the AAU-E had about 60,000 members (Bourrinet 2008, p. 167). This compares with about 100,000 members for the Bolshevik Communist Party of Germany (KPD) (Broué *et al.,* 2006 p. 628) and 340,000 for the Social Democratic Party of Germany (SPD) (Wheeler 1975, p. 263) at this time.

Seiwert had been in close contact with Red Marut who had worked closely with Neurath in 1919 (Cartwright *et al.* 1996, p.49) Whilst Neurath was imprisoned, Marut,

also accused of High Treason, fled a lived in hiding with Seiwert in Cologne (Goldwasser 1993). This political involvement shows that Seiwert had a good understanding of how the Bavarian Soviet Republic unfolded and hence an understanding of Neurath and his role in it.

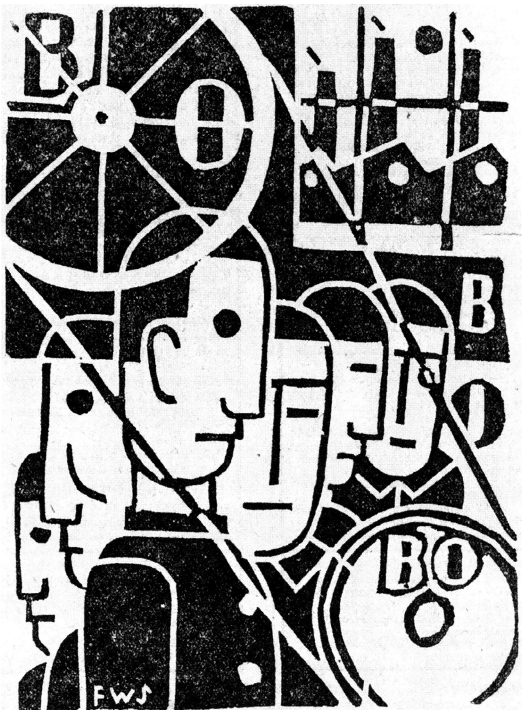
However Seiwert and his network of associates is as much revealing of how they contributed to Neurath's future development as it indicates a familiarity with his previous achievements. Seiwert had been involved in the creation of an international network of Constructivist artists since 1922, when met El Lissitzky at the Congress of International Progressive Artists held in Düsseldorf. They responded to a proposal for a “Union of International Progressive Artists”. They opposed the original proposal because it fell short of their own goal of creating an internationally accepted visual language (*De Stijl* 1922|74).

Lissitzky met both Seiwert and Neurath during the 1928 *Pressa,* the International Press Exhibition in Cologne. Lissitzky was responsible for the much-acclaimed Soviet Pavilion. Indeed Seiwert was to provide help in locating local skilled artisans who would not overcharge the Soviets (Lissitzky-Küppers 1968). It was following this coming together that Arntz and two other Figurative Constructivists, Augustin Tschinkel and Peter Alma, were employed by Neurath's GeWiMu. Alongside Neurath they were to gain a contract working in the Soviet Union from 1931-4 through the connection with Lissitzky.

The Constructivists had an approach to graphic art which brought together both procedural and theoretical aspects. They practiced participatory democracy in their creative/productive process. The creation of the Soviet pavilion was created as the work of a “collective of creators” with Lissitzky playing the role of co-ordinator. They applied the theory of *factography* according to which photomontage can be used “as a

way of assembling facts as raw data, as information and communication" (Anysley 1994).

The Figurative Constructivist grouped around Seiwert developed this in an even more precise way, which they called "sociological graphics". Augustin Tschinkel, one of the group employed by the GeWiMu, described their goal as to "present people as products of their relationships", illustrating this with illustrations from Peter Alma (also employed by GeWiMu) himself and Seiwert. These "show individual people as actual constituent parts of an operation which the employer can calculate numerically, like other inventory" (Tschinkel 1930).

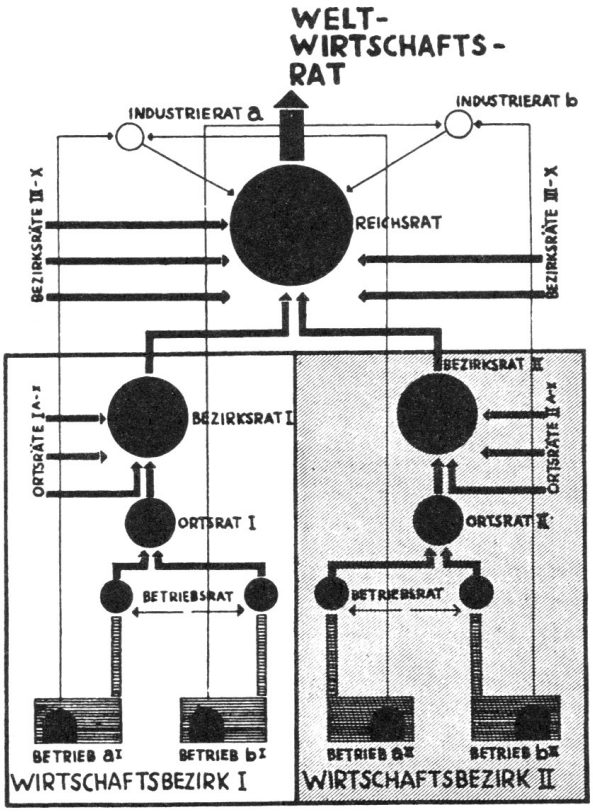


4: Seiwert (1923) 'Betriebsorganisation' The emancipatory use of an image of the worker as Cyborg used as cover of *Die Aktion*

This aesthetic approach is prefigurative of cybernetics the principal point of which is that "it intentionally overlooks the distinction that is usually made between 'living' and 'non-living' systems" (George 1977, p.3). It also prefigures Donna Haraway's Cyborg: "A cyborg is a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction." (Harraway 1991). Haraway's radical assertion is politically aligned to socialist feminism, and sets out to place this assertion on a scientific basis, thus paralleling the work of the GeWiMu. Haraway was in turn highly influential on Barad, who takes here conception of diffraction from Haraway (Barad 2007, p.71). This is not to suggest that either

Haraway or Barad are remiss in failing to give recognition to their predecessors: rather it is to confirm the methodology of refraction which does not create rigid intellectual genealogies, but rather searches for intra-actions which reveal embedded relations located in the structure of society.

The figurative-constructive pictorial forms were also used to illustrate an intended construction of a World Economic Council globally bringing together all the factory and local Councils of the world. This schema was accompanied by an essay formulating the difference in approach between state socialism and the Workers' Council movement. Neurath remained aligned with the Social Democrats envisaging a similar framework being developed through existing state and municipal structures (Benus 2013 p.234).



5: Seiwert (1932) 'Schema des Rätesystems' Weltwirtschaftsrat = World Economic Council, Reichsrat = National Council, Bezirtsrat = Regional Council linked through Ortsräte = Town Council Betriebsrat = works Council published in *A bis Z*

This chapter has shown how Neurath's working relationship with the Figurative Constructivists opened him up to diffractive influences both in terms scientific outlook and participatory politics. It has shown a relationship between their collaborative work at the GeWiMu and subsequent developments in cybernetics and socialist feminism. Both Seiwert and Neurath used the term “mosaic” to describe the way they aggregated information: Seiwert graphically as in the painting used on the cover of this report and

Neurath when describing the International Encyclopedia of Unified Science (Neurath (1937|1987) This is an area currently being explored by the Authority Research Network (2014) in New York.

NEURATH AND THE INTEGRATION OF KNOWLEDGE

This chapter looks at Neurath's involvement in the significant developments which occurred in the philosophy of science thanks primarily to the work of the Vienna Circle. The publication of *The Scientific Conception of the World: The Vienna Circle* (Neurath 1929|1973) announced their joint collaboration with the *Die Gesellschaft für Empirische Philosophie*, better known as the Berlin Circle. In 1930 they launched the journal *Erkenntnis* and in the first issue announced their *Conference for the Epistemology of the Exact Sciences* to be held in Königsberg that September. The conference set out to provide a platform for three competing approaches to scientific epistemology: Logicism (i.e. logical empiricism as developed by the Vienna circle), which was to be defended by Rudolph Carnap of the Vienna Circle itself, Intuitionism (where mathematics is conceived of as a human construction with no objective basis), defended by Arend Heyting, a student of , the L. E. J. Brouvwer and Formalism (whereby mathematics consists of rule-bound manipulation of mathematical symbols) represented by John von Neumann, an assistant of the founder of Formalism David Hilbert.

However this attempt to allow an open discussion of the three principle viewpoints on scientific epistemology was completely overshadowed by the presentation made by a young academic who had been involved with the Vienna Circle (although he was to distance himself from them after the conference). This was Kurt Gödel, whose contribution “On Formally Undecidable Propositions” (Gödel 1931| 1986) not only changed the environment of scientific epistemology, but also had an impact on the development of computing. Put simply, Gödel demonstrated through a

formal mathematical process that it was impossible to create a comprehensive mathematical system which was both complete but without contradiction. He had used an early method of recursive encoding: statements about numbers were encoded as numbers. Aside from proving that the formal process von Neumann had been working on was hopeless, this use of algorithms was also to prove crucial in the development of computational theory. Alan Turing in his ground breaking paper laid the theoretical foundation for computers using Gödel's work (Turing 1937).

This report now explores how Gödel's intervention had a significant impact on Otto Neurath. Gödel's contribution to the development of computing is well known: von Neumann dropped his involvement with Hilbert's formalism and transferred his attention to the development of working computers. However Neurath was not a mathematician or a technician. His manner of thinking was more subtle, applying cognitive models from one thought collective in the context of another. The examples produced will show that although he made no significant direct contribution to the development of computing, his thought does throw light on its subsequent development.

1. In 'Sociology in the Framework of Physicalism' (Neurath 1931|1983) Neurath advocates a unified language and syntax, which then create a way of formulating statements within the constraints of his physicalist language. He proposes the creation of a “thinking machine” based on the Logic Piano created by William Jevons (1835-1882), the English political economist who had introduced the general mathematical theory of economics (Jevons 1866). Jevons developed a version of Boolean algebra which then proved to be crucial in Claude Shannon's subsequent application of Boolean algebra to relay

switching circuits in 1940 (Barrett & Connell, 2005/6). This shows that like Jevons Neurath was thinking in terms of a machine which could enable complex logical calculations to deal with economic and social problems. Neurath's call for a “physicalist language” can be seen as presaging the development of formal computing languages which enable computers to handle logical operations.

2. The same year in a short article published in the USA (Neurath 1931) he speculates about how science organised according to his proposed language of physicalism could be expressed in Morse Code, i.e. a sequence of 1s and 0s as implemented by the electronic computer.

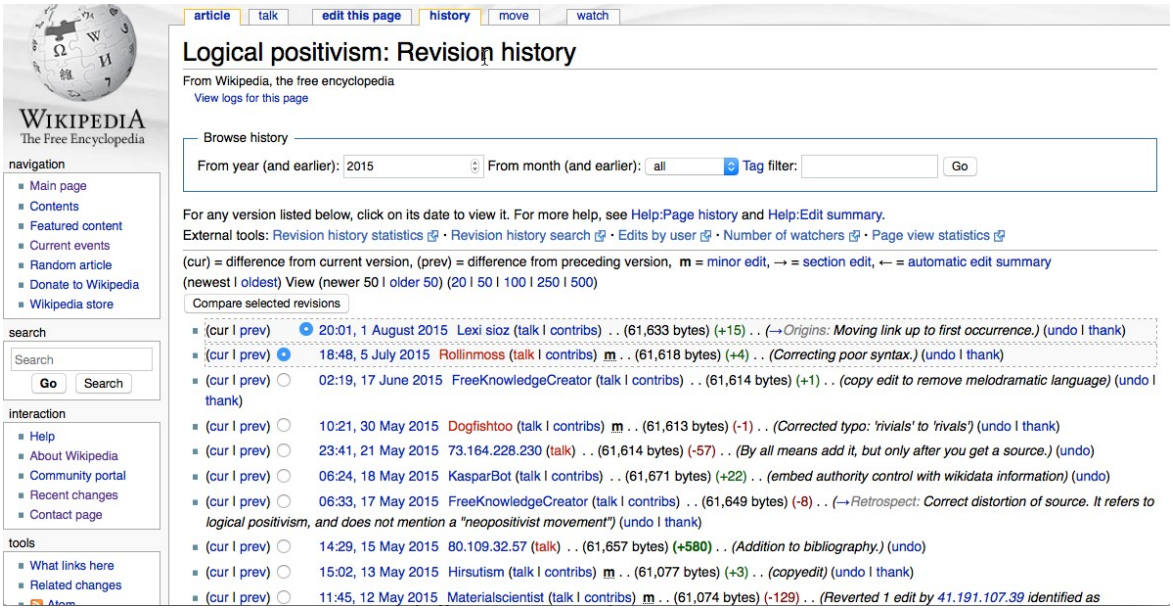
3. Also in 1931 the article 'Physikalismus' was published in Italy (Neurath 1931b| 1983):

> “An unblemished syntax is the foundation of an unblemished unified science. Language is essential for science; within language all transformations of science take place, not by confrontation of language with a 'world', a totality of 'things' whose variety language is supposed to reflect. An attempt like that would be metaphysics.” (p. 54)

This extract shows that Neurath regards the “syntax” as the crucial element of his physicalist language, within which science can be developed. This provides evidence of his dismissal of any attempt to make language a vehicle which can match the variety of the world. This is a foretaste of the Conant-Ashby Theorem: “the living brain, so far as it is to be successful and efficient as a regulator for survival, must proceed, in learning, by the formation of a model (or models) of its environment.” (Conant & Ashby 1970). Can Neurath's conception of unified science be regarded as a process by which the human reasoning capacity to make a model of the world can be aggregated through the

shared capacity of language to create a thought collective organised around isomorphic modelling of whatever aspect of an environment which a community of practice has been generated to deal with?

4. Protocol sentences as described by Neurath are somewhat prescient as regards the Wiki Way developed by Ward Cunningham (2001):

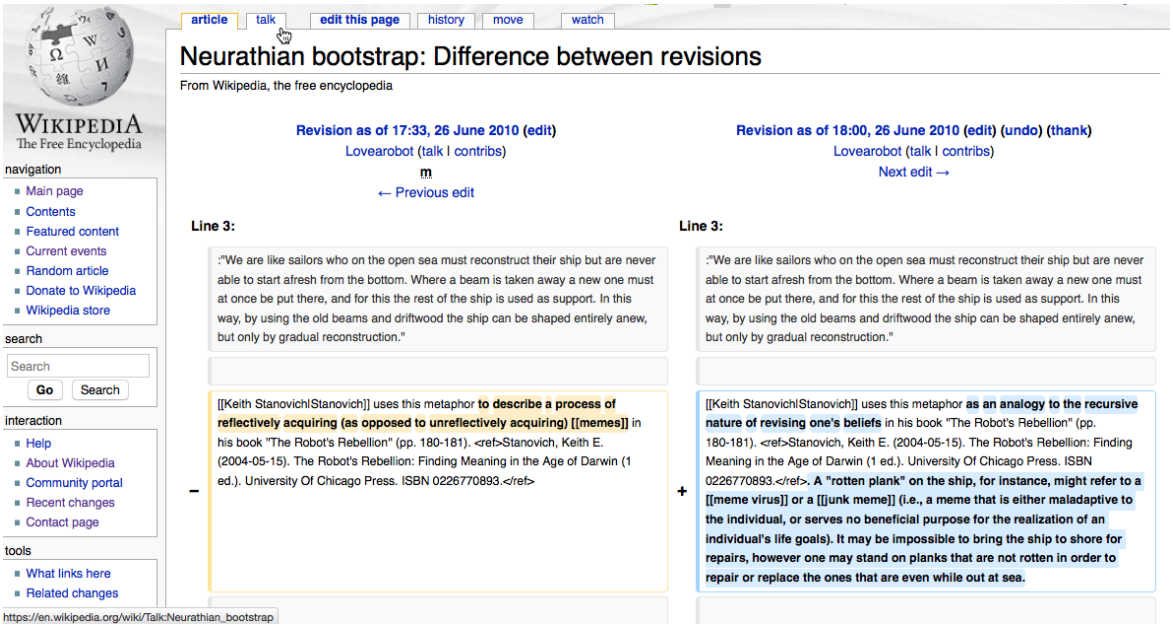


6: Screen shot of "Logical positivism: Revision history". Wikipedia (2015a)

> If, for example, I had said earlier: "Today, 27 July, I am busy with protocols of my own and of others", it would be more correct to say: "Otto Neurath's protocol at l0 a.m., July 27 1932: [Otto Neurath's speech-thinking at 9 hours, 55 minutes was: (Otto Neurath occupied himself between 9 hours, 40 minutes and 9 hours, 54 minutes with a protocol by Neurath and with a protocol by Kalon both of which contained the following two sentences . . ,)l". Although Otto Neurath words the protocol concerning the application of the protocols, he incorporates his own protocol into the system of unified science in the same way as that of Kalon. It may very well happen that Neurath deletes one of Neurath's protocol statements and adopts one of Kalon's in its stead. That a man clings more obstinately to his own protocol statements than to those of another, in general, is a historical fact—without any fundamental significance for our discussion. (Neurath 1932/3)

This is precisely how wikis record their collaborative process. Each page has a tab which takes you to the revision history. The Each individuals contribution is recorded, broken down into individual edits which can be as small as adding a punctuation mark. The individuals name and the time are recorded. This a

very precise match between what Neurath proposed, and what was implemented in Wiki software. The fact that most popular application of Cunningham's Wiki is Wikipedia, further confirms the view that Neurath's protocol sentences are precursors not only of contemporary digital practice but also modern encyclopedism.



7: Screen shot of "Neurathian bootstrap: Difference between revisions" Wikipedia (2015b)

However, this practical example of web-based encyclopedism has not been derived from an application of Neurath's encyclopedism. On the contrary, Wikipedia founder Jimmy Wales explicitly states that Hayek's 'The Use of Knowledge in Society' (1945) was central to his conception of Wikipedia (Schiff 2006). However this does not contradict the argument presented here, as it is based on diffraction, not linear causality. The fact that Wales, using an opposing starting off point ends up producing results in line with Neurath's framework would rather suggest that the structure proposed by Neurath for Protocol Sentences has an importance in the organisation of internet encyclopedism.

PARTICIPATORY DEMOCRACY AND CYBERNETICS

This chapter looks at the re-appearance of participatory democracy in cybernetics in the 1970s. This involves an encounter with another example of diffraction when the cybernetician Stafford Beer met Salvador Allende (1908-1973), an intra-action which created an “entangled ontology” (Barad 2007, p.89) whereby Beer's conception of cybernetics was radically transformed. Firstly this requires a look at Beer's career before Chile and then at the impact of his encounter with the Chilean president.

Beer (1926-2002) entered the Army aged 18 in 1944, and remained in the Army after the Second World War, seeing service in India where he had a position in Army Intelligence in the Punjab. When he was redeployed in England he joined the Army Operations Research Group, where he applied his knowledge of psychology. In 1949 he left the Army for a career in the steel industry, introducing the techniques of Operations Research and Cybernetics to issues of management. For the first six years they had no computers, but in 1956 he was responsible for installing the first computer dedicated for the purposes of management cybernetics at Cybor House, Sheffield, part of United Steel. This was a nationalised company employing over 37,000 workers by the time Beer left in 1961. He left to found his own consultancy firm, SIGMA, which had all the characteristics of a profitable business consultancy, soon gaining an international reputation. In 1962 SIGMA carried out contact work in Chile. This contract led to the contacts which would later lead to Beer's involvement in Project Cybersyn (Medina 2013).

In 1970 in Chile Salvador Allende became the leader of the democratically elected Marxist national government. This government then employed Stafford Beer as

a cybernetic technician to install an ICT system to help create the sort of participatory politics which Allende envisaged. Even though the project lasted barely two years, the ICT system known as Project Cybersyn was soon providing substantially better information retrieval rates than even a developed country like the UK could attain (Beer 1982).

Beer arranged a meeting with Allende, where he set out to explain how his proposed cybernetic system would work. He was just reaching the climax of his presentation, which involved describing a pyramidical system whereby all the information came together at a single point: the President himself. However Allende interrupted him, with a smile and said: “At last: the *people”* (Beer 1982). This had a profound affect on Beer, both theoretically and as regards his own personal viewpoint and lifestyle. Questioning the role of the state bureaucracy – no matter how well meaning – Beer asked “how can the pursuit of democracy itself be aided by science and technology, and how can they be harnessed to ensure the participation of the people in the national decisions?” (Beer 1974, p. 334) He attempted to realise Allende's notion of national assembly – participatory democracy at the level of the nation – through “a cybernetic answer”.

Like the Council Communists, he applies this answer firstly at the level of the factory with feedback loops to enable groups of workers to see how their level of satisfaction (eudemony) reflects that of the factory as a whole. They can respond to this feedback by adjusting the information they are feeding into the system at any time. This is continuously aggregated and the information as regards the factory as a whole is updated. Through the Viable Systems Model – which Beer was consolidating whilst in Chile – his cybernetic systems nested like Russian dolls. The process of aggregating the eudemony of constitutive parts can be applied in various ways: by industrial sector,

by locality, indeed by any category that is deemed appropriate – and even what is deemed appropriate can be altered by the same mechanism.

Alongside this Beer developed a Quantified Flow Chart which addressed precisely the problems Neurath had raised as regards monitoring complex production process to reveal how an economy in kind would work in an industrial society where bundles of goods would be continually modified into new categories of goods, each addressing a range of specific wants and needs (Beer 1989).

In 1973, the elected government was overthrown in a coup backed by the USA's CIA. A dictatorship led by Augusto Pinochet was installed and soon Hayek himself was one of its most vociferous supporters (Robin 2013). Like Alfredo Pareto and his support for Fascism, and Ludwig von Mises defence of the Freikorps crushing the Workers' Councils (Raico 1996) before him, Hayek became an apologist for the use of extra-judicial killing in pursuit of what he understood as a “free society” cleansed of impurities (Robin 2013). David Harvey has chronicled the role of Hayek in initiating projects for his Mont Pelerin Society in 1947 in Chile following Pinochet's coup (Harvey 2005).

This chapter has shown how the same issues which arose in 1919 reappeared in the development context of 1970s Chile. Beer went on to apply his approach in Uruguay in a project funded by the United Nations Development Programme (Beer 1989) and other projects in Venezuela and Mexico (Martin & Rosenhead 2002).

CONCLUSION

This research has has produced an account of the period outlined by Bateson in 1966. It has yielded an account rooted in participatory democracy and economies in kind, rather than in the Keynesianism with which Bateson was concerned. This research has been productive in providing an account of this period which fits well with several of twenty first century concerns.

Principle question:

> *To what extent is it valid and useful to consider Otto Neurath and the Unity of Science Movement as pioneers of cybernetics?*

The validity has been effectively asserted, identifying ways in which Neurath's work has contributed to the emergence of cybernetics two years after the end of the Second World War and Otto Neurath's death. Neurath's importance has been demonstrated, particularly in the area of International Development in the 1930s. Although his activity with the Industrial Relations Institute has hitherto remained obscure, it has been demonstrated that this was an important activity which stimulated his involvement with the Unity of Science Movement. Textual evidence has been supplied to show that although he did not have any direct responsibility for the development of computers, his work was related to those who did, and that he evinced a more than rudimentary understanding of some of the issues which would arise with the development of computing. The adoption of his protocol sentences by Ward Cunningham in his wiki software has been demonstrated. Whilst there is no evidence for a direct causal relationship, this further underlines a deep seated relationship

revealed by the diffraction of the methodology adopted. This perhaps makes it more remarkable than showing a direct causal relationship.

The comparison between questions of participatory democracy which arose from the Workers' Council movement in Germany 1919-23 and that attempted by Salvador Allende and Stafford Beer in 1970-3 has been very useful. Both started with what could be called a technocratic approach to the problem of rational management of an economy in kind. Both were profoundly affected by those they worked with to integrate an approach which encompassed participatory democracy. Whilst both Neurath and Project Cybersyn have been subject of a revival of interest in recent years, this research has placed them in relation to each other.

Subsidiary questions:

> *Does cybernetics and the Law of Requisite Variety provide a way of resolving the Socialist Calculation Debate?*

This research has shown that the Socialist Calculation Debate was in many respects part of a polarised discussion between Otto Neurath and Friedrich von Hayek that continued even after Neurath's death. The issue was not just a matter of economics but also concerned the role of science and the use of knowledge. The role of Ashby's Law of variety and of the Conant-Ashby Theorem have been shown to shed light on not only the Socialist Calculation Debate but also the debates about what constitutes a scientific approach to knowledge in the 1930s.

> *Does cybernetics, in the context of modern computing capacity, provide a means of developing an economy in kind as proposed by Neurath as a way of addressing the socio-economic problems of contemporary society.*

Whether cybernetics in the context of participatory democracy can resolve the issue of coping with a high level of complexity has not been resolved. Unfortunately the violent overthrow of a democratically elected governments to put an end to an innovation which threatened to disprove their doctrines. Nevertheless, participatory models of knowledge sharing have been shown to have potential well worth exploring.

This research has also revealed many areas where further research is likely to produce fruitful outcomes:

- The role of the Industrial Relations Institute in providing a focus for nascent forms of International Development prior to the Second World War
- Deeper research if the intra-action between Neurath and the artists who he worked with – not just Gerd Arntz but also Franz Seiwert and El Lissitzky. Much of the existing research is usefully focused around issues of graphic design, but this work could be expanded to include how visual education intra-acts with information and communication technologies.
- Cybernetics and particularly socio-cybernetics can be used to analyse the social transformations which occurred particularly in the period following the First World War.
- How the participatory co-creative processes which are often celebrated as a product of the globalised internet culture have their own history which can give insight into the opportunities these process can make available.

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