Otto Neurath and the Representation of Social Facts in the Digital Age

Marko Bralic

A Research Paper Submitted to the University of Dublin, in partial fulfilment of the requirements for the degree of Master of Science Interactive Digital Media

2019

Declaration

I have read and I understand the plagiarism provisions in the General Regulations of the University Calendar for the current year, found at: http://www.tcd.ie/calendar

I have also completed the Online Tutorial on avoiding plagiarism 'Ready, Steady, Write', located at: http://tcd-ie.libguides.com/plagiarism/ready-steady-write

I declare that the work described in this research Paper is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

Signed:

Date:

Declaration

Signed:

Date:

Acknowledgement

I would like to thank my supervisor, Dr Robin Fuller, for his constant advice and support over the course of this research paper.

I would also like to thank Julija Radovic and Damir Bralic, but not for the scientifically irrelevant work of performing their private roles of my girlfriend and my brother – Julija's proofreading and observations were essential in improving the quality of this paper, while talks with Damir about Otto Neurath inspired the paper's topic.

.

Abstract

This research paper shows how Neurath's invention of the method for creating pictorial statistics was primarily a result of his ambition to develop a tool that would transform the society. Ideas about transforming the society can be tracked back to his early economic writings about war economy and his experiences of an alternative social system during the Balkans wars. Neurath's method is analyzed in regard to its ability to transforming the society into a commonwealth of human brotherhood and shows how such action is supported by underlying principles of ISOTYPE. Finally, the paper proposes the replacement of the main medium of ISOTYPE, from two-dimensional poster to an interactive social web platform, in order to fix some of its shortcomings.

Table of Contents

List of Illustrative Materials

Introduction

Otto Neurath (1882 – 1945) is celebrated in the design community as one of the forefathers of information design and as the inventor of the modern pictogram. On the other hand, analytic philosophers praise Neurath's work on logical positivism within the famous Vienna Circle. Museologists and public educators study his work on establishing a first social museum. Recently, economists have begun acknowledging his contributions to the evolution of heterodox economics in the twentieth century. The wide scope of Neurath's endeavours makes it hard to notice that all of his actions were guided by an ultimate political objective of transforming the socio-economic system. Neurath always labeled himself primarily as a social engineer (Neurath P., 1991, p. 221). Keeping this in mind, this research paper will study Neurath's method of pictorial statistics (later know as ISOTYPE), not just as a method of visualizing data, but as a tool for putting Neurath's social and political theories into practice. Therefore, rather than focusing on Marie Neurath's concept of transformation (an act of putting the information into visual form), this paper will concentrate on Otto Neurath's ideas about transforming the society with visual tools that will educate general population about social facts.

Our first aim will be to find the answer to the question of why did Neurath develop a method for creating pictorial statistics. Most research on this topic tries to find the answer by studying overall Neurath's work. However, this paper is guided with the principle that one should concentrate on the Neurath's biography and writings up to the point when his method of pictorial statistics was first invented. Thanks to this approach, the paper offers some novel ideas into the background of Neurath's method of pictorial statistics. It shows how the combination of his ideas about war economy, the experiences of his travels through Balkans and the fiasco of the Munich Soviet Republic project has led him to envision a possibility to transforming the society

though education about socio-economic facts. The paper will also explain the theoretical foundation of this plan.

Second part of the paper analyzes Neurath's method for representing social facts through pictorial statistics. Firstly, we will explore the main features of Neurath's method. Secondly, we will analyze how those features work together with the Neurath's aim of transforming the society into the brotherhood of man. By doing so, we will define several underlying principle behind ISOTYPE.

Finally, the last chapter will explore in which way can the Neurath's method of pictorial statistics be improved with interactivity and new digital media.

Otto Neurath

Balkan Travels

Otto Neurath is mostly known as one of the main proponents of the philosophical movement of logical empiricism, as well as the inventor of a picture language which he later named ISOTYPE. However, initially before the First World War, Neurath was primarily an economist. He began studying mathematics and physics at the University of Vienna but has soon switched to economics, history and philosophy. Following the recommendation of Ferdinand Tönnies[1], he had moved to the University of Berlin from where he graduated with a dissertation about ancient conceptions of commerce, trade and agriculture (Cartwright, et al., 1996, p. 11). After finishing his military service, he worked as a teacher of political economy in New Business School in Vienna and mainly published in economics. He was mostly concerned with comparing different economic systems in regards to how they 'influence standard of living, that is, level of housing, nutrition, education, entertainment, labour and health of the population' (Cartwright, et al., 1996, p. 13). In this context, he had established a discipline of wartime economics in 1910. According to his theory, wars did not necessarily result in an economic decline, which he tried to prove by studying examples from Napoleonic Wars and American Civil War. Likewise, he claimed that there were 'several instruments of wartime economy, such as central planning based upon statistics, and the practice of an economy-in-kind and a barter economy, which even in peacetime would improve the people's standard of living. In his view, a war economy worked much better than the market economy' (Sandner, 2016). In 1912 and 1913 Neurath travelled to the Balkan region[2], where his stay was founded by the

[1] Ferdinand Tönnies (1855 – 1936) was a German sociologist. He was a major contributor to sociological theory and field studies and is best known for his distinction between two types of social groups, Gemeinschaft (community) and Gesellschaft (society) (Tönnies, 2001).

[2] Neurath gave a summary description of his journeys in a letter sent to Ferdinand Tönnies from which we know the number of visits to each country: Serbia: 6; Croatia: 3; Galicia (modern day Poland/Ukraine): 2; Hungary: 2; Bohemia (modern day Czech Republic): 2; Bulgaria: 1; Bucovina (modern day Romania): 1; (Sandner, 2016, p.205)

Carnegie Foundation, in order to investigate the social conditions and changes caused by the war which was then going on. That was the opportunity to test his economic theories in practice (Cartwright, et al., 1996). He observed 'that well-organized agrarian economies without large land holdings, such as those in Serbia and Bulgaria, were much better equipped to cope with war than the economies of either semi-feudal or industrialized nations. The most important reasons for this advantage, in his view, were the presence of free peasants, a relatively equal distribution of land, well-functioning communitarian structures such as the family and the village community, the development of cooperatives, and the fact that during times of recruitment and mobilization there will always be family members who will remain at home and cultivate the soil' (Sandner, 2016). Neurath especially focused on Serbia's success in the Balkan Wars. He attributed Serbia's victory to its homogeneous economic and social structure as well as its national and religious unity. Serbia was a peasant state without large land ownership. That meant that family members could easily replace every person who had joined the army and economical production could be continued. Most importantly, Serbian society was structured as a primitive agrarian democracy in a form of traditional social organizations called *Zadruga*[3] around which economic production and education were organized. The negative effect from the war was therefore reduced by Serbian's agrarian makeup and its community organization (Sandner, 2016). In his investigation of the Balkan wars, Neurath found the empirical evidence he needed to support his views about war economies as an alternative economic systems. It must be stated that Neurath was aware of the negative effects of wars and was interested in wartime economies strictly as a promising model for a planned economy in the peacetime. He believed that attendant regulation of production and consumption will eliminate waste and wasteful consumption, that 'the greater efficiencies achieved in this manner could *pre saldo* lead to a better standard of living' (Neurath P., 1991).

[3] Zadruga is a term coined by Vuk Karadžić in 1818 to describe a social organization found among South Slavs where multiple families would live in a highly cohesive group . Its characteristics were having high level of democracy and sharing common property (Karadžić, 1969, p. 173).

Socialization in Praxis

During the first two years of the First World War, Neurath served as a ration and provision officer in the Army Corps, which gave him some first-hand experience in managing the distribution of goods. In 1916 he managed to convince the Imperial and Royal General Staff that they should create a Museum of War Economy, to which he was appointed as a director. Despite being busy with managing the museum for which he created statistical tables and models that represented the mechanisms of the economy, Neurath was also able to gain a *habilitation* at the University of Heidelberg. Towards the end of the war, Neurath was committed to the idea of implementing his theories to practice. In a process named socialization, the market economy would be replaced with a centralized administrative economy with a bias towards the economy in kind (Neurath, 1973, p. 136). According to Neurath, socialization is a conscious creation of a new way of life in the sense of the totality of measures, institutions and customs of a person or group of people (Cartwright, et al., 1996, p. 29).

With the creation of the Munich Soviet Republic, Neurath saw a chance to realize the utopia he had conceived. In a month and a half, from when Neurath was appointed to plan the socialization process, until when he was arrested with the fall of the Republic, he was able to experience the chaos of the revolutionary changes[4]. Neurath practical implementation of socialization was heavily criticized by Max Weber[5] who considered his schemes for planned economy 'an amateurish, objectively absolutely irresponsible foolishness that could discredit "socialism" for hundred years and will tear everything that could be created now into the abyss of stupid reactions…' (Cartwright, et al., 1996, p. 54). Most of the protagonists of the short-lived Republic were either executed or

[4] The story of the Munich Soviet Republic is quite bizarre as it included two revolutionary regimes fighting each other and a series of incredible events which are not the topic of this paper. However, for illustration purposes, we will state that the minister of foreign affairs Dr Franz Lipp declared war on Württemberg and Switzerland over the Swiss refusal to lend 60 locomotives to the newly formed Republic. Likewise, he has sent a desperate telegram to Lenin in Moscow stating that the former Minister-President has unrightly taken the toilet key with him (Luhrssen, 2012, p. 119).

[5] Max Weber (1864 – 1920) was a German sociologist. 'Arguably the foremost social theorist of the twentieth century, Max Weber is known as a principal architect of modern social science along with Karl Marx and Emil Durkheim' (Kim, 2017).

sentenced to long sentences, while Neurath was released by the intervention of the leader of Austrian Social Democrats and have returned to Vienna.

Invention of Pictorial Statistics

Upon returning to Vienna, Neurath began his work on the method for creating pictorial statistics. The method was fully developed by him and his team a few years later at the Social and Economic Museum of Vienna, and it consisted of a set of standardized and abstracted pictorial symbols which were used for making visual representations of socio-economics facts.

This groundbreaking work, later branded under term ISOTYPE, has defined the practice of visual communication by pictograms as we know it today. The most recognizable use of this type of communication are perhaps various forms of signalization, like the symbols on the doors that indicate which toilet is for males and which is for females. There are also examples where the practice of pictograms is still being utilized to represent statistical data, like in the case of high-end data visualization done by some journals and news corporations. However, in all of the examples where the method developed by Neurath is used, it is always seen only from the utilitarian perspective of being the inspiration for a certain design. The question about the purpose of why such a method was developed in the first place is never raised. This paper will show that an answer to this question can bring to a better understanding of how to use Neurath's methods in the digital age. Therefore, what is the answer to why did Neurath develop a method for creating pictorial statistics?

The literature on this question offers several mutually supportive answers, which often reflects the academic setting of the discussion[6]. One of the answers that tries to

[6] A short investigation of the academic backgrounds of the authors of the literature about Neurath that was collected for the purpose of writing this research paper reveals that there are two dominant camps, that of Philosophy of Science that of Visual Communication Studies. Authors and their academic background: Nancy Cartwright (Philosophy), Thomas Ernst Uebel (Philosophy), Jordi Cat (Philosophy, History), Elisabeth Nemeth (Philosophy), Friedrich Stadler (Philosophy, History), Angela Potochnik (Philosophy), Başak Aray (Philosphy), Peter Galison (History, Physics), Adam Tamas Tuboly (Philosophy), Karl Müller

explain Neurath's involvement in pictorial statistics is that he wanted to create a visual language which would reflect the ideas of logical positivism (Galison, 1990). Some authors oppose this by turning Neurath into a sort of proto-postmodernist who experimented with creating an ambiguous visual language (Henning, 2010; Potochnik and Yap, 2006). Those and similar interpretations view ISOTYPE as a product of 'Neurath's general philosophical attempt to simplify language (in this case, visual language)' (Hartle, 2017, p. 102) . Another answer that interprets Neurath's sudden preoccupation with designing and producing graphic material looks at the context in which Neurath has found himself after he had returned to Vienna. Due to his imprisonment in Munich, the academic status that he had secured at Heidelberg University has been revoked. However, Neurath influence among Austrian Social Democrats enabled him to be appointed at the position of director of the Research Institute for Co-operative Economy. He has used this position as a springboard for his later career of the director of Social and Economic Museum of Vienna where the ISOTYPE method was developed (Burke et al., 2013, p. 25). Neurath interest in the pictorial statistic is explained with the ideological foundations of Austrian Social Democrats which ruled Vienna from 1919 to 1934. During that time, they have embarked on a socio-cultural programme to turn the Vienna into a model of the future 'socialized humanity' (Cartwright, et al., 1996, p. 56). 'The Austrian Social Democratic Party was unique among European socialist parties, not only in the amount of power it held but also in its policies, which were based on Max Adler's dictum that the future of democracy lay not in politics but in pedagogy. This emphasis on education (*Bildung*) came to define the widely admired programme of *Bildungspolitik*, designed to reform the whole of working-class life through policies affecting everything from housing to higher education' (Cartwright, et al., 1996, p. 57). Therefore, one can argue that

(Philosophy, Economics), Robin Kinross (Graphic design), Christopher Burke (Graphic design), Ellen Lupton (Graphic design), Michelle Henning (Photography, Cultural History), Johan F. Hartle (Art Studies, Media Theory), Nader Vossoughian (Architecture), Jae Young Lee (Graphic design), Frank Hartmann (Visual Communication), Robin Fuller (Graphic design, Semiotics), James McElvenny (Linguistics), Erwin Dekker (Cultural Economics), Stefan W. Schmitz (Economy), Robert Leonard (Economics)

Neurath methodology of creating pictorial statistics was developed as a part of the political and cultural efforts of Vienna's ruling party.

Although Neurath's philosophical views and the cultural and political atmosphere in Vienna surely influenced his interest in pictorial statistics, this paper claims the development of ISOTYPE was a natural result of Neurath's previous ideas. Fiasco in Munich has pushed Neurath away from politics and forced him to figure out another way of changing the socio-economic structure of the society. Instead of dictating the change from above, the change will be instituted from ground up by changing the attitude of the masses. The goal was that the masses realize and deeply understand how the society and economy function, which would then initiate the changes that would transform the society into 'a commonwealth of men united in a human brotherhood' (Neurath, 2010, p. 126). Neurath sees the main generator of this transformation in the proletariat, who would at first make smaller positive changes in the places with proletarian majorities in local councils and would gradually 'take in hand the whole organization of the economy and thus create the basis of socialist democracy between friends' (Neurath, 1972, p. 259). Neurath was aiming for comprehensive enlightenment about social structure in which one live, he writes: 'Workers' education contribute to the development of the individual. It influences his actions, the pleasure he takes in people and things, his integration into the workers' organizations. In all this, enlightenment about humans and material objects, about connections of all sorts, plays a central role' (Dvorak, 1991, p. 270).

Inspiration for the cohesive population which practices economy in kind and has a deep understanding of its internal socio-economic structure could have been found in Neurath's experience with Serbian's *Zadruga* organizations during his Balkan travels. Each member of *Zadruga* had a deep insight into the internal primitive agrarian economy of his community. This knowledge enables him to actively participate in maximizing the economic outputs of *Zadruga* through his own work and by participating in collective decision making. Neurath did not consider *Zadruga* as a

direct inspiration in the sense that *Barbarogenije*[7] is the solution to building a better future. *Zadruga* is a strict example of a traditional organization while Neurath was a modernist who wanted to break away from everything that has to do with traditionalism. Also, in terms of Ferdinand Tönnies, *Zadruga* is a typical example of *Gemeinschaft*, in which roles, values and beliefs are created among individuals based on their personal interactions. Neurath was interested in *Gesellschaft*[8], which characterizes urban and industrial societies, in which social ties are based on indirect interactions, impersonal roles and formal values (Tönnies, 2001). Neurath writes: 'It is not so important to establish the contact from neighbor to neighbor, but to non-neighbor. In this connection it is important to create a common atmosphere for people with different language, different occupation, different outlook who are in the same society' (Neurath, 1973, p. 248). Interestingly, upon returning to Vienna and before starting his groundbreaking work on pictorial statistics, Neurath was for a period of time involved in work that falls under the *Gemeinschaft* domain. He played a decisive role in organizing the Austrian Co-operative Housing and Allotment Association which was the umbrella organization for societies that consisted of *Zadruga*-like co-operatives[9]. He was occupied with increasing the standard of living by promoting co-operate way of living inside of communal houses. Like with the agricultural *Zadruga* organizations style of life, he proposed communal raising of children, youth care, built-

[7] *Barbarogenije* is an idea which can be literally translated as "barbarian-genius", invented by avant-garde movement Zenitism which was active in Yugoslavia from 1921 to 1926. Disappointed with the First World War and the culture of Western Europe, idea of *Barbarogenije* proposes balkanisation and barbarisation of Europe. It celebrates primitive and folk art from the Balkans which is seen as an unexplored area that could offer freshness and honesty.

[8] Neurath himself did not use the distinction between *Gesellschaft* and *Gemeinschaft* as see considered that terms merely denotate smaller and larger associations extended in space and time (Neurath, 1973, p.393). Such reductionist approach in social theory is typical for Neurath, who always aims to embrace the totality of a phenomena and weary of abstraction that aren't useful to him. However, for this paper such distinction is useful as it helps in answering the question of why did Neurath develop a method for creating pictorial statistics.

[9] In 1919, the cost of living in Vienna almost tripled in two months which left Vienna's many *Bettgeher* ("bed lodgers") homeless. 'The people moved to the outskirts of the city in their thousands – into the woods, to occupy and cultivate land and to build makeshift shelters... By 1921, more than 30,000 families lived in these partly illegal "wild settlements" on the edge of Vienna. National Geographic described them as "curious little patches of gardens, each with a makeshift fence and a wooden building that looks like a child's playhouse"' (Rumpfhuber, 2016).

in communal cultural and educational facilities, end of private kitchens and urged solidary among the co-operative community (Cartwright, et al., 1996, p. 60). The general ideas was to 'eliminate the separation of production, administration and consumption and create an economic way of life orientated towards collective happiness' (Rumpfhuber, 2016). However, by 1924 Neurath has changed the scope of his interests from *Gemeinschaft* to *Gesellschaft* and has completely concentrated his activities in developing a way which would enable a complex industrial society to gain *Zadruga*-like qualities of cohesion and cooperation.

Neurath's central idea of accomplishing this is based on the systematic and accessible education of the masses. If every individual had in-deep knowledge and understanding of the of social and economic foundations of the society, he would be immune to manipulation, would guide his actions towards the benefit of the whole and would be able to participate in common decision making. That is an old idea that can be traced back in earlies examples of utopias. Tommaso Campanella[10] describes an ideal model of society in the form of a city protected by seven circles of walls. The cohesion of the citizens is ensured by natural magic and astrology, but also by systematic education where everyone must be acquainted with all lines of work and have a deep understanding of the socio-economic system in which they live. As is the case with Neurath's pictorial statistics, education is delivered by pictures. The grand walls that encircle the utopian city and the walls of its palaces have the purpose of an educational tool. They are an illustrated encyclopedia of knowledge as they are 'painted with images of the all the arts and sciences' (Germana, 2014). Topic presented on the wall range from mathematical proofs and theorems to both detailed local and general global maps, illustrations of minerals and metals, plants and animals, mechanical arts and instruments (Campanella, 2013). 'Knowledge is not enclosed in books kept in separate places such as libraries but is openly on show to everyone's eyes. Visualizing in this manner promotes a quicker, easier and more efficient form of learning, in that it is

[10] Tommaso Campanella (1568 – 1639) was a Dominican friar and one of the most important philosophers of the late Renaissance. His best-known work is the utopian treatise *La città del Sole* (The City of the Sun) (Germana, 2014).

connected to the art of memory, which underlines the evocative and emotive power of images. From a tender age children run around in this theatre of knowledge, appropriately guided and following correct itineraries, so that they learn joyously, as if playing a game, without effort or pain' (Germana, 2014). Therefore, besides the idea of creating the cohesion and cooperation of the society through education, Neurath's vision coincides with Campanella's utopia in the fact that they both rely on education through pictures. Another interesting coincidence is that both authors came to the similar idea after evading death execution after unsuccessfully initiating a political revolt which aimed to transform the society by instituting common ownership of goods, Neurath in Bavaria in 1919, and Campanella in Calabria in 1599[11].

A key component in Neurath's educational program was the use of statistics, as he 'trusted only statistics to give an unbiased view of social and economic reality' (Hartmann, 2008, p. 248). 'Neurath saw statistics to be value-free' (Lupton, 1986, p.52). In "Empirical Sociology" he limits sociology on studying objectively measurable behaviour. 'Sociology on a materialist basis deals therefore only with relation of men with men or with their environment. It knows only of such behaviour of men that one can observe and "photograph" scientifically' (Neurath, 1973, p. 361). Neurath believed that the transmission of social facts through statistics would be the basis of social cohesion. In "*Statistik und Proletariat*" Neurath 'explicitly describes statistics as "a tool in the proletarian struggle! A component of socialist economics, a source of joy for the victorious proletariat, and last but not least, the foundation of human empathy". He later explains that statistics "does not move away from the living human being; it leads towards the living human being. It shows where the individual can feel compassionate, where he can feel joy. One can only feel part of a community with others when one can visualize how that entity suffers and rejoices"' (Hake, 2017, p. 220). In "Personal Life and Class Struggle" Neurath states: 'In the planning of the new

[11] In the spring of 1599, Campanella, 'under the banner of natural magic and Biblical prophecy, led a wretched band of libertine Dominicans, declassed noblemen, refugees, heretics, and bandits in a fantastic plot to overthrow the hated Spanish government in Calabria' (Eamon, 1995, p.371). Campanella's aim was to establish a new enlightened society founded on natural and rational principles. The revolt was a complete failure and Campanella somehow managed to escape execution by feigning madness.

economy, statistics become important for the proletariat as the basis for thought about welfare. Statistics show what social events mean for social groups. A new world outlook is forming, it will catch everything in as if in a net and assign to each thing and each event a definite place and time. What can be counted is most securely based' (Neurath, 1973, p. 252). Neurath believed that what statistics enables is that all work for the public good will be motivated by trying to achieve a certain goal, or in Max Weber's terms[12], working for the mutual benefit becomes an instrumentally rational action. By understanding the number behind their socio-economic life, people would view institutions as though it was his own affair. Neurath notes that 'today's large organizations generally do not create those community feelings that will be linked with socialist institutions. The customers of a banking house do not feel patriotism of accounts. Devotion to cartels or national railways in as uncommon as love for trusts' (Neurath, 1973, p. 259). That can be changed with the use of statistics, as they are the means that enable the unity between the community and its institutions.

In conclusion, the development of a method for creating pictorial statistics was primarily a result of Neurath's ambition to develop a tool that would transform society. Above all, Neurath considered himself a 'social engineer' (Neurath, P., 1991, p. 221), and pictorial statistics should be seen as the main tool in his toolbox. Development of the idea about social transformation of the society can be traced back to his early economic writings about war economy and his experiences of alternative social systems during the Balkans wars. After the failure of implementing the socialization program at Munich and nearly losing his life, Neurath turns away from the idea of changing the society by direct political action and begins his groundbreaking work of inventing a new method for education. The main focus of this education was to represent social facts to the general public. He believed that society

[12] Weber recognized four types of social action: instrumentally rational, value-rational, affective and traditional. "Instrumentally rational" action is determined by expectations as to the behaviour of objects in the environment and of other human beings; these expectations are used as conditions or means for the attainment of the actor's own rationally pursued and calculated ends. "Value-rational" action is determined by a conscious belief in the value for its own sake of some ethical, aesthetic, religious, or other form of behaviour, independently of its prospects for success. "Affective" action is determined by the emotional state of the actor and "traditional" action is determined by lived custom or habit (Ritzer, 2011, p. 125).

could be transformed by empowering individuals with knowledge about the social and economic foundations of society. Neurath believed that such knowledge could be delivered with his method of pictorial statistics.

Representation of Social Facts

Theory of Pictorial Statistics

In this chapter, we will try to utilize the view that Neurath method of pictorial statistics was developed with the aim to spearhead the transformation of the society. By understanding what qualities ISOTYPE contains in regard to supporting this aim, we will be able to gain the more profound understanding of Neurath's method of pictorial statistics, and in the final chapter, possibly adapt it for our digital age. But first, let us analyze what are the main features of Neurath's method of pictorial statistics.

As can be seen from Illustration 1, ISOTYPE is based on a large number of symbols. Neurath's team has accumulated a fund of symbols 'numbering between several hundred and several thousand elements, depending on how one counts them. These elements mainly serve to represent fields of economics, technology, and social and life worlds, and offer relatively few symbols for the field of politics and science' (Müller, 1991, p.224). How to use symbols to 'communicate is not something that has been exhaustively elucidated. Neurath writes that the first stage of the Isotype method is the construction of recognizable symbols, and the second is the combination of such elements to create new meanings' (Fuller, 2017, p.12). Neurath most important rule for constructing the symbols is that 'basic symbols have to speak for themselves' (Müller, 1991, p.244). Other than that, 'signs have to be independent of colour', and the use of colour must be consistent (Müller, 1991, p.244). 'Perspective should not be used. Perspective involves making object of the same size smaller or larger according to their distance from the viewer, which means that they can't be easily quantified' (Twyman, 1975, p.10). Signs must be created in such way that they can be combinable. For example, factory sign from Illustration 1 consists of a building with a great smoke-outlet. A sign of a person consists of a human silhouette, and in the context of this

Illustration 1

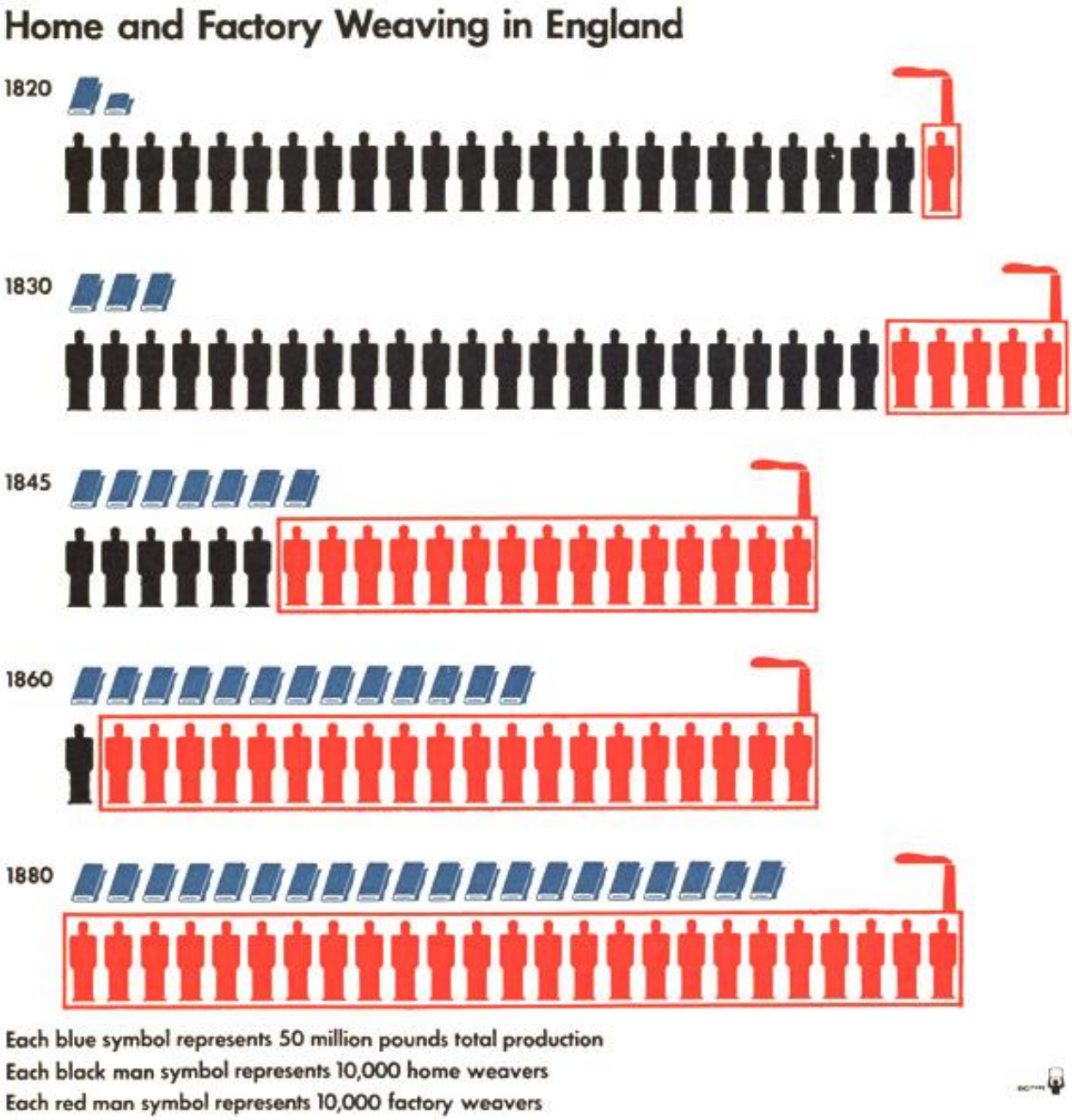

illustration the person is equalized with the textile weaver. The combination of these two signs creates a new sign which represents textile weaver that works in the factory as opposed to those who works at home. Neurath also gives three rules which concern the arrangement of basic signs. 'A sign is representative of a certain amount of things; a great number of signs is representative of a greater amount of things' (Neurath, 1936, p.73). The second rule is that 'pictorial statistics are to be read like a book, that is, from top left to bottom right. Finally, spaces must be arranged in the manner of maps (Müller, 1991, p.228). Neurath does not have any more implicit rules about how to create pictorial statistics which makes it extremely hard to build a theory of ISOTYPE. This lack of precise account of the semiotics of ISOTYPE have been noted by several authors. Karl Müller concluded that Neurath never explicitly developed a theory of pictorial-statistical representation (Müller, 1991). Christopher Burke claims that Neurath 'deliberately did not develop a theory of picture language, or even fully articulate a method, on the principle that it was too early in the history of visual education to make such definite statements. He also felt that such theorizing would restrict possible, future applications of Isotype' (Burke, 2011, p.31). While Robin Fuller ironically notes that 'Isotype was used almost exclusively to communicate information about things other than itself' (Fuller, 2017, p.12).

Pictorial Statistics in Praxis

Rather than concerning ourselves with the semiotics of ISOTYPE, we shall investigate how does the practice of using of ISOTYPE fulfil the purpose for which it was initially developed. As we have shown in the first chapter, Neurath has developed a method of pictorial statistics with a specific purpose of it being a tool which will have a transformative effect on society. Therefore, by the end of this chapter, we will try to define some underlying principles of using ISOTYPE for this purpose.

One of the great abilities of Neurath's method is that it can be used to represent social facts without the need to use ambiguous and metaphysical expressions. In accordance

with Neurath's empirical sociology, ISOTYPE is built with a purpose to empirically represent sociological concepts of "order of life", "terrain of life" and "living standard" which according to Neurath encompass the entire social structure. 'The human grouping appears embedded in a *terrain of life*, influencing it and influenced by it. The totality of customs and their changing, whether in themselves or in their combinations, we may designate as an *order of life* in the widest sense, but the provision for people's shelter, food, clothing and the live we shall call a *living standard.* The terrain of life appears as a stimulus applied to the order of life, which then changes [...] The living standard is again in some way the stimulus which the order of life produces in conjunction with the terrain of life' (Neurath, 1973, p.392). Neurath's book "Modern Man in the Making" is full of easy to understand graphical representation of the interplay between the three concepts without the need for lengthy and ambiguous explanations. For example, Illustration 1 tells the story about the industrial revolution, which is later used as a springboard to explain the process of market regulation by destruction, changes in standard of living and other complex socio-economic phenomena. Another example is a chart which presents a multiplicity of people with different religious denominations living together peacefully in the same country. Such chart 'tells a story of tolerance more impressively than a written chapter on the same subject' (Neurath, 1973, p.234).

Neurath method of pictorial statistics is especially suitable for the presentation of what he called 'total life situations' (Neurath, 2004, p.292). Instead of using 'average incomes per capita as an expression of corresponding difference in standard of living', one can use many different aspects of total life situations (Neurath P., 1991, p.219). In one such example from the "Modern Man in the Making" Neurath compares ten different countries on a single page in regard to various items such as number of suicides, number of radios in households and literacy rates.

One of the main characteristics of ISOTYPE which make it especially useful for presentation of total life situation is its ability to present information in multiple directions. Karl Müller explains this feature of ISOTYPE using Fred I. Dretske

distinction between digital and analog transfer of information (Müller, 1991, p.248). The sentence "The cup has coffee in it" is an example of digitally coded information. 'No more specific information is supplied about the cup (or the coffee) than that there is some coffee in the cup. You are not told how much coffee there is in the cup, how large the cup is, how dark the coffee is, what the shape and the orientation of the cup are and so on' (Müller, 1991, p.248). An example of analog form of information is a picture of a coffee. Such picture tells you 'that there is some coffee in the cup by telling you, roughly, how much coffee is in the cup, the shape, the size, and the colour of the cup, and so on' (Müller, 1991, p.249). Müller concludes that Neurath's method of pictorial statistics carries 'a potential manifold of information' (Müller, 1991, p.249) in the form of figures, colours, proportions, relations, etc. 'Such analog surplus value can be realized on three levels, the level of symbols, the level of symbol arrangements and the level of background-foreground partitioning' (Müller, 1991, p.249).

The requirement for the simplicity of basic symbols comes from the level of abstraction that is typical sociological topics. In Illustration 1, the symbols of man need to represent a large group of people rather than single persons. The use of simple symbols as opposed to more naturalistic pictures facilitates the understanding of the industrial revolution as 'the element of total social environment' (Neurath, 1939, p.2) rather than an event of particular place and time. Also, less complexity in the basic symbols enables more complexity of the general picture, that is, complexity in terms of their mutual relations. That provides a much deeper understanding of a topic in question. For example, rather than absorbing a sentence "This economy is based on export", one can see the trade relationship and study the quantity and type of products that are imported and exported.

Neurath's method is developed as a solution to the problem of presenting social facts in a natural way without being dull. As opposed to using natural pictures, formulating verbal statements in a neutral way is usually dull and unattractive. The attractiveness is an important reason why ISOTYPE looks the way it does. Neurath was aware that the person in the modern age 'takes a great part of his education in pleasure ways,

particularly during his leisure time, through visual impressions. If one wishes to spread social education, one must use such mean of presentation' (Burke et al., 2013, p.522). He saw modern posters as the most attractive method available at the time for presenting knowledge about social correlations and consider it to be a tool for 'disseminating social enlightenment' (Nemeth, 2019, p.126). Neurath acknowledged the attractiveness of other methods such as photographs and moving pictures, he considered them inadequate for the task of presenting complex issues such as 'inner processes of the social body, the shifts in class structure, the circulation of money and goods, the activities of banks, the connection between income and tuberculosis, between birth and mortality rates' (Burke et al., 2013, p.522). Neurath method of pictorial statistics is able to represent such social facts in a natural way, while remaining highly attractive and entertaining.

Neurath's method of pictorial statistics is designed around the principle where one starts from simple concepts to build more complex concepts. Neurath has named this procedure "humanization". He elaborates: 'We must begin our explanations in accordance with the knowledge and vocabulary already familiar to the people. Gradually simple traditional expressions in more complicated combinations and perhaps some more complicated terms may be introduced. But in principle, one should try to build up more comprehensive knowledge by simply looking at the environment, and by using the language of daily life and its derivatives.' (Neurath, 1973, p.231). In opposition to "humanization", Neurath detects the practice where one starts from the most complicated concept and then tries to simplify them into popular terms. By using ISOTYPE, one can explain something complicated without the need to first state that something complicated is going to be explained, which gives a person who is learning a feeling of relative sovereignty. For example, Illustration 1 explains the industrial revolution by just using symbols for workers, factories and textile without the need to mention scientific terms such as "industrialization", "urbanization", "economic growth" or even the term "industrial revolution" itself.

An important feature of Neurath's method is its contribution to the meditative atmosphere, where people can seriously consider cons and pros of certain interpretation of a social fact. Rather than being forced to accepting a statement by reading it, people are free to interpret the same facts differently and argument them among themselves. Not using any ambiguous and metaphysical expressions ensures that all of the discussion remains in the field of factual arguing. Neurath compares this feature to the humanities where a statement is always something doubtful since there is always a question of if it could have been translated in another way. As opposed to humanities, in science, knowledge is translated in a pattern of statements which only a fool wouldn't accept (Neurath, 1973, 233). Meditative atmosphere enables that one can study the observation, create a conclusion, and analyze it from different perspectives.

In conclusion, it is easy to see how the underlying principles of ISOTYPE contribute to the Neurath's aim of using the pictorial statistics to create a human brotherhood:

Elimination of ambiguous and metaphysical expressions from the explanations of social events enables people to interpret social facts more rationally and without bias. Discussion based on what can be counted connects people who are currently divided along lines of social identity or ideology. Such dialogue can create a basis for potential common action.

The ability of ISOTYPE to present information in multiple directions practices the skill of making a thoughtful judgment about social and economic issues. Those skills along with a habit of viewing the social phenomena in its totality, serve as a protection against malicious manipulation by oversimplification.

The simplicity of symbols developed by Neurath provides a way in which people can grasp complex socio-economic issues. A physical model can easily depict a function of a heart organ, but to understand the function of a central bank requires much greater distancing from the reality. Prerequisite of any action aimed at social change is the deep understating of a problem it is trying to solve.

The attractiveness of social facts represented by pictorial statistics push the complex socio-economic questions into the sphere of public discourse. In his visual autobiography Neurath writes: 'Education has to compete with entertainment – that is what we think is needed in our period. It would be dangerous if education were to become purely occupational matter and something boring itself' (Neurath, 2010, p.113).

Representing social facts by first mastering simple concepts and then moving to complex one, rather than starting by simplifying complex concepts, removes the frustration and inferiority complex from learning. Kepler's theory is today easily explained to elementary school pupils with a few oranges, even if it was at Kepler's time a subject of high academia. Neurath's method provides learning tools for the future in which people will with equal ease understand the concept of structural unemployment or the effects of government monetary policies.

Finally, the meditative atmosphere which the use of ISOTYPE provides, enables the option to differently interpret the observed social fact. That opposes the type of epistemology that is usually associated with the logical positivism which asserts that knowledge can be built on pure and infallible empirical foundations. To paraphrase the famous Neurath's boat analogy[13], there is no way to establish fully secured truths about how to interpret social facts. This type of openness is essential an prerequisite for any method that strives to be an agent of positive social change.

[13] 'We are like sailors who have to rebuild their ship on the open sea, without ever being able to dismantle it in dry-dock and reconstruct it from its best components. Only metaphysics can disappear without a trace. Imprecise "verbal clusters" [*Ballungen*] are somehow always part of the ship. If imprecision is diminished at one place, it may well re-appear at another place to a stronger degree' (Neurath 1983, p. 92).

Digital Age

New Media

Exactly one hundred years have passed since Neurath's failed attempt of socialization in the Munich Soviet Republic, after which he had focused on developing a method of pictorial statistics which would try to accomplish a similar goal, but this time through education, rather than revolution. Despite the fact that Neurath's work on pictorial statistics has revolutionized the use of symbols in visual communication, his initial idea of creating a human brotherhood through visual education has ultimately failed. In this chapter, we will explore if the technological advances of the digital age, such as new media and interactivity, can fix the shortcoming of Neurath's method of pictorial statistics. Ultimately, can the new technologies be used to revive the idea of transforming the society into 'a commonwealth of men united in a human brotherhood'? (Neurath, 2010, p.126).

Neurath has correctly detected that modern man consumes most of its 'education in pleasure ways, partly during his leisure time, through visual impressions' (Burke et al., 2013, p. 522). That is even truer in our digital age than it was one hundred years ago when Neurath's started his project of transformation through visual education. At that time, the two most attractive types of media that Neurath detects were 'cinema and illustrations' (Burke et al., 2013, p. 522). Neurath gives a good argument for illustration posters being a more appropriate medium for his method of pictorial statistics. He writes: 'Visitors, for example, can stand around an exhibit, look for longer and shorter times, compare one with another. A filmgoer is presented with a set sequence, a scene appears and goes by quickly, he cannot turn back the pages like leaves of a book. Museums are free for everybody, groups and individuals can go there, with or without a guide; their discussion could be supported by the visual material itself' (Neurath, 1973, p.238). Therefore, we can detect four reasons why Neurath had chosen the illustration poster as a medium for his pictorial statistics. Firstly, it is because a

colourful illustration was a novelty at the time. One hundred years ago, the luxurious plates painstakingly printed in several colors, created with the state-of-the-art printmaking technique[14], were considered an attraction. As we have stated before, the attractiveness is one of underlying principles of Neurath's method of pictorial statistics. Secondly, illustrations are given advantages over the moving image because they offer the ability to compare images and they support the meditative atmosphere, which are also the two underlying principles of ISOTYPE. Lastly, Neurath saw the benefits of the museum being a social place that was accessible to everyone. One can easily see that the medium of an internet platform fulfils all the requirements stated by Neurath. It evokes the same sentiments of novelty and attractiveness as Neurath's posters had evoked one hundred years ago. It enables a high degree of comparison capabilities, supports the meditative atmosphere, and it is a highly social medium.

This last feature offers an opportunity to fix one of the ISOTYPE shortcomings which probably contributed to the failure of Neurath's project of creating a human brotherhood. Even if the method of pictorial statistics was developed by a public institution, since Neurath and his team were employees of a publicly owned Social and Economic Museum of Vienna, ISOTYPE had ended up with a proprietary license. It is easy to see how making the method open source and free works well with the idea of brotherhood of men and enhances the visual literacy of the masses. Ivan Petrovich Ivanitskii, employee of the *Всесоюзный институт изобразительной статистики советского строительства и хозяйства*[15] has anticipated the need of making ISOTYPE free and open source as he stated: 'It is essential to simplify and standardize the manufacture of charts, so that they will take a minimal amount of time, so that they can be made not only by an artist, but by a worker, and so that the cost of a chart will not be ten roubles, but a few dozen kopecks... Anyone, who needs to construct a

[14] Neurath's graphics were primarily created by artist Gerd Arntz who worked with linocut printing technique. This technique was used first by the artists of *Die Brücke* in Germany between 1905 and 1913.
[15] All-Union Institute of Pictorial Statistics of Soviet Construction and Economy was an institution in the Soviet Union which was established by Otto Neurath in 1931. The institute remained active up until 1940, although from 1934 onwards it has stopped applying the Neurath's method of pictorial statistics.

chart, will be able to stick ready-made figures, like postage stamps, onto a ready-made standard grid and get a nice, cheap, attractive chart' (Burke et al., 2013, p.266). Neurath was not supportive to the idea of 'fully devolving the design of charts to the public; instead the wanted the process to be controlled by centralized offices' (Burke et al., 2013, p.266). In a letter from 1941, Neurath again resists the request to grant permission to other to use the ISOTYPE pictograms: 'we feel very strongly that the effect of our method depends not only on the characters, but very largely on the way how they are used [sic], on the selection of representations, on the simplifications, and many other measures. [...] Therefore we cannot allow the use of the symbols if we have no influence on the entire layout' (Burke, 2011, p.50). Other than 'protecting professional territory' and the principle that 'pictograms were not the whole point of ISOTYPE (Burke, 2011, p.51), the underlying reason of Neurath need to keep ISOTYPE under control, can be traced back to Plato's Republic[16]. As the representative of modernism, Neurath saw himself as a part of "intellectual elite" which is destined to lead the transformation of society based on the progressive modernist principles. Neurath's socialization project during the Munich Soviet Republic is a pure example of such attitude, which remained present in his next project of developing a method of pictorial statistics. As Burke has noticed, 'Otto Neurath's dream of universal usage for Isotype and his simultaneous wish to have close control over it were, to a large extent, mutually preclusive' (Burke, 2011, p.51). Transferring the Neurath's method of pictorial statistics on social internet platform and making every part of it free and open source, is a chance to correct this inherent flaw of ISOTYPE. Neurath envisioned a time where 'established conventions have been formulated for the presentation of social-economic findings, so that graphics statistics can be generally "read", just as easily as one can now read books or musical notation' (Burke et al., 2013, p.522). In our digital age we can notice the starting points of such practices. For example, Subreddit "dataisbeautiful" with over thirteen million members is currently one of the most

[16] The Republic is the best-known work by Greek philosopher Plato, written in 380 BC. In it Plato envisions a utopian city-state ruled by a philosopher kings. In his book "The Open Society and Its Enemies", Karl Popper traces the intellectual origins of the totalitarianism back to Plato's Republic (Popper, 2013).

popular subreddits and is primarily focused on amateur visualizations. Generally public is spontaneously communicating with data by using a visual language with the means of creating data visualization based on free and open source software. The revival of Neurath's vision of the brotherhood of men based on common knowledge about socio-economic fact can be accomplished by precisely this kind of mass amateurization through free and social-based internet platforms.

Interactivity

ISOTYPE method of pictorial statistics was criticized by Neurath's contemporaries for its high reliance on the process of simplification. Lucien Febvre[17] gave the fallowing objection to Neurath's charts: 'In the universe, they only want to see masses – massive masses, if I dare say. Underneath so many million of tons, underneath so many millions of inhabitants, production itself does not count; a state or a city are nothing. No doubt. From a certain point of view. But all the same, those people who are nothing, or who have nothing very special in this sense – if they are added together, they end up making quite a mass in the world; and a mass which perhaps (even from the narrowest point of view of the economy) has the right, and the duty, to make its voice known?' (Burke et al., 2013, p.199). Neurath response was that education affects are achieved by simplification and highlining. He believed that 'selection and simplification were legitimate educational strategies' for providing information and helping people 'find their voice' (Burke et al., 2013, p.200). Neurath famously stated: 'He who knows best what to leave out, is the best teacher' (Burke et al., 2013, p.198). Once again, it's the Plato's "philosopher king" who speak trough Neurath's voice!

Interactivity offers the solution to a problem of the need for authorly who decides which data should be omitted and what should be simplified. By making chart interactive we are able to transfer some of the agency from the designer to the user.

[17] Lucien Paul Victor Febvre was a French historian best known for the role he played in establishing the *École des Annales* (Annales School). He was a 'pioneer of a historical approach that took the geographical context into account' (Burke, et al., 2013, p. 200).

Rawlins and Wilson deference between five levels of interactivity in regard to how they change the balance of agency (Rawlins and Wilson, 2014). In the case of static visualizations such as are those done by Neurath, the designer has the complete control over the data, design and message that is transferred the to the user. On the other extreme, the user 'become active participants who can shape, redefine, and construct meaning, ultimately becoming co-creators of the visualization with the designer' (Rawlins and Wilson, 2014). 'Because the designer and user share creation of the interactive graphic, it is as if the fisher is inviting the man to go fishing instead of giving him a fish. Together they make decisions about where to fish, what methods and equipment to use, and what to do with the fish they catch. Certainly, the fisher is still the expert and may make many of the decisions in advance, but the man is an active participant in the process. They share agency in the creation of the graphic' (Rawlins and Wilson 2014). Therefore, with the introduction of interactivity, Neurath's teacher/designer who knows what's best is still present, but his sovereignty is greatly reduced to the benefit of the pupil/user.

Conclusion

Neurath's invention of the method for creating pictorial statistics was primarily a result of his ambition to develop a tool that would transform the society. Ideas about transforming the society can be tracked back to his early economic writings about war economy and his experiences of alternative social systems during the Balkans wars. After the failure of implementing the socialization as a part of a communist revolution in Munich, Neurath turns away from the idea of changing the society by direct political action and begins his groundbreaking work of inventing a new method for education. To Neurath, the main goal of the education was to represent social facts to the general public. He believed that the society could be transformed by empowering the individuals with knowledge about social and economic foundations of the society. Neurath believed that such knowledge can be delivered with his method of pictorial statistics.

The method itself should not be observed as a visual language, but rather through the prism of how it fits with the Neurath ambition of transforming the society into a commonwealth of human brotherhood. Such approach make it easer to notice the underlying principle of the design of ISOTYPE which support the transformation effect of the graphic presentations.

The digital age offers an opportunity to revive the Neurath's vision of the human brotherhood by offering the opportunities to fix the shortcoming of ISOTYPE. That can be done by replacing main medium of ISOTYPE from two-dimensional poster to an interactive social web platform.

Bibliography

Burke, Christopher. 2011. "*The Linguistic Status of Isotype*". In: Image and Imaging in Philosophy, Science, and the Arts. Ontos, Heusenstamm, pp. 31-58.

Burke, Christopher, et al. 2013. *Isotype: design and contexts, 1925–1971*. London-UK: Hyphen Press.

Campanella, Tommaso. 2013. *The City of the Sun.* Project Gutenberg. Last Updated: January 26, 2013 http://www.gutenberg.org/files/2816/2816-h/2816-h.htm

Cat, Jordi. 2018. "*Otto Neurath*". In: The Stanford Encyclopedia of Philosophy (Summer 2018 Edition), Edward N. Zalta (ed.), Metaphysics Research Lab, Stanford University, https://plato.stanford.edu/archives/sum2018/entries/neurath/

Cartwright, Nancy, et al. 1996. *Otto Neurath: Philosophy Between Science and Politics*, Cambridge-UK: Cambridge University Press.

Dvorak, Johann. 1991. "*Otto Neurath and Adult Education: Unity of Science, Materialism and Comprehensive Enlightenment*". In: Rediscovering the Forgotten Vienna Circle: Austrian Studies on Otto Neurath and the Vienna Circle. Boston Studies in the Philosophy and History of Science. Editor: Thomas E. Uebel, Kluwer Academic Publishers.

Eamon, William. Natural Magic and Utopia in the Cinquecento: Campanella, the Della Porta Circle, and the Revolt of Calabria. Estratto da "Memorie Domenicane", Nuvoa Serie 26, 1995.

Ferdinand Tönnies. 2001. *Community and Civil Society*. Editor: Jose Harris, Cambridge University Press.

Fuller, Robin. 2017."*Writing in the Language of Reality: Interwar Experiments in Language.* In: "CALL: Irish Journal for Culture, Arts, Literature and Language: Vol. 2: Iss. 1, Article 12. Available at: http://arrow.dit.ie/priamls/vol2/iss1/12

Galison, Peter. 1990. "*Aufbau/Bauhaus: Logical Positivism and Architectural Modernism*". In: Critical Inquiry16/4, p.709–752.

Germana, Ernst. "Tommaso Campanella", The Stanford Encyclopedia of Philosophy (Fall 2014 Edition), Edward N. Zalta (ed.), URL = https://plato.stanford.edu/archives/fall2014/entries/campanella/

Hake, Sabine. 2017. *The Proletarian Dream: Socialism, Culture, and Emotion in Germany, 1863–1933*. Walter de Gruyter GmbH & Co KG.

Hartle, Johan Fredrik. "Otto Neurath's Visual Politics: An Introduction to Pictorial Statistics Following the Vienna Method". ARTMargins, Volume 6, Issue 1. 2017. 98 –107

Hartmann, Frank. 2008. "Visualizing Social Facts: Otto Neurath's ISOTYPE Project." In W. Boyd Rayward (ed.), European Modernism and the Information Society, pp. 279–93. London: Ashgate.

Henning, Michelle. 2010."*Living Life in Pictures: Isotype as Modernist Cultural Practice*". In: New Formations 70, p. 41–59, p. 42–44.

Kim, Sung Ho. 2017. "*Max Weber*". In: The Stanford Encyclopedia of Philosophy (Winter 2017 Edition), Edward N. Zalta (ed.), Metaphysics Research Lab, Stanford University, https://plato.stanford.edu/archives/win2017/entries/weber/

Karadžić, Vuk. 1969. *Srbski riječnik.* Beograd: Prosveta.

Luhrssen, David. 2012. *Hammer of the Gods: The Thule Society and the Birth of Nazism.* Potomac Books

Lupton, Ellen. 1986. "*Reading ISOTYPE*". In: Design Issues, Vol. 3 No. 2 (Autumn 1986) p. 47-58 Published by MIT Press

Müller, Karl H. 1991. "*Neurath's Theory of Pictorial-Statistical Representation*". In: Rediscovering the Forgotten Vienna Circle: Austrian Studies on Otto Neurath and the Vienna Circle. Boston Studies in the Philosophy and History of Science. Editor: Thomas E. Uebel, Kluwer Academic Publishers.

Nemeth, Elisabeth. 2019. "*Visualizing Relations in Society and Economics: Otto Neurath's Isotype Method Against the Background of his Economic Thought*". In: Neurath Reconsidered: New Sources and Perspectives edited by Jordi Cat, Adam Tamas Tuboly

Neurath, Otto. 1936. *International Picture Language: The First Rules of Isotype*. Psyche Miniatures, General Series No. 83 Published by Kegan Paul, Trench, Trubner & Co, London.

Neurath, Otto. 1939. *Modern Man in the Making*. London-UK: Secker and Warburg.

Neurath, Otto. 1973. *Empiricism and Sociology*. Editors: Marie Neurath and Robert S. Cohen. Dordrecht-Holland/Boston-USA: D. Reidel Publishing Company.

Neurath, Otto. 1983. *Philosophical Papers 1913 – 1946*. Editor: Robert S. Cohen. Dordrecht-Holland/Boston-USA/Lancaster-UK: D. Reidel Publishing Company.

Neurath, Otto. 2004. *Economic Writings: Selections 1904-1945*. Editors: Uebel, Th. E, Cohen, Robert S. Vienna Circle Collection Vol. 23 Springer Netherlands.

Neurath, Otto. 2010. *From Hieroglyphics to Isotype: A Visual Autobiography*. Editors: Matthew Eve and Christopher Burke. London-UK: Hyphen Press

Neurath, Paul. 1991. "*Sociological Thought with Otto Neurath*". In: Rediscovering the Forgotten Vienna Circle: Austrian Studies on Otto Neurath and the Vienna Circle. Boston Studies in the Philosophy and History of Science. Editor: Thomas E. Uebel, Kluwer Academic Publishers.

Popper, Karl. 2013. *The Open Society and Its Enemies*. Princeton University Press.

Potochnik, Audrey and Yap, Angela. 2006. "*Revisiting Galison's 'Aufbau/Bauhaus'in light of Neurath's philosophical projects*". In: Studies in History and Philosophy of Science 37/3, p. 469–488.

Rawlins, Jacob D. and Wilson, Gregory D. 2014. "*Agency and Interactive Data Displays: Internet Graphics as Co-Created Rhetorical Spaces*". In: Technical Communication Quarterly 23 (4): 303–22.

Ritzer, George. 2011. *Sociological Theory*. New York: McGraw-Hill.

Rumpfhuber, Andreas. "*Story of cities #18: Vienna's 'wild settlers' kickstart a social housing revolution*". In: The Guardian, 2016. https://www.theguardian.com/cities/2016/apr/08/story-cities-18-vienna-austria-cooperative-self-build-settlers-social-housing-revolution

Sandner, Günther. 2016. "*Deviationist Perceptions of the Balkan Wars: Leon Trotsky and Otto Neurath*". In: The Balkan Wars from Contemporary Perception to Historic Memory, p. 197–215

Twyman, Michael. 1975. "*The Significance of ISOTYPE*". In: Graphic Communication through ISOTYPE (ed. J.A. Edwards and M. Twyman) University of Reading, pp. 7 – 17 Available at: http://isotyperevisited.org/The%20significance%20of%20Isotype.pdf