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Preface

This is the second of two volumes containing the proceedings of the conference ‘Image and Imaging in Philosophy, Science, and the Arts’, which was organised by Richard Heinrich, Elisabeth Nemeth and Wolfram Pichler, and held as the 33rd International Wittgenstein Symposium in Kirchberg (Austria) in August 2010.

The image, and in particular the status of images and diagrams as cultural and historical phenomena, as artifacts, as objects, or as tools of scientific interest, has for some decades been one of the most popular topics in interdisciplinary academic research. The aim of the Kirchberg conference was to provide a critical survey of the development of, as well as an occasion for more profound investigation into important issues that have been raised in the field. This is not necessarily best achieved by searching for a homogeneous perspective from a single vantage point. Philosophy has still to react to many recent developments in the sciences, in cultural studies and art history which address the topic of the image from different directions. Nonetheless, the significance that the concept of the image has throughout Wittgenstein’s own philosophy, the varieties of aspects of images and diagrams which he discussed or used as examples, gave us important clues for the structuring of both the symposium and the proceedings. The proceedings attest, we think, to the important role played by notions such as ‘seeing-as’, ‘saying/showing’, and ‘image-games’ in various debates on images—debates which are, of course, only in part directly related to Wittgenstein’s work.

The contributions collected in these two volumes cover a wide range of disciplines, from philosophy, psychology, and sociology to history of science, art history, and poetology. The first volume consists of (1) papers dedicated to various aspects of Wittgenstein’s philosophy, especially but not
exclusively to questions of picture-theory, (2) further studies in the history and theory of the image. This second volume is also structured in two parts. Its philosophical protagonist is Otto Neurath, and it addresses more generally the expanding field of ‘diagrammatology’ (to use Tom Mitchell’s neologism). It contains (1) papers first presented at the workshop ‘Picturing Social Facts. Otto Neurath’s Visual Language’, organised by Elisabeth Nemeth and Friedrich Stadler. This first part begins with two papers discussing Neurath’s concept of a visual language and its historical background. The following papers present, in chronological order, some specific applications of the Isotype method, while the last two contributions draw our attention to possible further applications of Neurath’s ideas. In addition, this volume also includes (2) papers which were delivered in sections on the topics of diagrammatic representation, mapping and modelling.

Inevitably, there are thematic overlaps between the two volumes, and not every decision which had to be taken in view of their composition was an obvious one. Besides, technical considerations had to be given their due (illustrations in colour had to be restricted to the second volume). We are nonetheless confident that, in the majority of cases, contributions of related interest are neighbours in the volumes’ topology.

Our thanks go to Friedrich Stadler for co-organising the workshop on Neurath’s visual language, to the Austrian Ludwig Wittgenstein Society (ALWS) for its confidence and organisational support, and last but not least to the authors for their participation, enthusiasm, and many inspiring insights.

Vienna, February 2011

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Otto Neurath’s Visual Language

Otto Neuraths Bildsprache
The ‘Vienna method of pictorial statistics’, created by Otto Neurath (1882–1945) and his team in the *Social and Economic Museum in Vienna* (1925–1934) and developed, after his forced emigration, into the ‘Isotype’ (International System Of TYpographic Picture Education), constitutes to this day a relevant contribution to educational work and the communication of knowledge and science. The reconstruction and renewing of this Enlightenment concept through both pictures and writing, within the context of a ‘scientific world conception’ and the *International Encyclopedia of Unified Science*, offers a fruitful perspective on the current possibilities and limits of visual communication between ‘science and the public’.

The integration, as pushed for by Neurath, of this picture language of ‘figurative constructivism’ (Gerd Arntz) into a comprehensive critical concept in the tradition of Comenius, Leibniz and the French encyclopédistes, running all the way to the Vienna Circle, leads to a remarkable, but unfortunately incomplete treatise on ‘Visual education: humanisation versus popularisation’ (Neurath 1945) as a model for a modern museology. Neurath’s posthumous publication, a comprehensive sketch of a cultural history of *Visual Education* (excerpts of which were printed in 1973, the complete version in 1996), served as an illustration of this topic and can in hindsight be fairly judged a concrete contribution towards highlighting the relation between science, politics and the public. Fortunately, his visual autobiography was published in the meantime and is accompanied by recent research.¹
The fact that, at present, written and picture languages are mostly conceived of as alternatives only has not been offset by a noticeable trend towards a ‘visual turn’ either: an interdisciplinary ‘visualistics’ as the study of images, or imaging science, seems more like a compensation for the powerful influence of communication, and an appendix to computer sciences, than a well-founded investigation of the two correlative areas of word and image taking place within the context of public demand for the popularisation of knowledge and science. The tension and complex relations between science and public are also impacted upon by the method of imparting knowledge and information, in which—similar to the TV and the Internet—visualisation brings about a strong polarisation between producers and consumers. It seems all the more surprising that a comprehensive practical and theoretical contribution to picture language and museology has only been noticed by a small number of experts—a contribution which is associated with the life and work of Otto Neurath. There may be historical reasons for this, to do with Neurath’s being driven into exile three times and his early death, but also to do with theoretical reservations and deficiencies grounded in ahistorical specialisation and typologising of language and its research. Against this backdrop, a critical reconstruction of Neurath’s ‘visual education’ is not only a contribution to the history of education and science but also constitutes an assessment relevant to today’s discourse on the ‘knowledge society’. It can both help prevent a nostalgic enshrining of ‘Austrian intellectual history’ and break up a perspective rigidly fixed on individual disciplines.

**Historical Interconnections**

The ‘Vienna method of pictorial statistics’ constituted a significant attempt to generate knowledge about socio-economic correlations for a broad public using picture language and diagrams, and was intended to serve as a communicative medium within the wider framework of the associated ‘Social and Economic Museum’. However these phenomena of ‘Red Vienna’s’ education movement were not intended to be isolated instruments of popularisation following the motto ‘knowledge is power’ but were rather always designed to be a part of a neo-enlightenment ‘scientific world-view’, which must be understood as an essential component of the encyclopædia movement up until the outbreak of the Second World War. We are therefore dealing with a thematic
development of Jan Amos Comenius’s *Orbis Pictus* such as was intended by its author, and of the French *Encyclopédie*. (Incidentally, the latter’s image plates alone guarantee a certain æsthetic pleasure, but they offer no purposeful overview of the corpus of referential knowledge.⁶) Furthermore it seems that the mature versions of picture language, in the form of Isotype, made a fruitful contribution to the debate on popularisation, challenging all ‘top-down’ models of didactics in terms of epistemology and education policies.

Neurath described the typical ‘Vienna atmosphere’, which would be partly responsible for the development of logical empiricism.

While the idea of German nationalism was dominant in university circles, there were among other intellectuals many who stood apart from the nationalist way
of thinking and who subscribed mainly to the ideas of Liberalism, but later also to those of socialism, of utilitarianism, pragmatism, and empiricism, in a mixture of varying proportions.\textsuperscript{10}

With this, people such as Rudolf Goldscheid, Theodor and Heinrich Gomperz, Friedrich Jodl, Wilhelm Jerusalem or Friedrich Adler represented both the ‘opponents of traditional thinking’, but also intellectuals of (mostly anti-Kantian) modern ‘scientism’ in Austria, which sprang from four roots: anti-metaphysics, empiricist views of a general sort, the inclination towards the systematic inclusion of logic, and the mathematization of the sciences. This self-conception is already reflected in the programme of the Vienna Circle (1929):\textsuperscript{11}

Thanks to this spirit of enlightenment, Vienna has been leading in a scientifically oriented people’s education (\textit{Volksbildung}). With the collaboration of Victor Adler and Friedrich Jodl, the society for popular education was founded and carried forth; ‘popular university courses’ and the ‘people’s college’ were set up by the well-known historian Ludo Hartmann whose anti-metaphysical attitude and materialist conception of history expressed itself in all his actions. The same spirit also inspired the movement of the ‘Free School’ which was the forerunner of today’s school reform.\textsuperscript{11}

This was not just a declaration of intent; we have documentary evidence of the vital participation of Vienna Circle members (especially Hans Hahn, Viktor Kraft, Otto Neurath, Friedrich Waismann, Edgar Zilsel) in adult education and school reform in Vienna (Edgar Zilsel and Karl Popper) from the turn of the twentieth century.\textsuperscript{12} The most effective manifestation of this cooperation was unquestionably the work of the ‘Social and Economic Museum in Vienna’ founded by Neurath, which—together with the Ernst Mach Society—both aided the development of a specific picture language, and served as a platform for discussion circles on the periphery of the Vienna Circle. Here, in theory and in practice, social reform and work on education merged to form a creative field of experimentation within modernity that lasted until the wrecking of democracy starting in 1933–34.

One tried and tested thought experiment, using a \textit{counterfactual} method, is to reflect on what could have been expected of Neurath and his colleagues had they lived longer, especially with regards the catastrophic outcome of
Fascism and National Socialism: as left-wing and enlightened intellectuals of Jewish origin, they would have been forced to reorient themselves and take stock of the situation; in the case of Neurath, in exile in Holland and England, this had already led to concrete answers (for example with his planned book on ‘Persecution and Tolerance’). And in the case of all of these leading figures the project of an ‘enlightenment in Viennese modernity’ is a topic of discussion even now in the postmodern present.  

**On Otto Neurath (1882–1945): Between Encyclopædia and Utopia**

The research on one of the most brilliant all-round intellects of modern Vienna meanwhile amounts to a substantial sum total, which can hardly be given in a brief account. Neurath’s life and work between ‘encyclopædia and utopia’ points to the continuities and breaks in social development since the turn of the century (during the struggle between revolution and reform) and the project of creating a scientific picture of the world in the spirit of the Enlightenment and in the context of modern civil society. In historicising this exemplary life-story of Austrian intellectual emigration,
there emerge relevant and essential elements of his future work in education and understanding of science, which can be outlined only by a few key words: a non-hierarchical picture of science (for instance the allegory of the ship’s captain popularised by Quine) together with a relativistic and non-reductionist epistemology, an empiricism (naturalism) that regarded the difference between everyday and scientific knowledge as one of degree, a single overarching perspective on specialisation and popularisation in words and pictures, and, especially, research and education as the subject and object of a cooperative scientific praxis with a constant demand for societal change. Accordingly, this unfulfilled and fragmentary project of modernity is thematised, in all its facets, in the present day: in the philosophy of science and science research, in the ecological perspective in political economy, in architecture and the social housing movement, in modern commercial art and typography, and finally in the present-day construction of museums as social ‘museums of the future’.15

It is no accident that the most recent literature on Neurath’s life’s work is international and inter-disciplinary and, similarly, lies at the interstitial points of tension between modern and postmodern diction.16 These disparate perspectives, which demonstrate the absurdity of the long-prevailing quarrel about positivism, are gradually providing the building blocks for his conception of his own life and research, understood as a dynamic undertaking in his contemporary environment such that the ‘producers’ of science were themselves made part of the epistemological process (the ‘Republic of Letters’), abandoning an absolute meta-perspective. From this vantage point alone it is easy to imagine how this conception would have interfered in past debates on the ‘science wars’. In view of the limitations and fragility of our context-dependent knowledge it would not have been an ‘Enlightenment dialectic’ but rather a critique of it as a partial answer to the experience of totalitarianism and the Shoah.17 At the same time, this epistemological approach means renouncing every secure system of science and knowledge, connected with thinking in alternative utopias of science/society, which certainly corresponds with a conception of possibility according to Robert Musil. This is the background to the vociferous Anti-Spengler’s postulating a plan for the establishment of freedom, happiness, and prosperity.18 Today—after the economic crisis and in an age of globalisation and corporate planning—this is, again, a highly topical demand, appealing both as an alternative to laissez-faire capitalism, and to a challenged New Economy.
In 1925 on Otto Neurath’s initiative the ‘Social and Economic Museum of Vienna’ (Gesellschafts- und Wirtschaftsmuseum in Wien, or GWM) was founded. The members of this association were the Municipality of Vienna, the Free Trade Unions, the Chamber of Workers and Employees, the Cooperative Societies, the social security institutions, and the Workers’ Bank. This new kind of institution, which was to be an ‘educational museum of the present day’ for the knowledge and understanding of socio-economic correlations, ran regular exhibitions in the Festival Hall of the new city hall, as well as in the first and twelfth districts of Vienna. Up to 1933 thirty-six national and international exhibitions were organised there or supplied with material.
The topics presented there convey an impressive picture of systematic encyclopædism, the work towards popular education that had been carried out in the spirit of social reform: health, women and children, social politics, housing and urban planning, peace education, schooling, the workers’ movement, art, social security, architecture, etc. Along with this there were independent touring exhibitions at home and abroad, as well as separate publications and articles in various periodicals and books. In 1927 Josef Frank, brother of Philipp Frank, was acquired for the museum as an architect, and a year later Neurath employed the artist and designer Gerd Arntz, who drew the characteristic symbols and systematised the production techniques. The scientific department under Aloys Fischer, the ‘Transformation’ department under Marie Reidemeister (later Marie Neurath) and the technical collaborators completed the team. For several years the innovative Social and Economic Museum cultivated a working partnership with Otto Glöckel’s social-democrat school-reform movement. This enabled the GWM to contribute to the cultural life of Vienna by making an impact on visual education. Additionally, in Holland in 1931 the ‘Mundaneum’ was founded with the aim of intensifying international collaboration. Branches were set up in Berlin, Amsterdam, Prague, New York, London, and the Soviet Union. Following this phase of productive work at home and abroad came the end of the GWM after the political events of 12th February 1934. Several functionaries were arrested, and valuable fittings were confiscated. The renamed ‘Austrian Institute for Pictorial Statistics’ remained under the control of the Austro-fascist corporative state, until the National Socialists seized this institution for their own propaganda purposes. Despite these confiscations Neurath was able to transfer a large amount of valuable holdings to Holland and England.

The fundamental objective of the ‘Vienna method of pictorial statistics’ was to represent socio-economic facts and correlations, particularly with regard to their historical development, in a simple, easily graspable system of symbolic figures. A range of real things and complex facts was to be represented by means of a fixed range of signs and symbols, in which the same sign would always be used for the same object. This method of visualisation therefore arose from the coinciding of content and size as well as from a mapping of sets, such that a larger set of objects was represented by a larger set of signs without perspective. In this way—said Neurath—the facts about society could be reflected quantitatively. The method, developed and improved following his emigration to Holland, was, with the change in
Written Language and Picture Language after Otto Neurath

circumstances, renamed the International System of Typographic Picture Education, with the acronym Isotype (which was also the Greek for ‘always the same sign’).23

In a memorandum (1924) Neurath developed his concrete ideas of an ‘educational museum of the present day’, which would facilitate knowledge and understanding of societal correlations. The (epistemological-)theoretical background of pictorial statistics possibly lies in the visualisation of logical empiricism, as the arrangement of images was meant to portray facts about society quantitatively. Likewise deserving a mention as part of the background knowledge are the ‘empirio-criticism’ of Mach and physicalism, since the non-dialectical form of representation—as expression of abstract sociological categories—was to correspond to the unemotional and neutral description of relations demanded by logical empiricism.24 At the same time, both pictorial statistics and Isotype must be seen as part of a broader nexus within the context of Neurath’s work: his greatest interest was in making a comprehensive contribution to general, international education. Corresponding to this cosmopolitan and egalitarian claim was the idea of an encyclopædia, which following his emigration Neurath attempted to put into practice through the Unity of Science movement. This aim formed no less a part of his emancipatory concept of social enlightenment through visual education, being a necessary premise for the ‘humanisation’ of life.25 For that reason pictorial statistics was only a part of the wider work in general education, and school and adult education only one of the contexts in which it was applied.

In Holland further well-attended exhibitions were organised, but—because of the impending Second World War—despite significant publications26 the mass impact that had been hoped for was no longer achievable. The escape of Neurath and Marie Reidemeister to England in 1940 brought an end to activity on the continent, while Gerd Arntz remained in Holland where he continued to work alone after 1945.27 After the death of her husband, Marie Neurath continued this productive work in Oxford with the newly founded ‘Isotype Institute’ and moved to London in 1948. Despite the unfavourable circumstances this was not entirely in vain, as today teaching and research in the tradition of the Vienna method of pictorial statistics and Isotype continues at the University of Reading in a department dedicated exclusively to modern typography and visual communication.28

In 1928 Otto Neurath engaged the German Gerd Arntz as a designer, which signalled the beginning of an innovative collaboration that was to last
Fig. 5
Diagram designed by Gerd Arntz, originator of a ‘figurative-constructivist graphic style’

Fig. 6
Survey depicting the international activities of Isotype
many years. Before this period Arntz had already marked himself out in the art world of the Weimar Republic as a member of the ‘Rhine Group of Progressive Artists’ (1918–1933) with an original socio-critical, figurative-constructivist graphic style. After the First World War he benefited from a specialist education amid the post-revolutionary climate of the young republic (especially in Düsseldorf) and came into contact with Cologne’s circles of artists. After that Arntz collaborated again with Peter Alma and August Tschinkel, among others, at the GWM, and from 1919 to 1933 published work in *a-z*, the theoretical mouthpiece of the Constructivists. There followed further international exhibitions and—as a corollary of the GWM’s activities in Moscow at the beginning of the thirties—contacts with the Russian avant-garde. Following the events of February 1934, and finding himself in danger, the artist emigrated with Neurath to the Hague and, alongside his demanding work at the Mundaneum Institute there, took part in the anti-fascist opposition movement (as well as in an exhibition in London and the Amsterdam exhibition *De Olympiade Onder Dictatuur* ['The Olympic Games under the Dictatorship']). It was in Holland that Arntz, together with Neurath, was able to achieve the apogee of the Bildstatistik output with the success of the book *Modern Man in the Making* (1939). During the war Arntz continued to work as lead designer for the ‘Dutch Foundation for Statistics’ (*Nederlandse Stichting voor Statistik*). Following his conscription by the Germany army he escaped to the Resistance in Paris, and was held as a prisoner of war. After the Second World War Arntz, now in changed circumstances, again resumed his commercial and artistic graphic work. Alongside the usual social commentary of his work there was also pictorial-statistical work for UNESCO, while from the end of the sixties his political graphic work would receive renewed international interest.

If Arntz’s first woodcuts were still located in the expressionist tradition, his work from the twenties was already abstract-constructivist. He integrated elements of the French Cubists (Ferdinand Leger) until he came to achieve a distinctive profile of his own within the ‘Group of Progressives’. The common characteristics of this Cologne group—among them Heinrich Hoerle, Franz W. Seiwert, Hans Schmitz, August Tschinkel, among others—were an aesthetic affinity centred on the use of figurative-constructivist picture-forms, a shared political (liberal-communist) outlook with a programmatic yoking of art and politics, the cultural background of the Rhine region, and finally the members’ conception of themselves as forming a coherent whole.
In accordance with the intensive response to the Russian revolution (Lunatscharski, Bogdanov, El Lissitzky, among others) joint exhibitions were organised in the Weimar Republic, which were marked by the post-revolutionary spirit. In their periodical the Constructivists also critiqued the New Objectivity (**Neue Sachlichkeit**), but they cultivated close contacts with Bauhaus artists—as did, incidentally, Neurath, Carnap and other members of the Vienna Circle. Here we must also mention another co-founder of modern typography, Jan Tschichold, whose influence can be detected in the typical figurative-constructivist picture-forms of Gerd Arntz and in the graphic design of the pictorial statistics. The principle held by Arntz, who opposed, for instance, the ‘psychologism’ of an Otto Dix or George Grosz, went thus: ‘make everything impersonal, use templates, be a constructor.’ In this we can detect the influence of the Japanese woodcut, the French purists, and the Dutch group ‘de Stijl’ (Piet Mondrian) between realism and objectivity.
As already mentioned, pictorial statistics were especially suited to pedagogic reform, such that for many years Neurath and his co-workers nurtured a productive collaboration with the Vienna school-reform movement. The school reform from 1918 to 1934, initiated by Otto Glöckel, represented an attempt to reform the traditional school system, with its state and church-dominated drill schools, and to set up secular ‘labour schools’ elsewhere, in which teaching would be carried out according to egalitarian and socially just methods. Here the educational principles of intellectual autonomy and practical relevance, of clarity and conciseness in education, as well as of an aesthetic education with a scientifically thorough underpinning played a large role. Pictorial statistics very much complied with these objectives. As early as the 1920s Neurath had stressed grasping the notion of the ‘statistical age’ as a teaching objective, and, subsequently, in a handful of articles and with systematic treatment in his 1933 book Bildstatistik nach Wiener Methode in der Schule (The Vienna Method of Pictorial Statistics in School), summarised the methods and principles, as well as the possibilities of applying them in a school setting. Practical cooperation culminated in the decision of the Vienna municipal school council to have pictorial statistics tested in a special experimental school.

This was preceded by the steady work of the GWM: statistics was included as a subject in school syllabuses on a trial basis, and the GWM itself had already made ‘intellectual life and schools’ a permanent topic area within its ‘contexts and culture’ department. Various school classes visited this educational museum, and visual-education experiments were carried out as early as the nursery stage. The collaboration also bore fruit in terms of publications, particularly with the periodical Das Bild im Dienste der Schule, with a GWM supplement that ran from 1927 to 1930. The use of pictorial statistics was articulated most impressively by the publications Die bunte Welt (1929) and Gesellschaft und Wirtschaft. Bildstatistisches Elementarwerk des GWM in Wien (1930). In the Ernst Mach Society and in various newspaper articles Neurath tried in addition to disseminate these reformist ideas. With the start of the school experiments further activities were set, until February 1934 saw the final failure of the school reform project; the above-mentioned dissolution of the GWM, as it then existed, soon followed.

The contribution of the GWM to didactic methodology and visual education had already been laid out by Neurath in his book Bildstatistik nach Wiener Methode in der Schule (1933): social enlightenment through training of
the intellect along with the nurturing of children’s drawing and design skills. His pictures of sets were successfully trialled at the Montessori Kindergarten and Montessori school in Vienna. The emphasis on praxis also led to affinity with the Freinet system of pedagogy that was then being developed in France, which put into practice the idea of ‘labour schools’, particularly by means of their school printing presses. The objective of the didactical experiments begun in the school years 1930/31 and 1931/32 was to optimise ‘ways and means’ in concrete educational environments across different subjects. They covered four classes of schoolchildren, and the experiences were shared during many conferences, so that numerous parties interested from home and abroad came to visit these classes. The conclusion of this project took the form of an exhibition on the pictures of sets that had been made as well as the teachers’ final reports. Here it was established that an introduction and a certain amount of time would be needed. Across all subjects multiple methods were used, from the presentation of prepared pictures of sets to their production by the pupils themselves. The disadvantages reported were, according to subject, the necessity of drastically rounding up the numbers, the amount of work required, as well as its unsuitability for the teaching of German. The advantages mentioned were the scope for working autonomously, the consolidation of the pupils’ knowledge of the material at the end of the problem-solving, the connecting of different subjects, the increase in motivation, and, in particular, its usefulness in the subject of history.

The key to the long-overdue reconstruction and updating of both writing and image, in the context of the scientific world-view, is Neurath’s publications on visual education. Using them we can systematically pursue both the theoretical development and the development of the picture language of this inter-disciplinary and collaborative educational undertaking, and link current revisiting of this potential to the methods, principles and contents of pictorial statistics. Neurath’s writings on visual education similarly represent an excellent field of study for inter-disciplinary and collective work on science and education. In numerous illustrated articles, brochures and books Neurath describes the history of the Social and Economic Museum as an organisation, and also the concomitant story of the internal theoretical and practical development of picture language from pictorial statistics to a visual pedagogy integrating writing and symbols. Here we can see the connections at its origin with the Vienna cultural movement as well as the interlinking of the principles of this popular education project with the logical empiricism of
the Vienna Circle and with the artistic work of the figurative constructivists around Gerd Arntz.

The programmatic titles of Neurath’s specific writings alone convey a sense of the intentions and socio-political orientation of this conception, which became an international one from 1930. The pictorial representation of social facts with the help of ‘statistical hieroglyphs’ would concisely and informatively explain society in all its aspects with a view to improving ‘living conditions’. The scope of topics therefore extends from home, the reality of the world of work, housing and urban planning, to economic considerations on social welfare. From a modern-day perspective the monographs Bildstatistik nach Wiener Methode in der Schule (1933), Internationale Bildersprache/International Picture Language (1936), and finally his most mature work Modern Man in the Making (1939)/Auf dem Weg zum modernen Menschen (1991) are of special interest. In these numerous pictograms are used to treat the theory and application of picture language along with written language. In addition, with his essay ‘Museums of the Future’ (1933) Neurath laid out a programme for a modern sociological and economic museum that remains impressive to this day, and which can be interpreted as the antithesis of the postmodern ‘hands on’ museums, the collections of devotional objects, and the contrived ‘total works of art’:

From Comenius’ Orbis Pictus an uninterrupted movement leads to modern visual education. A picture made according to the Vienna method shows at the first glance the most important aspect of the subject; obvious differences must be at once distinguishable. At the second glance, it should be possible to see the more important details; and at the third glance, whatever details there may be. A picture that has still further information to give at the fourth and fifth glance is, from the point of view of the Vienna school, to be rejected as pedagogically unsuitable.

Thus a new clarity and purposefulness is developing in communication that may be regarded as preparation for more incisive social planning. Teachers and other groups of people concerned in social education, directors of museums, and editors of periodicals are confronted with the responsibility of placing their energies at the service of this common international task.

The all too early death of Neurath prevented the completion of his sociohistorical monograph on picture language, which was published posthumously.
Fig. 9

One of the few articles written by Gerd Arntz explaining the ‘Vienna method’ (1930)

Fig. 10

Social criticism by means of graphic art: work by Gerd Arntz (1927/28)

Fig. 11

Advertising leaflet to promote the use of Isotype in the 15-volume *Compton Pictured Encyclopedia*, Chicago 1939 (F. E. Compton & Co.)
only in 2010. With these publications we can reconstruct the aims of this emancipatory visual education and evaluate the road ahead that was implied by ‘From hieroglyphics to Isotype’\(^{36}\) (1946) as well as an unfinished manuscript titled ‘Visual Education: Humanisation versus Popularisation’.\(^{37}\) The latter discusses the possibility of a non-hierarchical international picture language, which through its neutrality imposes tolerance on education and at the same time makes possible a humanisation in opposition to authoritative popularisation:

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 advanced 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. This procedure from the simplest to the most complicated, I shall call humanisation.

Generally speaking, the average books destined for children and the man in the street start in a different way. They try to simplify the highest level of scientific formulation, presented in scientific books. Sometimes writers think
Fig. 9

Cover of Society and Economy, a publication containing 100 coloured plates of pictorial statistics developed for the GWM (1930)

Fig. 10

Cover and double spread (pages 20 to 21) of International Picture Language (1936)
that a translation of well selected terms into popular terms is sufficient, whereas it is common knowledge that the insufficiency of these terms was the main reason for the introduction of scientific terms. This kind of translation from the complicated to the simple, from top to bottom, as it were, I shall call popularisation of knowledge.

In the humanisation of knowledge one tries to avoid what may be called an inferiority complex as well as all kinds of frustration which so often appear when people try to grasp a piece of knowledge in vain. Looking at a book often creates a kind of fear. There are not a few people who become uneasy when confronted with a general term like ‘magnetism’ but who would not be irritated by hearing about magnets and iron. Humanisation implies avoiding technical terms before they are really needed. The question is how far we can go without using more complicated expressions. […]

All statements which speak of seeing, hearing, touching, tasting, etc., appeal to the average man, because every sensual statement is possible in the common neutral and democratic language.38

Here, visualisation is presented as an essential means of aiding cross-cultural communication, which takes as its starting point people’s everyday concrete world and, acting as a building block, enables the construction of a social museum of the present that is, as it were, cosmopolitan in character (‘Mundaneum’). Equally apparent was the cooperative and international element of such an educational project, and this—against the spirit of the times—expressed the democratic idea of a ‘plan for freedom’:

Visual education leads to internationalisation much more than word education does. One can use the same visual arguments, connected with different words for explanation in various languages; one can even vary the remarks on the same visual material. Visual education is related to the extension of intellectual democracy within single communities and within mankind, it is an element of international social planning and engineering.

This is a period of planning, planning for getting something done, where without planning defects are manifest, such as destruction of coffee, unemployment, etc. But we can remove all this without regional planning, without city planning; we can imagine a nation with planned production as far as raw materials are concerned, but also building up ‘planning for freedom’, which signifies intentionally not interfering. Much city planning is full of pomposity,
Fig. 11

Covers of *Fernunterricht*, a subscription magazine for distance learning, each dedicated to an individual topic. (1931/32)
with a totalitarian undercurrent, pressing forward some way of life. Perhaps people want to do so; but the dictatorship of planning is a danger in itself and is not connected with planning against want. You may be in security, but free to choose your kind of life within this security. The either-or is important. We may create certain conventions in language without unifying the laws; a world language does not imply a world dictatorship but may help world understanding. For a democratic society it is important to have a common language.39

While the Vienna Method of Pictorial Statistics was relatively well known in its theoretical and practical application in school contexts, a parallel initiative in adult education received little attention: from 1931 to 1933 the GWM in Vienna regularly published the *Fernunterricht* (retitled *Bildstatistik* from 1932), a series of distance education booklets issued as subscriptions, with each dedicated to an individual topic.40 As this series of publications for popular education was not reprinted in the *Gesammelte bildpädagogische Schriften*, due to its purely non-theoretical, applied approach, a brief characterisation is presented below. From today’s perspective one can treat these brochures with their changing topics as foundation stones, or defining landmarks, in the field of social history. As it emerges from the preface, there was particular emphasis on user-friendly orientation and the invitation to provide feedback, which helps in creating an interest-oriented mode of communication that puts the participants on an equal footing:

*Der Fernunterricht* is dedicated to anyone endeavouring to acquire new knowledge, and especially to adult educationalists and teachers who impart their knowledge to a narrower circle. Newspapers and periodicals are not able to devote their attention to the systematic training of the readers; the former give us ephemeral information on the day’s events, the latter thorough discussion concerning specific questions. Not everyone has the time and energy to form this into a well-ordered overview and to acquire the necessary information to complement his/her knowledge. This is what *der Fernunterricht* intends to do. Lack of time compels learners and teachers to look for concise summaries. For this pictures are a great advantage. They demonstrate, clearly and quickly, even to those with the little preliminary knowledge, what is essential. The ‘Vienna Method of Pictorial Statistics’, which has already proved its worth internationally, combines objectivity and easy memorability. In view of all this, *der Fernunterricht* offers not prettily written articles, detailed discussions, but very
Neurath then goes on to give an account of the connectedness between science and popular education, which, according to his thinking, could be brought about through the empirical view of science. The Fernunterricht magazine was especially important in publishing the GWM’s pictures of sets, such as those, for instance, from the elementary work in pictorial statistics Gesellschaft und Wirtschaft (Society and Economy, 1930); they were accompanied by introductions and explanations, which could be obtained by post as transparencies and off-prints. An inserted page for questions and suggestions from readers facilitated free correspondence concerning particular issues of the magazine, and hence regular feedback from subscribers. Selected questions were answered in writing in the following issues. Going by reactions to it, the undertaking was a success, which was also noted abroad. The political turning points of 1934 and 1938 finally brought about the disappearance of this enlightenment tradition in Austria, and after 1945 it fell into oblivion. It is no coincidence that it was in England, where the bourgeois enlightenment brought about egalitarian concepts of education, that Neurath’s ambitions struck fertile soil. Thus Neurath was able to present the importance of visual education vis-à-vis popular education in several articles in the periodicals of adult education organisations. Above all the article ‘Visual aids in adult education’ (1944) ran the gamut from Comenius to modern picture language and its role in the struggle against superficial knowledge, illiteracy and the confinement to simplistic reading material; his argument was supported by a web of various ‘visual arguments’, and ended with a perfectly realistic, but still unrealised vision:
It seems to be within the reach of our generation to support a future commonwealth in a practical manner. Of course the network of arguments conveyed by means of Isotype is much smaller than that conveyed by literature, but it may be of a similar kind. Should all these international day-dreams of an intellectual world of the common man not be realized, the introduction of visual education in schools and adult education classes seems nevertheless to promote an atmosphere of argumentative meditation and of some peacefulness.44

Current international research into the field of visual communication and general semiotics confirms to an impressive degree the viability of developing Neurath’s approach further.45 Following the further development made in the Anglo-American world, slowly but surely in German-speaking areas, too, attention is turning to this innovative tradition of the ‘Vienna Method’, as demonstrated by the new discoveries, and the rediscovery, of Neurath’s life and work.46

Outlook

The contemporary relevance of picture language after Otto Neurath in the context of science, politics and the public can only be outlined here. His model of a combined visualisation and museology, against a linear and hierarchical popularisation of knowledge and science, is manifest in at least four overlapping research areas:

1. In perception research, starting from the static diagram (as a ‘visual argument’) all the way to the TV screen and film application.47
2. In reconstruction within a general inter-disciplinary semiotics which had begun to show itself at the time in the cooperation with the Dutch significs around Gerrit Mannoury for the journal Synthese.48
3. In the critical assessment of the correlative relationship between society and science which is apparent, for instance, in the new works on the potential of the encyclopædist project.49
4. In its applicability in the area of the social sciences and the alternative political economy, which does not restrict the criteria for progress and wealth to money alone.50
Concerted work on this loose programme after Neurath would once more show the limits and possibilities of building and rebuilding a ship, a task which would only be possible through cooperation and a continuous division of labour in a joint and endless project. But that, of course, is the fate of every conception of science, which is in principle sceptical vis-à-vis the demands for a single method and a single rationality. The late W. V. O. Quine recognised this fact as far as philosophy is concerned, when he used Neurath’s sailor simile—outside its historical and thematic context—as a motto for his book:

Wie Schiffer sind wir, die ihr Schiff auf offener See umbauen müssen, ohne es jemals in einem Dock zerlegen und aus besten Bestandteilen neu errichten zu können.

We are like sailors who must rebuild the ship on the open sea, never able to dismantle it in dry-dock and to reconstruct it there out of the best materials.\(^{51}\)
Notes

This article is a translated and revised version of my ‘Schriftsprache und Bildsprache nach Otto Neurath—Popularisierung oder Humanisierung des Wissens?’, in: Wissenschaft, Politik und Öffentlichkeit. Von der Wiener Moderne bis zur Gegenwart. Edited by Mitchell G. Ash and Christian H. Stifter (Wien: Facultas, 2002), 267–303. I am grateful to Naomi Osorio-Kupferblum (Vienna) and Bryn Harris (Oxford) for their valuable translation work.


6 Neurath himself referred to this connection time and again in his writings. For a systematic comparison of the relationship between pictorial statistics and Neurath’s modern encyclopedia, see Karl H. Müller, Symbole, 10, and Dahms ‘“International Encyclopedia of Unified Science” als Torso’ in Elisabeth Nemeth/Richard Heinrich (eds.), Otto Neurath: Rationalität, Planung, Vielfalt (Berlin: Oldenburg und Akademie Verlag, 1999), 184–227. For a research-oriented history of his life and


Written Language and Picture Language after Otto Neurath


31 Arntz, Kritische Grafik, 47.
32 Especially with the periodical Fernunterricht and with articles in: Die Volksschule and Die Quelle.
33 Neurath, Gbs 1991 (all subsequent references are taken from this).
34 Neurath, Gbs (particularly the relevant publications of 1925–1946).
39 Empiricism and Sociology, 231 f.
40 Gesellschafts- und Wirtschaftsmuseum in Wien (Leipzig-Vienna): Fernunterricht (1931/32), continued under the name Bildstatistik (1932/33).
41 Fernunterricht, 1 February 1931.
42 Ibid., 11.


Cf. particularly the publications already mentioned above in note 13.


In a thorough study titled ‘Neurath’s theory of pictorial-statistical representation’ (published over twenty years ago in *Rediscovering the forgotten Vienna Circle*) Karl Müller concluded that Otto Neurath never explicitly developed such a theory and questioned Neurath’s claim that Isotype was a language, due to the weakness of evidence for this. In implicit agreement with Müller’s analysis, this essay will draw on Neurath’s correspondence and his ‘visual autobiography’ to show that he 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.

There are some contradictions in the way Otto Neurath discussed Isotype, as perhaps there were in other areas of his work; Thomas Uebel has described him succinctly as ‘a very contrapuntal writer’.\(^1\) It seems almost to have been a principle of Neurath’s to be self-contradictory (or at least equivocal). In his 1942 essay ‘International planning for freedom’ he quoted Conrad Meyer: ‘I am not a wittily constructed work of fiction; I am a human being and full of contradiction.’\(^2\) Neurath’s habit of undermining certainty causes some difficulties of interpretation. He made statements claiming that Isotype was a kind of language, which should be in widespread use, yet he also admitted that it could never be a real language and he wanted to keep close control of how it was produced.

Neurath’s book of 1936, *International picture language*, firmly established a claim of linguistic status for Isotype. The use of this phrase is partly
explained by Neurath having written the book in C. K. Ogden’s Basic English, which has a vocabulary of only 850 words to choose from. Nevertheless, Neurath stated in his introductory note that the rules he would explain in the book are ‘in harmony with a complete system for an international picture language’. This is not something that he and his collaborators ever tried to develop, despite the claim for a system being made in the name Isotype itself—an acronym which stands for International System of Typographic Picture Education. In her account of how she invented this name, Marie Neurath confessed that it was not an ‘entirely satisfactory solution’.3

The name Isotype replaced ‘Vienna Method of Pictorial Statistics’ (*Wiener Methode der Bildstatistik*) around the time that *International picture language* was being written, soon after Neurath and a group of close colleagues from the Gesellschafts- und Wirtschaftsmuseum in Wien had settled in the Netherlands. In correspondence at that time, Rudolf Carnap asked Neurath:

> What does ‘isotyp’ [sic] mean? Representation by means of a similar picture? For a logician it rouses the association: ‘of the same logical type’. Wouldn’t it be possible to find another word?4

Carnap referred here to an interpretation based on the Greek words ‘isos’ (the same) and ‘typos’ (type, symbol). Neurath replied:

> Isotype—the name for our picture language; we are glad we have it. Reidemeister [later Marie Neurath] developed it systematically: I-nternational S-system O-f Ty-pograhic P-icture E-ducation. And it otherwise means: using the same types, which we in fact do. I hope it does not cause any great confusion among logicians.5

Neurath’s last comment here—perhaps a little sarcastic in tone—indicates that he did not perceive Isotype as occupying the ‘icy slopes of logic’; instead he welcomed the name as a kind of brand to effectively identify work produced at the International Foundation for Visual Education in the Hague. After leaving Vienna and losing the municipal subsidy given to the Gesellschafts- und Wirtschaftsmuseum, it was necessary to establish practice on a commercial basis. The Dutch Foundation struggled financially and, after two years in the Netherlands, Neurath wrote:
But we can barely exist any longer, and don’t know how things will go on, in
spite of the positive attitude of important people towards our work, in spite
of ‘success’ now again in educational circles. Just like our unified science has
success—but it doesn’t bring us one penny.⁶

Neurath may have been content to portray Isotype as a kind of ‘system’
and ‘language’ in order to enhance its appeal to potential clients during this
difficult period.

Nevertheless, after the analytical debates about the use of language in the
Vienna Circle, Neurath was naturally wary of using the term ‘language’ for
referring to Isotype. He asked Carnap for advice on the matter during the
writing of International picture language:

I am treating the work of our Institute theoretically and call it ‘International
picture language’[.] [I] indicate rules which we use and also show how one
‘stresses’ something—that corresponds to stylistic rules of [letter]spacing [in
gothic type] and underlining, etc.

Now I would like to know how one should differentiate between the term
‘script’ and ‘language’. In ethnology many speak of ‘picture languages’,
others of ‘picture script’. One speaks of Chinese script, although actually
a language is meant whose translation into the spoken word is debatable.

I would prefer using a terminology which is consistent with yours. Please
make some remarks.⁷

Neurath probably sought consistency with Carnap’s book Logische Syntax
der Sprache, which had been published not long before this request.⁸ Carnap
replied:

I use the term ‘language’ in the broadest sense. I have hardly used ‘script’ or
‘script language’. I would possibly use these terms in such a way that ‘script’
or ‘script language’ designate a special variety of language, namely the written
variety. A system of rules for the use of pictures (to express facts) is then a
special type of language. Hence it seems to me that one can use the term
‘picture-script’ as well as the term ‘picture language’.⁹

Neurath took this as a kind of approval for calling Isotype a language: ‘I will
use the term picture language as you have indicated’, he told Carnap. Yet he
was hesitant about taking this step, explaining that he had previously used only the term ‘picture script’ [Bilderschrift]. Indeed, in his longest and most detailed account of the Vienna Method—Bildstatistik nach Wiener Methode in der Schule (1933)—he seems quite deliberately to have used this term and avoided ‘picture language’ [Bildersprache]. To Carnap, he continued:

\[\text{… it is naturally something else if there is a picture language with its own syntax, or a picture language without its own syntax. Translatable word for}\]
word, so to speak. The German script-language itself is different from the German speech-language. Above all in ‘style’, which is also language.¹¹

Neurath pointed out in *International picture language* that Isotype could not translate verbal language ‘word for word’; but it did have some basic syntactical rules, which were established during the Vienna period. The basic rule is that pictogram units should not be increased in size to indicate an increase in quantity, but should instead be repeated in greater numbers, at the same size. After initial years of experiment, it was also resolved to line them up in horizontal (not vertical) rows, with time running on the vertical axis. Arranged this way, Neurath likened the pictograms to letters composed in a printed line.¹²

Some examples were prepared around 1936 to show how statements such as ‘boy walking through doorway’ should be conveyed through Isotype, with counter-examples (figs 3 & 4). These make clear that Isotype has no components that are directly equivalent to words in many cases; but it would be difficult to interpret rules which dictate that these statements should be conveyed in precisely the approved configurations given here. Perhaps this

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**Fig. 3 & Fig. 4**

Examples of ‘not Isotype’ and Isotype depictions of some simple operations.

c.1936 (T1413 & 1414)
was the point—that there should always be flexibility to allow for economical (and creative) graphic renditions. (More examples of this kind appeared in *Basic by Isotype*, the book that was prepared alongside *International picture language*.)

Almost a decade after writing *International picture language*, Neurath continued to refer loosely to Isotype as a ‘visual language’ in a book titled ‘Visual education’, which he wrote towards the end of his life. He seemed to recognize the debatability of his usage, however:
If one shows realistic pictures instead of using impressive sentences or expressions, one uses a language which is a rather vague one, but vagueness in itself is no objection as long as ambiguity is avoided.\textsuperscript{13}

Contemporary with this, in his ‘visual autobiography’ titled \textit{From hieroglyphics to Isotype}, Neurath clarified that Isotype was not a language but a ‘language-like technique’:

There are many reasons why Isotype cannot be developed as a ‘complete language’ without destroying its force and simplicity. Our daily language, even in primitive societies, is to some extent richer than our Isotype representations can be, and one needs words added to the pictures.\textsuperscript{14}

Around the same time he wrote to a colleague in England:

I object to all attempts to look at Isotype as a quasi-language in full dress. It is just my point to maintain, that Isotype is adapted to impressive presentation of relatively simple correlations. A full scheme of Hieroglyphics should frighten me.\textsuperscript{15}

Neurath had admitted this in other words already in \textit{International picture language}, calling Isotype a ‘helping language’ (in later writings he called it an ‘auxiliary language’).

While \textit{International picture language} remains the best written account of Isotype, it should not be interpreted as a set of definitive statements that wholly encapsulate what was an activity of collaborative, graphic design. Taking that book as a summa ignores the rich and varied history of Isotype between 1924 and 1971, and encourages an appraisal of Isotype in purely conceptual terms. Neurath’s epistemological (and economic) writings enrich an analysis of Isotype, without doubt; but he certainly never considered it as a philosophical exercise. He often commented to colleagues and clients that Isotype could not be fully explained but only demonstrated in action.

The makers of Isotype clearly did not want to construct a whole language; Isotype was instead an approach to design for education, with some linguistic aspirations. Its few basic rules provided a certain systematic aspect. Neurath hesitantly referred to ‘Isotype vocabulary and the Isotype grammar, if one is allowed to use these terms in such a context’.\textsuperscript{16} Some rough parallels with
language can be drawn: for instance, in the way that pictograms could be combined to create the equivalent of compound nouns. Also, by linguistic analogy, a certain significance was attached to changes in form or colour; they were not changed arbitrarily.

To some extent Isotype was defined by what it did not do—what was left out. There is a similarity here to the way in which Neurath simply left out specific words from his vocabulary when writing, in order to avoid certain complications. Isotype generally never shows things in perspective, for example, because Neurath thought that such naturalism detracted from the power of the simplified imagery.

In From hieroglyphics to Isotype Neurath stated that the Isotype team attempted to achieve a ‘visual consistency’ lacking in some previous efforts in visual communication. Yet, on the same page (103), he claimed that ‘I think we were the first to evolve a theoretical framework of visualization’. This sounds suspiciously like the very thing which he criticized other people for doing, although it is perhaps a reasonable description of the broad rules formulated for Isotype. Such a phrase, added to claims for Isotype to be an ‘international system’ and a ‘picture language’, may encourage interpretation of it as having a utopian aspect. Karl Müller observed that Neurath thought ‘full symbolic languages’ were something desirable but not practicable. There is no way of breaking down Isotype into definite components of meaning any more than verbal language could be, in Neurath’s view:

I cannot deny that many scientifically minded people do not like such a start full of vagueness; they would prefer—as I would prefer too, if I did not regard this wish as a utopian one—to start with exact initial definitions and atomic simple elements.

Isotype was not any kind of ‘ideal language’, which is what Neurath described Carnap as having attempted to develop in his book Der logische Aufbau der Welt (1928). Neurath considered Carnap’s formulations as inapplicable to the social sciences (the principal province of Isotype) because they did not reflect the necessary mixture of ‘clean’ and ‘unclean’ ways of thinking. In his autobiography Carnap recalled that Neurath insisted on the materiality of language:
Neurath emphasized from the beginning that language phenomena are events within the world, not something that refers to the world from outside. Spoken language consists of sound waves; written language consists of marks of ink on paper. Neurath emphasized these facts in order to reject the view that there is something 'higher', something mysterious, 'spiritual', in language, a view which was prominent in German philosophy. I agreed with him but pointed out that only the structural pattern, not the physical properties of the ink marks, were relevant for the function of language. Thus it is possible to construct a theory about language, namely the geometry of the written pattern.20

Here is a significant difference between the views of Carnap and Neurath: Carnap’s response, to dismiss the physical properties of graphic language as irrelevant, showed his vestigial attachment to the idealism of German philosophical tradition; Neurath had been occupied since the early 1920s with designing and producing graphic material and, for him, the particular form of ink marks on paper were not incidental—they were intrinsic to Isotype.

This difference between Carnap and Neurath emerged during the seminal ‘protocol sentence’ debate within the Vienna Circle. Neurath argued that ‘What is first given us is our historical ordinary language with a multitude of imprecise unanalysed terms [“Ballungen”].’21 In his view protocol statements were not intended as ‘elementary statements’—‘In this form they are even a protest against elementary statements.’22 As an example he gave the sentence ‘Otto observes an angry man’: this was imprecise because ‘angry man’ is not precisely defined (‘but “Otto” itself is in many respects an imprecise term’, he added). ‘We start by purifying this ordinary language of metaphysical components and thus arrive at the physicalist ordinary language. A list of forbidden words can serve us well in doing this.’23 Such a ‘physicalist language’ is also served by using pictures instead of words: pictures make a direct, iconic connection to the physical world, not a symbolic one. Yet the Isotype pictograms representing ‘man’ or ‘woman’ are by nature imprecise—they are deliberately generic. In Neurath’s terms, they are also ‘Ballungen’, imprecise clusters of concepts.24 The graphic simplification in Isotype is instrumental, and does not correspond to a reduction of connotation. Isotype pictograms are generalized pictures due to their simplicity. Neurath commented: ‘The figures must not function as individuals, rather as symbols for a genus [Gattung].’25

Although Neurath recognized no direct descent of Isotype from either hieroglyphics or Chinese script, he found some analogies with these
A people with a conceptual script (like the Chinese, for instance) has difficulties in creating a freely mobile symbolism; on the other hand, it runs less easily into the danger of talking philosophical nonsense. …

… letters as signs without conceptual meaning are, however, well suited for a strictly scientific symbolism. 27

Care must be taken in mapping Neurath’s views about verbal language onto his work in picture language. There are some enticing similarities, but the shift from word to image is, in Isotype terms, a ‘transformation’ or metamorphosis [Umwandlung] of linguistic mode, which entails more differences than similarities. However, to make a crude analogy, Isotype charts could
be seen as a kind of graphic protocol statement lacking the rigour of the verbal kind defined by the bracketed qualifications about who exactly made the observation and when. Although Isotype charts bear the signature of the Isotype Institute (and before that the Gesellschafts- und Wirtschaftsmuseum or the Mundanaeum), the origin and editing of the information contained in them is rarely made explicit: sources of statistics are often only given when a book appendix allows space, for example.

Neurath was not interested in analytical systems that pretend to classify whole languages. As Herbert Feigl noted, Neurath was ‘skeptical if not outright opposed to’ semantics as developed by Carnap. In ‘Foundations of the social sciences’ he stated:

I think that ‘semantics’, as evolved by Carnap and [Alfred] Tarski, will support many kinds of calculus analysis, but I feel uneasy when thinking of its application to empiricist arguments and the danger of slipping into ‘ontological’ ways of arguing.

For the same reason Neurath had reservations about the theory of ‘semiotic’ (singular, not plural) expounded by the American philosopher Charles Morris in a long essay titled ‘Foundations of the theory of signs’ for the first volume of the International Encyclopedia of Unified Science. Neurath was editor-in-chief of this encyclopedia, although he seems to have left the editing of Morris’s essay mainly to Carnap, who was assistant editor (along with Morris himself). Neurath gave Morris’s essay the title ‘Semiotic’ in an initial contents list, having noted Morris’s previous use of the word, but Morris resisted it as a title ‘because the term is not known to many people’, and instead proposed ‘Theory of signs’. Neurath welcomed this as ‘a real name of a science’. Yet he considered Morris to have gone too far in terms of constructing a system of classification: he agreed with Morris that one should try to ‘systematize’ as far as possible, without pretending to make a complete or final system—this was essentially the approach in Isotype—but it seemed to him that in Morris’s study ‘the classification exceeds the clarity that can be attained in this area at the present time’. ‘I fear that too much terminology in an area that is so little developed does not have a clarifying effect.’

It is perhaps significant that Neurath barely mentioned Morris or Semiotic[s] in his introduction to volume one of the Encyclopedia; he mentioned more favourably the linguistic discipline of Significs, which
Fig. 9

A diagram by Charles Morris titled ‘Semiosis and semiotic’. This was included in a letter he sent to Neurath, 3 February 1938. (VCA-m)

Fig. 10

Extract from Neurath’s reply to Morris, 14 February 1938, including his diagram based on Morris’s concepts. Neurath’s version tends toward Isotype in being purely visual, with separate verbal explanations. It also begins to resemble an atomic diagram. In the text below he appears to introduce the term ‘design’, but this is an abbreviation of ‘designatum’, as used by Morris. (VCA-m)
responded principally to the pragmatic aspect of language. In his introduction Neurath offered an epigram that illuminates study of much of his work: ‘One can love exactness and nevertheless consciously tolerate a certain amount of vagueness.’ He continued: ‘How can one combine such a critical and skeptical attitude with the unparalyzed driving power which is needed to attain success in social and private life?’

Neurath was consistent in observing that visualization had strong limits—that it was capable of less complexity than verbal language. He discussed this matter with Patrick Meredith, a member of the advisory committee for the Isotype Institute in the UK. Meredith established a Visual Education Centre at University College, Exeter (in south-west England); he also became the first lecturer in visual education in Britain. He met several times with Neurath, and some of Neurath’s ideas are clearly recognizable in short essays written by Meredith in the early 1940s. He described the work of his ‘Visual Education Centre’ as ‘concerned with the bearing of three normative disciplines on visual production, namely logic, semantics and statistical theory’. Neurath was doubtful about establishing visual education as some kind of academic discipline by pretending that it was more developed than it really was:

I think the Visual Education business is in the beginning. It seems to be rather dangerous to create terms for such a provisional activity. The statements one wants to make are poor and few only. After some research work you will perhaps need a few terms.

My answer is: try to discover how visual education goes on at the moment, particularly in certain disciplines. Even a first rather vague information would mean a lot, since one does not know anything about the state of affairs. From such research you will reach certain results and making descriptive statements, perhaps, maybe, you will use some expressions frequently, which afterwards will be fixed by use and then become elements of the normal discussion, but I think it hardly desirable to start with such phraseological attempts before any clear results have been reached. You see from my articles how careful I avoid to use particular terms. [sic] I try to remain within the daily life language realm. I avoid even acknowledged expressions of modern psychology, knowing how many misunderstandings may grow up from that. Therefore I suggest to speak simply and frankly of the problem without anticipating any classification or hypothesis.
Neurath’s resistance to Meredith’s use of the phrase ‘visual logic’ led him to admit that ‘logic’ had been on his notorious list of ‘dangerous’ words since the Unity of Science congress of 1937, which, he conceded, put him in a difficult position: ‘In short, I myself do not know how to apply the term properly, and therefore—against my intentions, because we speak of Logical Empiricism—I dropped the term altogether.’35 By contrast he seemed content to use the word ‘language’ in a rather loose way, possibly expanding its definition, without fear of creating confusion.

Meredith claimed that ‘visual language’ is ‘a richer and more powerful medium of expression than verbal language’—Neurath disagreed:

... you want to present our Isotype or Visual Education in general as something ‘theoretically’ better evolved than something else in the field of verbal presentation. I cannot see that. But I think you have the desire to give the Visual Education business some ‘higher’ marks than it deserves. You see such over-statements may induce people to reply and then we shall be in a bad position, because we cannot show how fine Visual Education is in supporting theoretical analysis—it is not.36

Neurath also objected to Meredith misrepresenting one of Neurath’s ideas by stating that ‘visual expression’ is ‘multi-dimensional’.37

... you write, that Visual Education by means of its more dimensions is better adapted to the more dimensions of modern thinking. I said just the opposite. The visualization is based on three or two dimensions, that is sometimes an advantage from the viewpoint of impressiveness, compared with the writing appearance of one dimension.

But, scientific reasoning needs an indefinite number of dimensions, this is just given by our writing, but not by visualization. The presentation is more impressive but is relatively poor, poorer than our language, and that is, I think one fair reason, why some people subconsciously and consciously are against visualization, I myself have this serious criticism.38

After Otto Neurath’s death Marie Neurath continued to warn Meredith about being too theoretical (he appears to have been constructing an analytical framework called ‘semagraphics’):
I will tell you why I cannot see how your approach could help me any further. I cannot see how you can show, by making your structure in the epistemic space, whether a lesson or a chart or a chapter is good or bad educationally. It is the same with your semagraphics as far as I understand it. It seems to me that you can find a place for any type of representation, whether good or bad or senseless. Why then the whole trouble? Don’t you want to find out what is good and what bad in visual education? Why not help to develop methods to find this out?

This was what Otto tried to impress on you during the last long talk wasn’t it?39

The Neuraths’ priority was creating graphic material, not primarily analysing it. Their concern was a practical one—to design visual material that conveyed information clearly, and they were interested in research if it helped to show what was effective in practice. Indeed Neurath had approached the influential professor of psychology at the university of Vienna, Karl Bühler, about making some scientific studies with Isotype material.40 He was open to research on the assumptions behind Isotype, commenting to Meredith: ‘I would like to make experiments and research dealing with problems of “icons” and verbal expression. The borderline between word language and picture language is insufficiently analyzed.’

**International system or proprietary technique?**

In *From hieroglyphics to Isotype* Neurath reflected:

The history of hieroglyphics covers a long period, while the history of Isotype as yet covers barely two decades. During this short time it has become somewhat stabilized and is now only changing like a language, which also alters and enriches its vocabulary, grammar and style. (104)

But, unlike most languages, it was intended for one-way communication. It was not a language offered for anyone to create statements for themselves. In terms of reading, Isotype should require little or no learning; Neurath hoped that looking at Isotype was not much different than looking at the real world. But creating statements with Isotype was complex and, in his view,
required a certain attitude—essentially that of Logical Empiricism. ‘Isotype is not just the application of symbols [pictograms] to something,’ he remarked to a colleague, ‘it implies a particular attitude, which needs careful treatment before becoming successful.’ He explained to Patrick Meredith that ‘Isotype education is similar to empiricist education and is connected with a certain alteration of attitude, teacher and pupils.’

Neurath gave more details about this ‘attitude’ to R.W. Moore (headmaster of a well-known private school in England named Harrow):

You see our educational tendency is to present problems in a simple way, not by transforming verbal generalizations again, but, as far as possible by presenting descriptive items, from which the reader may infer a generalization. Of course even that has not to be handled in a rigid way.

We try to start from something you can understand as a plain man, without particular education. We think that one may present something of any problem, one can discuss properly, in this way—but not the whole problem. A selection is unavoidable because visual representation is something coarse and primitive.

He summarized this approach to another colleague: ‘The point is: in Isotype we avoid “analogies”, we try to present either concrete factual items or symbolic relations.’

The application of Isotype to consistent design and production of graphic information is accurately reflected by Neurath’s description of it as a ‘language-like technique’. It could be argued that it was a proprietary technique, due to the fact that it was never fully systematized, or even fully articulated. Neurath suggested that there was a secret ingredient in Isotype already during the Vienna period:

For it is clear that the ‘Vienna Method’ is, unlike the usual graphic methods, not a machine into which one throws sequences of figures in order to get quantitative pictures. The ‘Vienna Method’ requires creative [gestaltende], educational work.

Marie Neurath described the work of design in Isotype (‘transformation’) as requiring ‘educational tact’ [pädagogischen Takt].

During the last years of his life Otto Neurath recognized that the Isotype method remained somewhat elusive:
Up to now there is no Isotype curriculum in existence which would enable people to learn this new technique properly from the start. It is more or less routine work, based on a great many rules, the application of which depends upon a highly skilled judgement.48

But he did not accept others freely adapting Isotype principles. There was a right way to do it, in his view, which was partly covert: he insisted that any prospective Isotype ‘transformers’ should be trained only at the Isotype Institute. Neurath explained this to his son, Paul, who began to teach the visualization of statistics in the USA during the early 1940s:

We devoted many years to Visual Education. Sometimes we thought, perhaps one could make the subject teachable in a simple way, but after experience and research we discovered that only a team of highly skilled people are able to make transformations and to create charts and models composed of standardized elements. Long training is needed, years.

He reiterated the point that he had made about the Vienna Method:

We discovered that one cannot make automatically Isotype charts, as one cannot make automatically musical compositions, or architecture or something else, in spite of the fact, that there are rules which regulate the conventions.49

When discussing the same issues with Meredith, Neurath added that the matter ‘touches many principles of the transfer of abilities and skill’.50 He saw Isotype chart-making as a craft that could only be learned by apprenticeship.

Otto and Paul Neurath had a strong disagreement with each other about the propriety of Isotype—and their discussion of the matter is informative with regard to Isotype not being an easily teachable system. Otto Neurath criticized his son for pretending to teach a subject without sufficient experience of it; his disapproval was partly linked with his dislike of the adaptation made of Isotype in America by Neurath’s former colleague Rudolf Modley. Paul Neurath showed a page from Modley’s book How to use pictorial statistics (1937) to his students because Otto Neurath himself had not written a book on ‘how to make’ Isotype charts (International picture language is too full of equivocation to be such a book). His father explained to him the differences between conventional, schematic visualization and Isotype:
Visualization by means of geometrical devices is a work, which skilled people can learn, but visualization by means of Isotype is something wholly different, because here the educational decision enters the field. To present something impressively, implies dropping something, making rough figures instead of exact figures, but not in a systematized way, but from case to case. A technique of presentation very useful today may be not useful tomorrow … the mankind chart [fig. 11] very good as long as you get the three rows—fine. If alterations appear, perhaps the arrangement should be changed … And
that is something startling for many people. The substitution of bars by rows of puppets becomes boring and if you want to be exact you are destroying the effect of Isotype. To explain these finesses needs an intense analysis—even if one devotes only three hours to the presentation of the results.\(^{52}\)

A balance of unity with variety was essential to Isotype, in Otto Neurath’s opinion, as he explained to Meredith:

we always fear that the vivid and imaginative element of Isotype could be too much pedantically framed and transformed into a kind of litany … The combination of a unified language with a multiplicity of striking expressions, that is the secret of the Isotype habit.\(^{53}\)

Variety was important in making each chart as individual as possible within the limits of Isotype because memorability was central to its educational aims. During the period of the Vienna Circle’s linguistic debates, Neurath wrote with polemical overstatement: ‘In language nothing but order is essential, and that is already represented by a sequence of signs in Morse code.’\(^{54}\) It is clear, however, that while he may have considered order the only essential aspect of language, he did not consider it the only desirable feature. This applied to ‘picture language’ too:

Isotype ‘writing’ is like writing a novel in any language. It is not sufficient—as everybody realizes—to know the words and the grammar; one also has to know how to select combinations of words to produce a striking result.\(^{55}\)

He developed this point in correspondence with a colleague:

I myself stress the point, that Isotype is mainly a technique of educational style and a highly complicated grammar. The elements are stable, but the wit is in the arrangement, like Shakespeare is in the arrangement not in the dictionary of our English language. Isotype is the name of this technique executed by a team of highly skilled people. … I should not speak of ‘perfection’. The Isotype stock will be enriched, never finished …

Here Neurath added two further important observations: that Isotype should be open ended—an accumulative, encyclopedic enterprise; and that it
was a collaborative process of design and craft, not a fully theorizable system. All the skills involved—from analysing data to sketching graphic configurations, to cutting out pictograms and sticking them down as part of the final artwork—were important and had their place.

But the fulcrum of Isotype work was ‘transformation’, and it was this creative design work which Neurath deemed difficult to teach. ‘It is hopeless, my dear, to explain Isotype to anybody’, he declared to a colleague, ‘it is important to get the possibility to show it.’ Paul Neurath wrote to his father of the difficulty he had in justifying this approach to his students:

I use[d] to tell them, and this is a pretty verbatim quotation: As to the production of these types of [picture-statistical] graphs there are several opinions. The one held by the originator and main proponent of the method, and author of the books I have shown you, is that nobody can make satisfactory graphs of this type unless he has gone through several years of careful training in the outfit of the author. The method can not be learned from books, not from his own nor anybody else’s. He says so on the basis of about twenty years’ experience. Now I have my doubt in this opinion. [sic] And particularly do have doubt in general in the usefulness of any method, graphical or technical or sociological or anything, that can not be taught in other ways than by the originator in person, and that is therefore practically doomed to die with the author.

This last observation proved to be rather prophetic. Isotype was inextricable from the economic, sociological and scientific preoccupations of Otto & Marie Neurath. When Otto Neurath died, Marie Neurath (as co-director of studies at the Isotype Institute) was able to carry on the work. Indeed, the role of the transformer had developed from Marie Neurath’s work in the Vienna Method, and, after it was renamed Isotype, she remained the only one filling this role. She seems to have found nobody to train as her successor, and consequently Isotype work stopped when she retired. Nobody has since taken it up in the same way.

If the Neuraths had been more open to free adaptation of their method, it would perhaps have spread more widely, but also more thinly, in a diluted form. It may be possible to trace the influence of Isotype in the incorporation of pictograms into international signage—although this is not the primary influence that Neurath would have wished for. When asked if he would grant permission for Isotype pictograms to be used by others, Neurath replied:
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 layouts.59

Naturally, there was an aspect of protecting professional territory here, but it is perhaps this principle—that pictograms were not the whole point of Isotype—which prevented Marie Neurath from pursuing copyright procedures for Isotype pictograms when she was advised to do so after Otto Neurath’s death.

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. As with other modernist ideals (such as orthographic reform, for example), the individual proponents had no political power with which to enforce their proposals. There was some official sanction given to the Vienna Method in the USSR, where the Council of People’s Commissars issued a decree that ‘Dr Neurath’s method of graphic representation of statistics is to be applied in all schools, trade unions, public and cooperative organizations’.60 It is not clear to what extent this was enforced; in any case, Neurath would not have approved of an inflexible order to apply the Vienna Method to all kinds of information.

Neurath was in the same position with Isotype as with Logical Empiricism, or more precisely with the use of physicalist, verbal language: he could not institute them (and indeed did not wish to) but could only lead by example. He may have occasionally overstated his claims in these matters, but Neurath was more aware than most people of the difficulties of instituting reforms on a broad basis. Nevertheless, should Isotype be considered a failure for not achieving the true status of an ‘international picture language’, as Peter Weibel suggested in his paper at the International Wittgenstein Symposium 2010?61 Judging by effective projects such as the ‘Fighting Tuberculosis’ exhibition, seen all over America in the late 1930s, or the civic education programmes in West Africa of the 1950s [see Eric Kindel’s chapter in this volume], Isotype can be considered to have achieved significant practical success.

Should we expect Neurath’s pronouncements on the international validity of Isotype to have been realized to a greater extent than his equally optimistic proposals for alternative forms of economy, or for a socialist order? Isotype was an early move away from ‘mechanical objectivity’ towards ‘trained judgment’ in scientific visualization, to use the terms suggested by Lorraine
Daston and Peter Galison in their fascinating book *Objectivity*. Daston and Galison address the vexed issue of failure:

To contend that mechanical objectivity (or, for that matter, trained judgment) is a fraud and a delusion because it is never realized in purest form is a bit like making the same claim for equality or solidarity. These ethical values can change society without ever being perfectly fulfilled, and the same is true for epistemic virtues in science.\textsuperscript{62}

Thanks to Robin Kinross and Elisabeth Nemeth.
Notes


4. Letter Carnap to Neurath, 12 June 1935 (translation by Marie Neurath; Vienna Circle Archive [VCA], Noord-Hollands Archief, Haarlem, Neurath correspondence 227/8).


8. Neurath recognized the importance of this book, and it made him conscious of his historical place in the Vienna Circle debates. After reading a draft before publication, he remarked to Carnap: ‘I must now make a new place for myself in the world and I have a positive interest in my personal achievement being rather more precisely defined in your book.’ Letter of 8 March 1934 (English translation by the author; Vienna Circle Archive microfilm [VCA-m], Institut Wiener Kreis, University of Vienna). This also reflects Neurath’s preoccupation with making a living at this time; he even wondered about resuming an academic career. Indeed Carnap and Philip Frank made some effort to secure for him a professorship in Prague, but he was rejected on anti-semitic grounds.


11. Letter Neurath to Carnap, 28 December 1934 (VCA-m).


15. Letter Neurath to R.W. Moore, 23 May 1944 (Otto & Marie Neurath Isotype
Collection; Department of Typography & Graphic Communication, University of Reading [henceforth IC] 1/10).

16 *From hieroglyphics to Isotype*, 102.


19 Neurath cited from Thomas E. Uebel’s translation in *Overcoming logical positivism from within*, 74.


22 ‘Pseudorationalism of falsification’ (1935), *Philosophical papers*, 128. Neurath pointed out that Carnap’s view of protocol sentences differed from his own on this point.


25 Neurath [uncredited], ‘Form und Farbe der Mengenbilder des Gesellschafts- und Wirtschaftsmuseums’, *Das Bild* (October 1929), 193.

26 *Bildstatistik nach Wiener Methode in der Schule*, 283; *From hieroglyphics to Isotype*, 103–4.

27 From two slightly variant translations of ‘Wege der wissenschaftlichen Weltauf- fassung’ (1930): the first paragraph is taken from *Empiricism and sociology*, 82; and the second from *Philosophical papers*, 46.


Richardson (Minneapolis: University of Minnesota Press, 2003), 197–215.

31 The omission of Semiotic[s] and the favouring of Significs was repeated in Neurath’s essay ‘Universal jargon and terminology’.


34 Letter Neurath to Meredith, 15 May 1944 (IC 1/35). Neurath had made a similar point previously in print, warning of the dangers of the ‘hasty postulate’ of ‘complete definiteness’. (Ways of the scientific world-conception, Philosophical papers, 45–6.) His scepticism was echoed fifty years later by the coiner of the phrase ‘the pictorial turn’, W.J.T. Mitchell, in Picture theory: essays on verbal and visual representation (Chicago: University of Chicago Press, 1994): ‘... settled answers of a systematic kind may be impossible. This may well be an introduction to a discipline (the general study of representations) that does not exist and never will.’ (7) Mitchell continues: ‘I am skeptical about the possibility both of transdisciplinary theory and of avoiding “bias” or achieving neutrality in the metalanguages of representation. Although I have great respect for the achievements of semiotics, and draw upon it frequently, I’m convinced that the best terms for describing representations, artistic or otherwise, are to be found in the immanent vernaculars of representational practices themselves.’ (14–15, n. 10)

35 Unsent letter from Neurath to Meredith, 22 January 1944 (IC 1/35). ‘Logic’ is a surprising addition to Neurath’s index verborum prohibitorum, which has been usefully reconstructed by George Reisch in ‘Economist, epistemologist … and censor? Otto Neurath’s index verborum prohibitorum’, Perspectives on Science (vol. 5, no. 3, 1997): 452–80.

36 Letter Neurath to Meredith, 15 May 1944 (IC 1/35). Neurath’s erratic use of commas in English has been corrected here.


38 Unsent letter from Neurath to Meredith, 22 January 1944. Neurath made a similar point in both ‘Visual education’ (320) and From hieroglyphics to Isotype (109), implying that his discussion with Meredith helped him to formulate his position.

39 Letter Marie Neurath to Meredith, 29 July 1946 (IC 1/35).

40 Letter Neurath to Bühler, 5 September 1937 (VCA-m). Neurath also discussed funding with the Carnegie Foundation (New York) to publish a book based on tests made with Isotype material. (Letter Neurath to Charles Morris, 6 January 1937; VCA-m.)
Letter Neurath to H.E. Kleinschmidt, 8 July 1945 (IC 1/46).

Letter Neurath to Meredith, 27 December 1944 (IC 1/10). Moore had mentioned reservations about Isotype in a lecture at the Royal Society, London.

‘Bildstatistik nach Wiener Methode’ (1931), Gesammelte bildpädagogische Schriften, 185.


From hieroglyphics to Isotype, 102.

Letter Otto to Paul Neurath, 27 February 1944 (Nachlaß Otto & Marie Neurath, Österreichische Nationalbibliothek [henceforth ÖNB]).

Letter Neurath to Meredith, 24 October 1941 (IC 1/35). See also ‘Visual education’, 319.

‘Bildstatistik nach Wiener Methode’ (1931), Gesammelte bildpädagogische Schriften, 184.

Letter Otto to Paul Neurath, 15 October 1945 (ÖNB).

Letter Neurath to Meredith, 27 January 1941 (IC 1/35).

‘Sociology in the framework of physicalism’ (1931), Philosophical papers, 62.

From hieroglyphics to Isotype, 102.

Undated letter Neurath to H.E. Kleinschmidt [1945] (IC 1/46).


Letter Paul to Otto Neurath, 21 December 1945 (ÖNB). (This was the day before Otto Neurath died, so he did not receive the letter.) The occasionally emotional content of this letter reveals that there were deeper, personal aspects to the disagreement between father and son, which are beyond the scope of this paper.

Letter Neurath to Mr James (Calcium Chloride Association, Detroit), 26 November 1941 (IC 1/4).


Weibel, ‘Bildsprache und wissenschaftliche Visualisierung’, ALWS Kirchberg, 10 August 2010. Weibel contended further that Neurath did not grasp the ‘digital
revolution’—but the digital revolution occurred long after Neurath’s death. Should Johann Gutenberg be similarly criticized, despite the benefits that printing with movable type has brought us for more than half a millennium?

62 *Objectivity* (New York: Zone books, 2007), 377. Daston & Galison’s description of the expert with trained judgment corresponds precisely to the Isotype transformer: ‘The expert (unlike the sage) can be trained and (unlike the machine) is expected to learn—to read, to interpret, to draw salient, significant structures from the morass of uninteresting artifact and background.’ (328). There are some intriguing parallels between the historical, visual material examined by Daston & Galison and Neurath’s own selection in *From hieroglyphics to Isotype*.

Unless otherwise stated in captions, all images are taken from the Otto & Marie Neurath Isotype Collection; Department of Typography & Graphic Communication, University of Reading, UK.

This essay stems from research carried out for the project ‘Isotype revisited’, funded by the Arts & Humanities Research Council and conducted at the Department of Typography & Graphic Communication, University of Reading, UK.
I have heard with great interest about the latest developments in relativity theory which can be traced to your conception that gravity as a function depends on the total distribution of mass and remains constant toward certain transformations (for example, rotation). It was this idea in your Mechanics which has never left me since my first reading, and has influenced my own intellectual development and by indirect paths even economics itself. It was your tendency to derive the meaning of particulars from the whole rather than the meaning of the whole from a summation of the particulars, which has been so important. It is in value theory in particular that these impulses have benefited me through indirect paths.¹

These lines are taken from an undated letter from the front which Otto Neurath wrote to Ernst Mach, probably in 1915. Although serving as an officer in Galicia at the time, he was evidently resolved not to lose sight of his scientific career as an economist and, indeed, to advance it as far as possible. It was probably not long after writing this letter that he suggested to the War Ministry that a research post be set up and commissioned to document the experiences of the war economy for subsequent research work. The Ministry took up the proposal and put Neurath in charge of the post.²

In 1917 he obtained his habilitation in political economy at the University of Heidelberg, thereby establishing himself as an expert on ‘state-run economic systems’, as the title of his habilitation lecture: economy in kind, war economy, planned economy. This specialisation was certainly in keeping with his work before the war, albeit with an emphasis due primarily to developments during the war. Indeed prior to 1914 Neurath’s studies of the theory of war economy was only one facet of a complete scientific œuvre remark-
able for its extraordinary breadth. It ranged from works on the sociology of religion in the Balkan states to banking and finance under the Monarchy, the impact of state interventions on pricing, and the history of optics, without forgetting philosophy. For Neurath, at the core of it all was nothing less than a new theoretical foundation of economics that would make it possible to bring together, in a fruitful way, the two main adversaries of the time: the historical school of national economy, with its empirical orientation and its view of national economies as entities on the one hand, and the Austrian school with its mathematical methods and its emphasis on the individual appreciation of commodities as the basis of the value theory on the other. In his letter to Mach Neurath alludes to this highly ambitious project, a project on which he had already begun to elaborate around 1910 in a number of writings on the theory of social sciences and the value theory, and which he had also presented in his contributions to the debates on methods and values at the Social Policy Association.

It will suffice, for our purposes, to sketch out Neurath’s project in a few broad outlines. Given that his economic theories were long considered absolutely abstruse and that, to this day, his terminology requires a degree of familiarisation, it should be said that his economic approaches have proved more robust—to use a contemporary buzzword—than could ever have been thought. Since the 1990s they have been the subject of serious consideration in ecological economics; his contributions have also re-emerged in welfare and development economics and are now being discussed again in the context of Amartya Sen’s capability approach.

In one of his most important essays on the value theory, Neurath advocated adopting ‘wealth’ as the subject matter of national economy, thus reviving a tradition that stretches from Aristotle to Adam Smith. Neurath believed that in spite of its venerable roots it was a tradition that had virtually disappeared from modern theory, to his mind quite wrongly.

In referring to wealth as the subject matter of national economy we are concurring with an ancient tradition. By wealth we mean the totality of pleasure and displeasure to be found in individuals and groups of individuals. The term pleasure, according to our usage, has the advantage of embracing both complex and primitive facts simultaneously.
In Neurath’s view, the fact that economists have concentrated on the logic of exchange circumstances under market conditions, as represented in the unity of money, has all too narrowed the economic view. He felt that the price theory was often treated as if prices were an accurate representation of wealth. Admittedly, there are also ideological reasons for this constricted view: ‘The classical school of economics has examined one unique form of such systems of organisation, free competition, and it has praised it just like the mercantilists praised theirs.’ But according to Neurath, the influence of an anachronistic science ideal was more important for such a restriction. And while such an ideal—the mechanistic—had long since been overcome in the natural sciences, it was very much alive and well in monetary and price theory. It re-emerges here as the ideal of the calculability of economic value with the aid of a single unit.

When Neurath defines wealth as the ‘totality of pleasure and displeasure to be found in individuals and groups of individuals’, it is not because he wishes to introduce a unit of measurement other than the monetary. Rather, he proposes a terminology that prevents us from looking for a unit in the first place that might serve as the basis for calculating the welfare of individuals or groups. Neurath justifies the terminological decision in favour of ‘pleasure’ with the fact that the term ‘in our usage embraces both complex and primitive facts to an equal degree’. The expression does not readily suggest that we search for an element that might serve as a unit of measurement for the whole. Accordingly, in Neurath’s wealth theory, ‘pleasure’ and ‘displeasure’ include elements as different as: the pleasure and displeasure afforded us by good/bad food; living conditions; clothing; good or bad working conditions; access to education or exclusion from it; but also the enjoyment to be gained from a professional or leisure activity; satisfaction through social recognition; access to culture such as theatre, music and museums; involvement in public life; etc. From 1917 Neurath refers to this constellation of different elements as the ‘life circumstance’, and it is with this conceptual understanding that his approach is now once again being discussed.

As Neurath says, the approach aimed at conceiving of wealth as composed of fundamentally different types of elements is based on a decision. It consists in introducing ‘wealth as a comparable quantity, albeit one that is not measurable’. Even under this prerequisite the wealth of individuals and groups can be studied accurately, according to Neurath. True, we need to use more developed mathematical models than a calculus which captures a complex by reducing
its elements to a unit of measurement. According to Neurath, it is the modern methods of relational calculus that will enable economists to compare systematically different constellations of dissimilar elements of wealth.

Neurath was aware that this comparative approach poses immense problems of methodology. And he realised that the question of selecting the right methods for assessing these heterogeneous constellations was of the utmost methodological importance. So what were in his view, in 1911, suitable means for representing and systematically comparing such heterogeneous constellations: curves? formulæ? tables? In Neurath’s view neither curves nor formulæ are suitable for grasping the problems that are involved here. For Neurath, geometric representations are often detrimental to scientific analyses: because of them, one ‘all too easily transfers to the substrate characteristics that pertain to the geometric figures rather than to the substrate which they represent’. He added that geometric representation easily leads to ‘using simple curves and to neglect cases that might for instance require isolated dots for the representation’. They were also an invitation ‘to formulate all problems in such a way that only two or at most three variables occur in each case’.

Neurath was also of the view that efforts to express observed connections using formulæ can easily be misleading. Indeed, ‘formulæ are particularly apposite in cases where one approximately knows the nature of a connection, even if its details are unknown.’ And in the area Neurath is concerned with, that is precisely not the case. He is therefore in favour of using the much older table form. Why?—Because tables allow us first of all to describe complexes that are still unknown to us. Even in cases where a great deal remains undetermined, they allow us to achieve clarity and to monitor simultaneous changes of entire constellations. […] In investigations such as those practice demands, one is required to look into complexes that are entirely unknown to one and which one must first describe. The table form makes it possible to follow separately the variations of each individual combination in a clearly structured way. […] Tabular representation allows random indeterminacy; gaps can be noted; etc. In such indeterminate cases geometric representation fails completely as one cannot very well draw an ‘indeterminate’ curve that may prove to be a series of isolated points. If one renders the theoretical representation and the concrete description in table form, one has the great advantage that one can carry out all the transitions from the most general to the most specific analyses in an analogue form.
The two terms ‘describe’ and ‘variation’ are key concepts in Ernst Mach’s epistemology, and it is no coincidence that they should occur at precisely this point in Neurath. Let us remind ourselves of the letter to Ernst Mach mentioned at the outset, a letter in which Neurath links his ideas in the field of economics with Mach’s *The Science of Mechanics*. At this point I would like to say a few words—very briefly—about Mach.¹⁵ In his *Science of Mechanics*—indeed in precisely the place to which Neurath alluded in his letter with his reference to the theory of relativity—Ernst Mach suspended, as it were, the classic formula of the law of inertia because he believed that the nature of the connection as formulated by the law had to be rethought. His famous studies of Newton’s terminology (in particular the way in which Newton introduced the concept of absolute space and absolute time) ultimately led Mach to propose a new formulation in which gravitation appears as a function of the entire mass distribution of the universe. In this critical reconstruction of key elements of Newtonian physics Mach himself saw only one example of something far more general. Something he did not tire of highlighting as an essential—perhaps even the essential—momentum of scientific progress: namely the dissolution of concepts which, to contemporary research, appear as established once and for all. Mach believed that it had to be shown time and time again that even the most firmly established concepts were merely auxiliary constructs that served to do nothing other than give a provisional account of relations extant between our experiences. And while such auxiliary constructs cannot be dispensed with—whether in our everyday lives or in science—we do tend to forget that we were the ones who introduced our concepts—as auxiliary constructs that help to give an account of the relations between our experiences. Lest we forget this, Mach demands that we should also keep dissolving the most firmly established concepts and formulæ (particularly those) so that we do not perceive them as something independent of ourselves and allow them to become obstacles to our knowledge.

That is precisely the context in which Mach sees research into the history of science as an essential part of natural science itself. And it is also the context in which he explains what his theory of elements is about. No researcher, says Mach, can detach himself from historical developments; he always builds on findings already acquired, correcting them here and there, following them up elsewhere, and ‘also adding his own errors, often unnoticed, to those of his predecessors and contemporaries’.¹⁶ Such errors are due not least to the fact that ‘it was very much a matter of chance, of practical need, of earlier inves-
tigations, as to which elements emerged as the more important, which ones received the attention, and which ones remained unheeded. We cannot undo the path, writes Mach, the attention of past researchers has taken in history, nor would it be desirable to do so. For even if we were to succeed in returning to ‘the entirely naive standpoint’, it would offer the advantage of unconditionality, but also its disadvantage: namely ‘the confusion resulting from the complication of the task and the impossibility of beginning an investigation’. The steps backwards into the past which Mach has in mind are of a different type. They should not lead us to a primitive standpoint, but to something which Mach calls ‘artificial naivety’. A resolution into Machian ‘elements’ is conceivable only from the starting point of a high level of scientific thinking:

So if today we appear to return to a primitive standpoint in order to conduct anew the research by better routes, it is an artificial naivety that does not surrender the advantages gained over a long cultural journey, but on the contrary uses insights which presuppose a fairly high level of physical, physiological and psychological thinking. It is only on such a level that a resolution in ‘elements’ is conceivable. It is about a return to the starting points of research with the deeper and richer insight brought about precisely by the research that went before.

It is my contention that, with his extremely broad definition of the wealth of individuals and groups, Neurath was seeking to adopt such a standpoint of ‘artificial naivety’ for the field of economics. By using different, non-mutually derivable elements as determinations of the phenomenon of wealth (and poverty), he introduced to economics an approach analogous to that of Mach in the fields of physics, physiology and psychology. Mach stressed the fact that—contrary to a common misconception—his theory of elements was not about finding some ultimate units which definitively could not be broken down any further. Rather, it was a matter of starting from complex findings and breaking them down into ‘elements that cannot currently be broken down any further’. The elements repeatedly listed by Mach by way of example—‘colours, tones, pressures, heat, odours, spaces, times, etc.’—clearly show that he meant largely to invalidate the traditional classifications for physical, physiological and psychological objects. It is not for nothing that most philosophers regarded Mach’s elements as nothing other than a mishmash from which they
turned away in disgust. Neurath did not fare much better with his wealth elements: they are just as confusingly heterogeneous as Mach’s elements.

It is important to see that, for Mach and Neurath, the willingness to adopt such an artificially naïve approach represents an essential moment in the scientific attitude. The value of that approach is not motivated morally (e. g. as a virtue of personal modesty), but epistemologically: the scientist needs such an approach if he (or she) is not to succumb to the seductive power of extant concepts.21

The key link with Neurath’s ‘Visual Education’ is precisely here. In a lengthy text written in the last few years of his life titled ‘Visual Education. Humanization versus Popularisation’ (published in 1995) Neurath differentiated what picture language was meant to achieve from what he referred to as the ‘popularisation’ of knowledge:

Generally speaking, on an average, books destined for children and the man in the street […] try to simplify the highest level of scientific formulation, presented in scientific books. Sometimes writers think that a translation of well-selected terms into popular terms is sufficient, whereas it is common knowledge that the insufficiency of these terms was the main reason for the introduction of scientific terms. This kind of translating from the complicated to the simple, from top to bottom, as it were, we shall call Popularisation of knowledge.22

Let us focus on what, from Neurath’s point of view, is problematic about popularisation. According to Neurath, the main reason for introducing scientific terms was that everyday language often proved inadequate when it came to formulating certain complex issues and their connections as precisely as scientists require. The popularisation that seeks to dumb down, as it were, the artificial language of science must therefore be misleading. So when Neurath speaks out against the top-down strategy of popularisation in favour of a bottom-up strategy and refers to it as the ‘humanisation’ of knowledge, it would be a mistake to consider everyday language as such as the starting point (i. e. the ‘bottom’). The terms used in both scientific and everyday language mislead us towards the uncontrolled use of terms handed down to us. In both cases the strategy of choice—for both Neurath and Mach—is ‘artificial naivety’, which is deliberately aimed at perceiving our terms as sets of heterogeneous elements whose relations to one another we need to describe.
There are many people who become uneasy when confronted with a general term like ‘magnetism’ but who would not be irritated by a heading like ‘magnetic and magnets and iron’. Why should we not start with the pupil’s own realm and his own tools for expression and analysis? ‘Electricity’ is not a term to be used at a lower stage. By speaking of some piece of glass being ‘electric’ if it behaves in a certain way, and of such simple observation-statements, one avoids the misleading questions ‘what is electricity’, ‘what is gravity’, ‘what is life’? If we speak of living bodies when they behave in a certain way, we can go on to describe a virus, which is sometimes crystallised, sometimes propagating etc.23

Let us now turn to Neurath’s pictograms. They have been somewhat rediscovered and reappreciated in recent years.24 I would like to begin my thoughts on Neurath’s picture language with a passage which occurs several times in Neurath’s writings and which has often been cited in recent years. In my opinion it has been thoroughly misunderstood time and time again. According to Neurath, it is important for the ‘teaching-picture’ that it is created according to the following method: ‘At the first look you see the most important points, at the second, the less important points, at the third, the details, at the fourth, nothing more—if you see more, the teaching-picture is bad.’25

The misunderstanding about this passage, which I intend to repudiate in the following, consists in assuming that the criterion of a successful visualisation according to Neurath lies in the speed with which its content can be grasped. From that point of view one would have to deduce from Neurath’s remarks quoted above that the—perhaps unattainable—ideal case would be one where the visualised contents are grasped instantly, i.e. at a glance. The second and third glance would be nothing other than necessary evils, to be minimised of course; and in the case of a particularly successful visualisation they might not even be necessary. Frank Hartmann appears to be saying precisely that when, following the quotation, he explicitly writes: ‘A statement has to be recognisable at first glance.’26 And by way of example Hartmann cites a passer-by who also comes up in Neurath: he has little time and is able, en passant as it were, ‘to roughly take in the information in passing’.

This fictional passer-by is an important indication of where—I believe—the misunderstanding comes from. The pictograms used by Neurath began to take the world by storm in the 1930s, notably as symbols used for orientation purposes in public spaces and in our everyday world (operating instructions).
To this day we live with the ‘talking pictures’ designed for the most part by Gerd Arntz and to the dissemination of which Neurath contributed a great deal in his countless publications. (See picture 1 and picture 2.)

So Neurath accurately recognised the role of these pictures in guidance systems for public spaces and assessed their future significance quite correctly. That includes presenting information so that it can be grasped as quickly as possible. However this function must not be confused with the method’s intended purpose, for which Marie Neurath, Otto’s third wife, invented the name Isotype (‘International System of Typographic Picture Education’). The name designates the main methodological principle through which the Vienna method differs from other visualisation methods. It does so by combining the two Greek words ‘isos’ (equal) and ‘typos’ (character). Differences in the size of quantities are to be represented by the juxtaposition of pictorial characters of the same shape and size—rather than by pictorial characters of different sizes. The most famous example from the Vienna period features the long queues of the unemployed (see picture 3). Neurath further illustrated the point of the Vienna Method of Pictorial Statistics (the older name for the ISOTYPE method) by comparing it with examples of poor visualisation (see pictures 4 and 5 overleaf). Similarly analogous references to poor visualisation can also be found in today’s publications on the theory of visualisation (see picture 6).
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Picture 3.

Visual Area and Numerical Measure
Another way to confuse data variation with design variation is to use areas to show one-dimensional data.

Picture 5.

Picture 6.
What is particularly interesting in our context is the way in which Neurath explained the main advantages of the methodological principle in Isotype. Here—in picture 7—Neurath shows us four different ways of visualising quantitative data: squares, circles, rectangles, and groups of figures. In all four cases sets are related to one another, specifically sets 1 and 2, and sets A and B, with A as a subset of 1, and B as a subset of 2. Neurath then strikingly demonstrates that the visualisation method used in each case determines how much the observer finds out about the size ratios. In the first case (the representation using squares) we can only determine the absolute size differences between A and B and between 1 and 2. The circles (example 2) already contain more information: with the help of the segments we can determine quantitatively the ratio of subsets A and B in relation to each of the total sets 1 and 2. Admittedly, the comparison between sets 1 and 2 (between the two circles) is limited to ascertaining an absolute difference in size. If we now consider the rectangles consisting of units (example 3), we can also work out for the first time the quantitative relation between set 1 and set 2. Finally the fourth case (groups of figures) is different from the others. Here it is not about the information on the set ratios being more abundant. The benefit is on another level, namely the memory level: we directly perceive which objects are involved and are therefore also better able to remember what objects were involved.
So a key aspect is that Neurath’s visualisation method is not about representing a statement in such a way that it can be perceived at a single glance. Indeed, Neurath constructs his charts in such a way that it is impossible to grasp what they have to say at one glance. That is probably also the reason why the Isotype method is virtually never used in today’s newspapers and why pie charts dominate instead. This phenomenon is not down to the fact that the Isotype method has been forgotten. The graphic artists of today’s Austrian Social and Economic Museum were specifically told by journalists that the Isotype method was too complicated for today’s readers.\(^{28}\) They would need too much time and too much attention to understand an Isotype graphic. It should be noted that Neurath was well aware that reading his pictograms required a degree of practice.—So what, then, is the advantage of the whole thing if it is not to provide people with information that can be grasped at a single glance?

Let us remind ourselves of Neurath’s project for a renewed economic theory. He was looking for a method that would be capable of describing the life circumstance of an individual or population as the embodiment of quite disparate elements. Neurath was already advocating that size ratios should not be calculated in figures but represented symbolically instead. In his extensive critique of Wundt’s *Logik* from 1910 he wrote:

> Even Wundt, who after all does also consider exact logic and the parts of mathematics that do not deal with measurable quantities, does not indicate that the method of symbolic-exact representation and that of quantitative-exact representation do not have to coincide at all.\(^{29}\)

Indeed, with the aid of symbols, it would be possible to compare heterogeneous entities precisely with one another without having to reduce their components to a uniform standard. Neurath made clear at the time what he had in mind by referring to the way in which pictures are compared.

> One cannot compare two states by comparing them bit by bit, say first the constitution, then the climate etc.; each of them has to be comprehended as a whole. After all, neither can we compare pictures in this way, nor can we do this with respect to machines. The very idea of a calculus, however, consists of deriving a complex from the individual elements.\(^{30}\)
Pictorial statistics provide a much clearer idea of what Neurath had in mind in this early text. For the comparisons that mattered to him to be carried out, the ‘pictures’ of the states that are to be compared have to be structured in a particular way. If we choose the first visualisation method (using squares), our judgements will have to be limited to form ‘A is larger than …’. To achieve greater precision, we would have to make a separate calculation. In this particular example that would be very easy to do (measure the sides of the squares, and calculate their surface areas and the difference between them). The calculation would end in a precise figure, namely the difference in surface area in mm². The precision is, of course, obtained using a method that replaces our visually guided comparative judgement. In more complicated cases the calculation would have to be made by an expert, aided perhaps by a computer.

By contrast the visualisation method which Neurath advocated is based on an approach in which the added precision is achieved in quite a different way, namely by comparing back and forth between two constellations of elements. The contrasted constellations trigger certain activities in the observer: ‘considerations’ in which she constructs the comparison herself. What is important to note here is that the pictorial representation conceived by Neurath cannot by any means replace the language of words. On the contrary. It is only in the case of the visualisation method he rejected (in the case of squares or of pictures of different size) that we can grasp what the comparison says directly, as it were, without language, at a glance: larger—smaller. By contrast the Isotype pictures are constructed discursively. We cannot grasp what they represent through immediate ‘intuition’ (using a philosophical expression of long tradition), but only by ‘going back and forth’ and gradually uncovering what the comparison is about. This is shown very nicely in the chart on the automobile industry. (Picture 8)

Here we see at first glance that many more cars are manufactured in North and South America than in Europe. In a next step—by adding up how many people work in each car industry—we see that eleven times more cars are manufactured per worker in America than in Europe. And in a third step we find out how this enormous difference comes about: behind the workers in America we can make out the conveyor belt. So again: without putting what we see into words, we will not grasp what is represented in the pictures. But we can and must find our own words for that—ideally in discussions and conversations about what is shown, such as those which, according to Neurath, were often to
be observed at the Social and Economic Museum. Neurath made many interesting observations about the educational implications of this experience and their significance in terms of democratic policy. But we cannot go into them here.

Here it is first and foremost a matter of understanding the Isotype method as an intellectual tool designed to make observers of the pictorial statistic charts perceive societies from a particular point of view: as collections of different elements of individual pleasure and displeasure, of life opportunities and restrictions that can be unevenly distributed within a group of individuals. The charts draw our attention to the fact that the distribution depends on factors that concern the whole of a population, a nation, a group, etc. However, the visualisation is structured in such a way that the individuals do not disappear within the whole to which they belong. On the contrary the observer has no option but to reconstruct a social whole, in each step of his comparison, as heterogeneous totalities of individual life circumstances. Through this means of visually guided judgement we experience the fact that what we see as the well-being of individuals and groups can vary sharply in scope and content depending on the point of view from which we consider them. And also that a great deal depends on the work and the imagination of those who seek to make societal facts visible. What those facts are will depend on which aspects of human life—and how many—they include in
their observation, and what influencing factors they are seeking to address as a topic.\textsuperscript{32} In this process of visualisation of social facts it is by no means just social scientists, statisticians and graphic artists who are called upon. Observers, too, who are prepared to engage with the charts of pictorial statistics, so to speak as readers, will realise that deciphering the charts entails work and that the work involved frees up the imagination. If the charts are well made, they capture only a few aspects of a population’s life circumstance and represent them in several constellations. Good pictorial statistics, according to Neurath, are limited to correlating a clearly demarcated set of contents for the purposes of mutual comparison.\textsuperscript{33} And it is precisely because the Isotype representation limits itself to representing only a few clearly defined data in correlation that it gives the observer something to think about. Here science does not emerge as the authoritative body that issues explanations and demands from non-scientists that they follow the explanations.

The question of which causes are responsible for the differences between the compared constellations is suggested whenever an Isotype chart is considered. In many cases it can be regarded as the key point of the entire comparison and fully imposes itself on the observer. Of course it is striking that, within the charts, the question of causal relationships is only rarely posited and answered explicitly – one of the examples in which this does happen is the conveyor belt at a car manufacturing plant (see picture 8). While in some charts the question of the causes does impose itself, it cannot be answered from the chart itself (e. g. the cycles of unemployment in picture 3). Some charts juxtapose size ratios where the question of a cause

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{picture_9.png}
\caption{Picture 9.}
\end{figure}
barely seems relevant (e.g. the case of housing density in cities, picture 9); in others a dependence between sizes becomes visible for which a causal interpretation seems irrefutable (e.g. the chart on ‘Home and factory weaving in England’, picture 10). The fact that the representation using pictorial statistics usually leaves unanswered the way in which the dependency between the represented sizes is to be interpreted is anything but a coincidence or an omission. Rather, Neurath is following an agenda inspired once again by Ernst Mach: Mach believed that the concept of cause was an anthropomorphism that ought best to be eliminated from science altogether. Likewise the notion of the unity of science is one which Neurath borrowed directly from Mach. As Neurath wrote in 1945: ‘The educational background for Visual Education is that of Unified Science. The Unity of Science Movement is really concerned with a common terminology and with replacing e.g. a ‘cause-effect’ terminology by a ‘grow-out-of’ terminology’. It is perhaps worth mentioning that a line could be reconstructed here, leading from Ernst Mach to Neurath to today’s widespread theories of ‘emergence’.

Sometimes though, as in the chart on ‘infant mortality in Vienna’ (picture 11), our attention is actually drawn to a whole range of factors that has an impact on the level, composition and distribution of well-being within a population. But even in this case it is not about naming an individual cause for
the distributions and the way in which they change. We are dealing here with a comparison in two dimensions: between the periods 1901 to 1905 and 1925 to 1929, and also between two municipal districts of Vienna. Each of the four pictures shows 20 babies, with several of them obscured by small coffins. They symbolise the children who died before reaching their first birthday. We see at first glance that, overall, the number of small coffins in the 1920s is dramatically smaller than at the beginning of the century: infant mortality fell by more than half in 20 years—a remarkable success story. We can imagine how the visitors at the Social and Economic Museum might have paused for thought and then wondered: what brought about this dramatic improvement? Hygiene measures, medicine, better nutrition? So while the picture raises the questions of the factors involved, it does not answer them. It focuses the attention on the second dimension of the comparison: the differences between the ‘more affluent’ and the ‘poorer’ districts of Vienna. Expressed in absolute figures, the drop in child mortality is the same in both districts: in both districts there are two small coffins fewer than in the years 1901–1905.

Of course for the wealthier 7th district that means a reduction of two thirds; for the poorer 16th district a reduction of only half. In the 1920s child mortality in the working-class district of Ottakring was still twice as high as in the middle-class district of Josefstadt. So how is it that both districts were able to benefit to such varying degrees from the overall improvement? The picture gives at least an indication of the answer to that question: the apartment in which the babies of the 7th district are shown is one third bigger
and considerably brighter than the one in the 16th district. This refers to the serious housing problem that existed in Vienna between the two World Wars, and the enormous building activity undertaken by the Municipality of Vienna in the 1920s. And yet this pointer can hardly be misunderstood as a monocausal explanation. It draws attention to the ‘institutions and measures’ that can be taken and are indeed taken. Here again we can well imagine the visitors of the Social and Economic Museum wondering and saying to themselves: the larger, airier apartments are one thing—but isn’t medical care just as important? Or setting up nurseries? Maternal health care? and so on and so forth.

In a genuinely scientific museum it could never be a matter, from Neurath’s point of view, of proclaiming certain answers as the only right answers. He devoted a lifetime to combating ‘pseudorationalism’, which elevates science to the pedestal of a quasi-religious body. Entirely in the tradition of Ernst Mach, Neurath regarded it as the task of science to describe relations between phenomena. And like Mach he was of the opinion that our view of the connections is often obscured by our own traditional concepts. For Mach, science was not just an instrument of enlightenment, but also an ‘enlightening’ activity par excellence. As mentioned earlier, for Mach scientific progress is based on nothing other than the ability and the willingness of researchers to keep seeing through their previous concepts and theories as auxiliary structures.\textsuperscript{35} What for Mach as a natural scientist was the progressive value of science in general had a direct political significance for the sociologist and economist Neurath. For Neurath, introducing a scientific approach in the Machian sense to social theory meant developing an approach that highlights connections that would otherwise remain unnoticed as long as there is talk of the ‘nation’, the ‘people’ or the ‘class’ as a whole. It very much takes these entities into account, but considers them as a group of individuals whose life circumstances are characterised by a set of elements whose distribution depends on political, economic, cultural … measures and institutions. The project of making this artificially naive, scientific approach accessible to as many people as possible using visual education meant nothing other than an attempt to create the social preconditions for a discourse in which the issue of the political shaping of the social order in a rational way figures as a topic.

In one of his last writings Neurath once again emphasised the political dimension of this project. He wrote that visual education was not aimed first and foremost at imparting knowledge, but at passing on a ‘scientific
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attitude’, adding that such an attitude was essential to the further development of democratic societies.

Education is not only the handing on of knowledge, it is also concerned with the ability to analyze observations and to find out something and contemplate all the matter under discussion from all sides. [...] The transfer of looking at more than one possibility, to be prepared to alter statements, is the principle of the scientific attitude. The social pattern, which permits more than one opinion etc. is the ‘democratic pattern’. Part of education deals with the evolution of one’s own judgment, of a ‘scientific attitude’, a quality not restricted to scholars only; there are laymen who have it, and there are scientists who do not have it.36

Notes


3 Uebel 2004 gives an excellent, comprehensive analysis of Neurath’s economic thought.


6 Neurath 1911, reprinted in Neurath 1998, 470–518. Unfortunately this version of the article contains several errors. I therefore decided to use the original text from 1911. All the following quotations from Neurath 1911 were translated by Stephen Grynwasser and Naomi Osorio–Kupferblum.

7 Neurath 1911, 53.

8 Neurath (1910) 2004, 272.

9 Contemporary poverty research speaks of the ‘multi–dimensionality’ of poverty
and wealth (cf. Lessmann 2007a and b), and ecological economics of the ‘incom-
mensurability of values’ (cf. Uebel 2005a, 319 ff.).

10 In italics in the original. Neurath 1911, p. 80.
11 Neurath 1911, 78.
12 Neurath 1911, 79.
13 Neurath 1911, 80.
14 Neurath 1911, 80.
15 I have expounded and substantiated what follows in greater detail in Nemeth
2007.
16 Mach (1905, 1926) 1991, 14, All the following quotations from Mach (1905, 1926)
1991 were translated by Stephen Grynwasser and Naomi Osorio-Kupferblum.
21 Incidentally, there is an affinity here to Bachelard, Foucault and also Bourdieu.
Burke 2009, 2010a, Nemeth forthcoming. I want to draw special attention to the
edition of a manuscript of the late Neurath which has not been published until 2010:
From hieroglyphics to Isotype (see Neurath 2010) and to the excellent introduction by
C. Burke (Burke 2010b). The volume includes the numerous illustrations intended
by Neurath to accompany his text, and is completed by an extensive appendix
showing examples from the rich variety of graphic material that he collected.
26 Hartmann 2002, 49.
27 The example in the figure is taken from Tufte 2001, 69, who by the way makes no
mention whatsoever of Neurath in his other books on the visualisation theory.
28 In a personal discussion following a lecture at the Austrian Museum for Social and
Economic Affairs.
29 Neurath (1910) 2004, 277.
31 For the relationship between holism and individualism in Neurath’s thoughts on
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economics and how it impacts the Isotype method, see Nemeth 2003 and 2006.
32. We should refer here to the strong affinity between Neurath’s project and Martha
Nussbaum’s works in the 1990s. See in particular Nussbaum and Sen, eds., 1993.
Thoughts on this affinity can also be found in Nemeth 2003 and 2006.
33. That is the point in Neurath’s repeated insistence that a picture should not
contain more information than can be grasped in three glances. See the
quotation in note 24.
35. See: Uebel 2000, 93–95.

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**Picture Credits**


In keeping with his principle that ‘metaphysical terms divide, scientific terms unite’ Otto Neurath (1882–1945) wrote in 1931 in the German teacher’s journal \textit{Die Volksschule}:

Finally it should be noted that the picture education, especially the pictorial statistics, are of international importance. Words carry more emotional elements than set pictures, which can be observed by people of different countries, different parties without any protest; Words divide, pictures unite.²

For the primary aim to communicate empirical based observations Neurath believed his method of pictorial statistics to be a useful tool to transmit rational information across barriers of class, culture and education most effectively.

In figure 1 overleaf one sees Otto Neurath, two years before his untimely death in 1945, in front of a statistical chart on the occasion of an exhibition at the London cinema screening of the documentary \textit{The World of Plenty}. The film was produced by British director Paul Rotha in cooperation with Neurath.³ In this film animated statistical charts were extensively used to explain the complex cycle of food production and subsequent distribution by the nutritionist Boyd Orr. In addition to that Neurath’s method was used as a voice-over in the film to help ordinary people to understand the figures behind the statistics. Like in other image-guided displays the pictures here were indeed capable of uniting the spectators, but not of speaking for themselves. Neurath’s method, however, had a discursive element. His statistical
charts were meant to encourage a discussion on the information displayed. Following Neurath’s famous slogan ‘words divide, pictures unite’ I will start with a brief comment on the labelling of his pictorial statistics as language. Yet the main part of my paper will focus on two overlapping historical aspects of his pictorial work in Red Vienna, rooting in his philosophical and educational intentions. To sum up my argument I will use the example of the peoples of the world in his chart collection Society and Economy published in 1930 to show in greater detail how Neurath’s philosophical and pictorial work went hand in hand.

Labelling his system as an International Picture Language as he did in his booklet from 1936\(^4\), when he changed the name of his technique from Vienna Method of Pictorial Statistics into International System of Typographic Picture Education (short Isotype), did not mean that Neurath claimed a general superiority of his system over natural languages.\(^5\) Moreover, he did not want his image-guided displays to communicate through visual tools alone. Isotype was developed as an educational aid and instrument for
teachers to train the spectators to comprehend complex information. It was by no means intended that the spectators would design their own charts. Neurath was aware of the fact, that images are polysemous and need to be complemented by other media to become comprehensible. The design of the charts was a very complex task, because it required a particular expertise.

Isotype was developed closely along the writing system. The pictorial charts include words and numbers as in headings and legends to give precise information about the displayed subject. The symbols themselves were arranged in lines and columns like in writing and charts. Neurath’s pictorial statistics required a structured observation. Isotype was supposed to facilitate a strong empiricist view on the social order. It was primarily intended to appear in various educational contexts, like reading newspapers, school lessons, lecture halls or films as well in exhibitions. At least the first contact with this kind of visual material was monitored by trained teachers, who assisted the audience in absorbing complex information. In books and newspapers the pictorial statistics were explained by the corresponding text. In other situations a voice guided the acquisition of facts.

Seen from the production side one must say that charts were intended to make social reality comprehensible by generating social facts, which were mostly—but not exclusively—based on quantitative information. Neurath’s aim was to give access to expert information and to base public discourses on visual arguments. Isotype was an auxiliary device to observe the social order in a pertinent way. Neurath intended the pictures to unite the audience because the encoding of their visual arguments was supposed to work—generally speaking—regardless of the viewer’s background.

**Flying over the Earth with Bird-like Empiricist Eyes**

As a social engineer Neurath transcended the confusing variety and complexity of the social world. He did not let himself become confused by the chaos of individual impressions, but rather developed a way of observing patterns of social order and behaviour that could signify relevant global changes in time and space. His perspective was bird-like, with the exception that he flew from the North and West to the South and East. Likewise he developed the following thought experiment in explaining how one should view the expansion of worldwide capitalism in 1928:
If one could only fly over the Earth and show everybody, Chinese gardeners live side by side in old fashion. Next to them a capitalist germ cell which puts its feelers out into the country! See the factory chimney smoking! Ships come and go. And in the North, nomads and tribes of hunters who don’t know anything of a capitalist order even though they sell furs to entrepreneurs. A sharpened eye would be able to grasp this. All of this can be grasped and represented in pictures.

The charts show what his sharp empiricist eyes have seen, especially how different elements constitute a social phenomena or how persons, objects and things are linked together, which he claimed to be the only legitimate objects of research in the social sciences published in the Vienna Circle manifesto in 1929 as well in his *Empirische Soziologie* in 1931 and in his writings in picture education.

Neurath’s occupation with pictorial statistics is closely connected to his philosophical work. Thomas Uebel commented that his method contributed to building the foundations of the Scientific World-Conception, but not merely in a one-way direction. Simon Shaffer underlined his argument that during the 20th century the public had a tremendous impact on what was regarded science by referring to the Viennese Museum of Society and Economy as institution that served as an instrument for the Vienna Circle in general and for Neurath in particular to transmit the right image of science to the public, thus fighting metaphysical tendencies as well as irrational and religious belief.

Neurath’s method was intended to fix information in the mode of protocol statements, that is, to register all variations of a phenomenon in time and space. It became the public trademark of a non-disguised application of the scientific attitude to reality. Elisabeth Nemeth has convincingly shown how Neurath in his early foundation of social science was looking for a way to compare heterogeneous entities in a precise way without reducing the subject to one single denotation and how to use the example to compare two pictures to explain his method.

Neurath’s philosophical work and political activities went hand in hand with his occupation with the pictorial statistics (in figure 2, statistical publications among his books and editions are set in bold italics). Neurath designed the Viennese method in line with his Scientific Conception of the World, which he was advocating as a left-winger of the Vienna Circle and the Unity of Science Movement. I agree with Peter Galison and Robert
Leonard, who consider Neurath’s preoccupation with pictorial statistics as
the visual pendant of his philosophical program to renew philosophy on
an empirical and rational basis. The defined rules of his method, like the
simplicity, uniformity and meaningful distinctions of his symbols as well as
his syntax, only allow him to display visual arguments that meet the limit-
ed standards of protocol sentences. Neurath’s pictorial statistics display a
social order in which phenomena were strictly specified through temporal
and local functions. As Neurath said, one would not be able to design picto-
rial statistics according to the Viennese method for meaningless, all-up or
religious statements and beliefs.
A Museum of the Future

The institution that allowed Neurath to develop his method was the Viennese Museum of Society and Economy (fig. 3). This institution and Neurath’s Viennese Method of Pictorial Statistics were specific outcomes of Red Vienna’s housing and settlement movement of the early 1920s (see also figure 2). As general secretary of the Austrian Union of Settlements and Allotment Gardens, Neurath organized an extensive education program, including lectures and courses for settlers as well as very popular public exhibitions on housing, town planning and building techniques.\(^1\) From 1923 on he arranged for the teaching activities of the Union to take place under the roof of the Settlement and Town Planning Museum. It held exhibitions but also functioned as a centre of practical advice for settlers. In 1924 Neurath approached the municipality of Vienna with the idea of expanding this institution and renaming it Museum of Society and Economy in order to be able to organize even larger exhibitions on much broader social and economic issues.

It opened officially in January 1925. Besides a section on Settlement and Town Planning, which was inherited from the earlier institution, it had two new departments: ‘Arbeit und Organisation’ [Labour and Organiza-

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**Fig. 3**

*Advertisement of the Museum of Society and Economy, The Otto and Marie Neurath Isotype Collection* (reprinted by permission of the Department of Typography & Graphic Communication, University of Reading)
tion] and ‘Lebenslage und Kultur’ [Life Circumstances and Culture]. In contrast to the traditional museums of his time, which exhibited numerous unique artefacts and curiosities, Neurath’s museum concept was different and more challenging. It was neither a place where objects were collected for their peculiarity nor a building with exhibition rooms. It was a workshop for the production of didactic material. This material was displayed in a spot, where people had to pass it by on their way to the administrative offices. Since each current permanent exhibition located in the foyer of the New City Hall, people had to pass it by on their way to the administrative offices, thus allowing them to become acquainted with the displayed material in a way that was not as intimidating as a museum might have been. Satellite exhibitions were displayed on the outskirts of Vienna.

He conceptualised his institution as a ‘museum of the future’. It should be organized, he claimed in his article in *Survey Graphic* in 1933, around the presumed interests of the citizen seeking explanations for social and other important issues of the day.

In his workshop he strived to manufacture charts for exhibitions as one might manufacture cars or books in series of identical copies:

> To speak of the museum of the future is like speaking of the automobile of the future. Automobiles are manufactured in series and not produced one by one in a smithy. The idea that every museum ought to contain unique exhibits has come to us from the past. […] It was the same at one time with books: some famous manuscript entered into a collection, a unique treasure; but today, there are ten thousand reproductions of the same manuscript. In the future, museums will be manufactured, exactly as books are today.

For Neurath museums of the future were to be able to manufacture their exhibitions anywhere and publish copies of their artefacts for any media, instead of displaying unique objects. His model of production for the Viennese method was the modular assembly system.

### Representing the World Population via Pictorial Statistics

Looking at one particular example, allows one to better understand how Neurath’s principles were incorporated into his pictorial statistics in collabo-
ration with his colleagues at the Viennese Museum of Society and Economy. Figure 4 is part of the global collection ‘Society and Economy’ including 100 coloured charts showing the distribution of populations, natural resources, economic products as well as social, political and cultural aspects of life in time and space.\(^{18}\)

The result of Neurath’s bird-like flight over the Earth results for instance in a snapshot of the peoples of the world in 1930: showing three main groups, represented in white, yellow and dark colours. One basic figure of a man of the same size, body shape and gender is used because Neurath believed that all humans belong to the same kind. The signs were understood as signatures of objects and phenomena that should be represented. Following his basic principle that nothing seems to be more dangerous than a symbol that tells the observer more than the designer wants to express\(^{19}\), he disapproved of too much detailed realism in the expression, polysemous display or meaningless graphical information. He thus clearly disassociated his visual method from art, where the focus was on individualistic expression. In Neurath’s pictorial statistics all its graphical characteristics were supposed to be exclusively of informational value.\(^{20}\)

In order to take into account the human diversity, he clustered groups of people together by colouring their skin and focusing on hats. The upper row shows the Europeans and their emigrated descendents in white. The second depicts the American Indians in red, Africans in black, and Oriental and Indian people in brown. The lower row, finally, represents the Chinese, Mongols, Japanese and Asians in yellow. In his choice of colours he followed the general tradition in representing human diversity, but avoided the supposedly clear race classifications of his time. He used the more neutral term of ‘population groups’, largely defined in social anthropology.

The figures were structured in series, designating a certain number of people being part of one group on a scale of 100 million people. Neurath’s chart not only portrayed statistics in the picture, but also gave the observer a visual argument regarding the equilibrium between the political and economic leading world of the West and the North (upper row), the colonial world of the South (mean row) and the rising powers of the East (lower row). The pictures were part of Neurath’s colonial political education on the occasion of the International Socialist Workers’ Congress 1928 in Brussels. In the corresponding article Neurath referred to the globalization of capital and the resulting problems for the international working class.\(^{21}\) In showing
Fig. 4  Peoples of the World from Gesellschaft und Wirtschaft (1930), Plate 96
that the world population splits in three groups of almost same size, among them the Chinese who were fewer than expected, he intended to rationalize political discourse by restricting himself to pure observational facts. The big task—as he said in his article—was to persuade the workers from the West (especially in Germany and Austria, who had no first-hand experience with colonialism) that the cattle breeders from the East were neither a danger nor strangers, but came from the same social class, and that workers around the globe should make a united front against the exploitation of worldwide capitalism.

As early as 1926 Neurath had recognized how crucial his visual vocabulary was for the depiction of the international working class by graphical means:

It is difficult to describe workers from different countries in different ways. It is a striking feature of our age that clothing becomes more similar, so that, by a mere glance, it is difficult to distinguish a German from a French or an English worker. The same is the case with the entire population. It is not wise to reach back to the old ideas of past eras and to describe, for example, the Americans as wearing a grey cylinder, a goatee or other strange things, or the Germans as wearing a pointed cap. Modern people are not aware of these differences.²²

Neurath was aware of the fact that for semiotic reasons stereotyping and standardization of his pictures were necessary to make communication across borders possible. The search for cultural independent symbols was obviously not trivial and perpetuating stereotypes. In fact, the representation of the peoples of the world for a pictogram representing human mankind in 1930 was the result of a much longer process and not his final solution at all.²³

‘We could not photograph social objects even if we tried.’

The example also demonstrates how Neurath mediated between a more naturalistic representation, such as used in physical anthropology to represent humans by using photographs, and a more abstract pure schematic depiction through words, numbers or graphs that only experts could decipher. With his pictorial statistics Neurath wanted to achieve the same effect that was already
common practice in, for instance, biology and physics, namely the production of pictures with a camera to which objectivity, authenticity and realism were attributed. In his paper on the museum of the future he justified his method in the following way:

To come to the point, an abstract formula is educationally as useless as is a naturalistic reproduction. What we need is a schematic representation that can be immediately understood. We could not photograph social objects even if we tried. They can be demonstrated only through symbols. It is because this is not an easy task that it has so long remained unfulfilled.²⁴

For epistemological as well as educational reasons, Neurath viewed the existing graphical methods for visualizing statistics as unsuitable. He repeatedly argued that in most of the cases curves and diagrams would misrepresent exactness with regard to social facts that had not been empirically proven.²⁵ Neither were mere abstract representations the solution due to their incomprehensibility for the layman. Especially in Neurath’s own field of expertise, the social sciences, in which the principles of the Vienna Circle were even less accepted, he introduced his pictorial method as prescription to produce facts that were based on observational statements and to make clear-cut statements on heterogeneous entities like populations.²⁶

Neurath’s plan to democratize the global order through the use of Isotype in the communication of anything anywhere failed in its pretentious totality. Like contemporary pictorial systems, they work where people of different cultures need orientation in space, for instance, at the airport or in a refugee camp. Other useful applications are the labelling of consumer goods and instruction manuals. These examples demonstrate how for well-defined purposes image-guided displays can bridge cultural differences and complement the Babylonian confusion caused by everyone speaking his/her own natural language. If we study Neurath’s case in its historical context we see how innovations in pictorial systems were deeply connected with ideas to modernize science and society.
Notes

1 I want to thank Elisabeth Nemeth for inviting me to the Workshop at the Wittgenstein Symposium 2010 in Kirchberg. Preliminary results of this paper were presented at the departmental seminar in the Max Planck Institute for History of Science in Berlin (Dept. III) in November 2009 and at the Panel on ‘Creating a World Population: The Global Transfer of Population-Control Technologies in the Twentieth Century’ of the Historikertag in Berlin in October 2010. I thank the participants of both meetings for helpful comments. For access, help in evaluating and permission to reproduce archival material from the Otto and Marie Neurath collection of the Isotype Institute at the Department of Typography & Graphic Communication, the University of Reading I am indebted to Chris Burke and Eric Kindel. For their help with the translation I thank Birgit Kolboske and Marc Weingart.


5 Otto Neurath, International Picture Language (as in note 4), 373.


17 Otto Neurath, ‘Museums of the Future’, *Survey Graphic* 22 (1933), 9: 458


Otto Neurath: 
Mapping the City as a Social Fact? 

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Introduction

Architects are trained to distinguish between two kinds of maps: representational ones and those that serve as heuristic devices. While representational maps are usually drawn to make observations more accessible to a larger audience, the map as an architectural tool, serves as a device for design thinking. By means of drawing space it makes relationships visible that could not have been conceived without drawing. When deploying such maps, architects pay close attention to the particularities of space, because insight can only be gained when non-spatial observations are put in relationship to a certain terrain. Its synergy generates new content, meaning, knowledge and possible design solutions.

Austrian philosopher and economist Otto Neurath (1882–1945) was famous for his engagement with representational maps. He revolutionized the discipline of chart making by finding a way to create picture statistics and quantitative maps that were accessible to a larger public. In this paper however, I will argue that Otto Neurath’s map City Planning served not only as one of the first well-accessible socio-political maps of a city, but that it was in effect also a heuristic device.

Originally crafted in color, City Planning (fig. 1, overleaf) was edited to appear in red, black and white, accompanying Neurath’s text ‘Visual Representations of Architectural Problems’, in Architectural Record in July 1937.1 The text and the 1937 map were a direct reaction to a similar and in effect more extensive mapping operation pursued by CIAM IV (Congrès Internationaux d’Architecture Moderne, International Congresses of Modern Architecture) in 1933. Nonetheless it was Neurath who first illustrated the socio-political map for urbanism according to graphic rules and with a
graphic vocabulary that possessed a consistent logic and even syntax. In addition, I will explore to which degree Neurath perceived of the city as an agglomeration of social facts and in how far his socio-political map contributed in planning the city on such basis.

In order to create this map, three main fields of expertise came into play. First, Neurath’s specific views on urbanism were different from those of most architects. A second necessary expertise to Neurath’s undertaking was the ability to graphically craft abstracted data—the transformation, which was invented at Neurath’s ‘Museum of Society and Economy’ (Gesellschafts- und Wirtschaftsmuseum). Thirdly, in search of ‘humanizing’ knowledge, Neurath hoped that by making information graphically available, he would enable all people to ‘participate in a common culture’, eliminating ‘the canyon between educated and uneducated people’.2

CIAM however, was a catalyst for creating the 1937 map as well, in that it triggered Neurath’s further research in illustrating the city. When in 1937 his map finally appeared, it marked the culmination of Neurath’s search for simplicity in the context of a spatial discussion. The map was however also the last to ever accompany one of Neurath’s texts on architecture and urbanism and it ended Neurath’s public theorizing of the city, which had lasted for two decades with the exception of the Bilston experiment.3
Rem Koolhaas’s AMO (research unit of OMA, Office for Metropolitan Architecture) is the most prominent architectural think tank promoting the use of the map as tool as well as representational device in a contemporary context. Through their heavy publication activities and their particular architectural wit, AMO has fostered an interest in mapping that is now found in architecture schools all around the world. Although Koolhaas never cited Neurath, some aspects of AMO’s maps are strikingly similar to the ones produced by the Museum of Society and Economy. So when I first decided to assess socio-political mapping and its application to architecture it was precisely to understand this missing piece: how did socio-political mapping in architecture first emerge, which connotations did it possess, which goals did it initially pursue, did Neurath have an influence on the contemporary debate on mapping and if so, how?

**Otto Neurath’s Urbanist Convictions**

The Austrian Settlement and Allotment Garden Association

The first and most fundamental component to the 1937 map *City Planning* was Otto Neurath’s distinct perception of urbanism. To Neurath the Modern city was an economic organism. But unlike many of the Modern figures in architecture that either rationalized city building by economic means, or subordinated the production of city planning to the economy of the industrialized world, Neurath perceived economic strategies as a means to substantiate a lively urbanism. Neurath’s conviction that life in a city could largely benefit from the forces that shaped it, was based on his knowledge of economic relationships.

When Neurath collected images of harbors, grain silos and factories in 1925 for instance, he did not necessarily admire them for their machine aesthetics, as modern architects did at the time. For Neurath, ports, warehouses and elevated railway tracks represented the global industry, in which he believed lie the foundations for a socially improved Modern city.

What does the city of the future look like? Above all, it is shaped by the modern, large scale industries of global trade. The city of the future is characterized by harbors, railway stations, silos, warehouses, factories, sweeping platforms of elevated trains, and ironworks. [...] But how will the residential dwellings be distributed?
Hence, to Neurath the city was an agglomerate of economic relationships and such institutions, and housing maintained a crucial position amongst them. Furthermore, they had to be connected via transportation routes, which he also saw as interwoven with sociological and anthropological components. Cities were spaces where cultural exchange took place, where people met in plazas and in coffee houses, where they demonstrated and went to school, where they were hospitalized, enjoyed a walk in a park, or swam in a public pool. When looking at urban fabric, Neurath saw it as a unity between architecture and organization. And he realized this unified vision between architecture and organization when he became the secretary of the ‘Austrian Settlement and Allotment Garden Association’ (Österreichischer Verein für Siedlungs- und Kleingartenwesen).

During the years of WWI ‘wild settlements’ had emerged on the outskirts of Vienna, when people in search of food and shelter had started to cultivate small gardens and build provisional barracks. The Austrian Settlement and Allotment Garden Association finally came into existence in the early 1920s to unite the 230 dispersed settlement clubs. Neurath’s great achievement was to mend it into an efficient operation while still maintaining the settler’s principle of self-help.

Due to his knowledge in economies and organization, Neurath put a system in place that allowed the large building enterprise the settlement movement had become to be governed by three core agendas: economical, political, and educational ones. In particular these agendas were all shaped around the concepts of ‘communal economy’ (Gemeinwirtschaft) and community (Gemeinschaft). This meant that the settlers where still involved in building their own houses, even when architects designed them, and that each settler kept ‘a piece’ of all communal facilities. In addition, educational material was provided within the association to inform and publicize the achievements of the settlers. Often this included extensive exhibitions and magazines.

In comparison to other housing typologies, later pursued in ‘Red Vienna’, the settlement movement perceived of itself not necessarily as a strictly urban form of living. Houses were rarely higher than two stories—as the chief architect of the Association’s Siedlungsamt, Adolf Loos had proclaimed—and they always maintained a close connection to their gardens, where they tilled vegetables. Often houses even had small stables or barns.

It was with the settlement movement that the unity of organization and urban strategies came to full bloom. For Neurath economical and political enterprises truly were as important as the objects—the urban elements—they
created. And the hidden organization that lived behind all elements of a city was also what had to be drawn out and explored in Neurath’s 1937 map, and what would take his urban project to a next step.

In terms of housing, Neurath always favored settlements over multi-storey dwellings, but over time his receptiveness to other urban conceptions grew. He started to recognize that settlements could not be employed everywhere, since they were not as dense as the communal projects the city of Vienna started to realize. He also underlined that Gemeinschaft, thus formally articulated differently than in the settlements, was also generated in the municipal dwellings. He wrote: ‘In the public dwellings of Vienna’s municipality emerges a new common life. The common courtyard serves the play of children, on summer evenings young and old possibly even dance to the sound of the loudspeaker.’

He also noted that the diverse proposals for common living, worked out by many different architects in Vienna encouraged beneficial pluralism. This notion of pluralism in urban planning was connected with his philosophical perception of coherentism and logical empiricism. Coherentism advanced the idea that truth was a compound of entire systems, but could also be ascribed to its individual propositions. However, scientific
opinions differed on the question of whether coherentism allowed many possible systems of truth or only a single one. Neurath believed that whatever decision one made ‘lay in the ‘path of life’ chosen by the decision maker.’

Therefore, a city had to encourage various models to solve problems, so a collective decision could be made by many people on the basis of what they found appropriate for their ways of life and their needs. This attitude foreshadowed Neurath’s notion of the purposes of picture statistics. By showing various statistics (aspects of reality) chart by chart, they encouraged their viewer to draw his or her own conclusion.

**Otto Neurath’s Graphic Convictions**

**The Search for Simplicity**

Since Neurath perceived of the Modern city as an economic organism, he had to find a way to illustrate the ‘invisible forces’ that governed it. To facilitate this comprehension, which could potentially transgress borders and social status, he strove for a universal language: the language of picture statistics.

In fact, for exhibitions of the settlers a visual chart collection of their achievements was established. In 1925 a permanent Museum emerged from this, soon called ‘Museum of Society and Economy’ (Gesellschafts- und Wirtschaftsmuseum). This Museum became the home of picture statistics, where the graphic depiction of data was tested and refined.

Most crucial to creating quantitative charts was the role of the transformer—the statistical and graphic personnel that translated data into the quantitative map. Charts at the Museum were not only created according to aesthetic judgment and graphic knowledge, but were also mathematically precise although they were rounded off.

The graphic history of the 1937 map, *City Planning*, was threefold, since the map consisted of pictograms, patterns made of symbols and spatial parameters.

I.S.O.T.Y.P.E. (International System of Typographic Picture Education) symbols usually showed quantities by the repetition of a singular symbol, rather than by scaling in size. While in the 1920s quantitative charts were mainly characterized by arrays of symbols, which actually represented quantities, a main shift occurred in the early 1930s when symbols started to be paired. Until then ‘factory’ and ‘shoe’ for example, were represented as two

Fig. 6  ‘Baumwollwirtschaft Chart 44’, ca. 1929–1930, source: *Gesellschaft und Wirtschaft*. 
separate symbols, had two separate meanings and usually indicated a quantity of shoes or factories when multiplied. By the early 1930s however, symbols started to appear in pairs, and the merge of shoe and factory indicated, ‘shoe factory’. This fundamentally added to the nature of ISOTYPE.

While the history of pictograms is well documented in Neurath’s writing, the graphic history of the hatches, the second entity employed in the 1937 map, is less clear. From an architectural standpoint, they represented a breakthrough because they bridged the symbol to the plan. They allowed the symbol not only to signify quantities within space, but to actually become space when multiplied. They efficiently represented the fabric of rural and urban space to the ‘uneducated eye’. Color solids, and technical hatches composed of horizontal, vertical and inclined lines, were employed in other architectural maps at the time, but they were never nearly as comprehensive as Neurath’s ‘wallpapers’, as he liked to call them.

Neurath employed his quantitative maps to depict information in an unbiased way, as done with geographical maps, and his aim was for them to contain a catalogue of universal signs as neutrally as in geographical maps, yet he seldom worked with the actual spatialities of a city. For one, the implications of actual spatialities of the city and their illustration required a degree of technical or architectural craftsmanship that was too complex for the ‘ordi-

Fig. 7

**Paired Symbols, ‘Picture 17’**
nary man’ to decipher. In order to illustrate simple facts Neurath decided to dismiss actual geographical charts and decided to work with cartograms.

In the appendix of Gesellschaft und Wirtschaft Neurath argued that ‘the cartographic depiction of the atlas was adjusted to match the picture statistics.’ They were intentionally ‘not geographical maps, but only cartograms’. Furthermore, the Museums’ town plans rarely contained more than one geographical layer, which was also usually highly abstracted. Neurath insisted that quantitative information was to be kept completely separate, once a map reached a more detailed level of abstraction. According to Neurath, town plans should only ‘explain the character of a district, but not its exact location or disposition.’

This shows that it was not until the 1937 map that Neurath thought in depth about how to map socio-political factors onto space. Before then, these two layers were consciously kept apart. Pairing layers stood at the end of a long process. Although the segregation of space from statistical information might have fostered better understanding of the chart, it also testifies to Neurath’s underestimation of space’s dispositions and its resulting complexities.

Since the cartograms consciously followed the laws of the pictogram, they never inherited the properties of a real diagram. Besides Neurath’s notion of pluralism the concept of the social silhouette is crucial for investigating Neurath’s resistance to spatial praticallys, which are essentially design
strategies. The social silhouette promotes that certain aspects of life ought to be only depicted in single charts, so that they do not lead the reader to false conclusions. In *The International Encyclopedia of Unified Science* (1944) he states:

> Various nations have different mortality rates; one cannot say that where the mortality rate is higher, we may also expect a lower standard of public health. It may be that in one nation the percentage of old people is extraordinarily high and, therefore, the national mortality rate may also be very high, even if in all age groups the mortality rates were lower than in other nations. The silhouette of mortality rates would tell us what the situation is.

This is precisely why Neurath wanted to illustrate every single category by itself. Only in their collectivity would the charts create a social silhouette that would show a more holistic picture of social interconnectivities. In contrast to architects, Neurath, the philosopher, could perceive the city as the cognitive construct of manifold social relations that it was. He was freed from the burden of having to coerce it with the specificity that a design task demands.

But it is also for this reason, that Neurath’s maps were representational tools, but rarely heuristic instruments. Because only in mapping various spatial aspects within one realm design solutions can be derived.

With the 1937 map Neurath did not mean to arrive at design conclusions, but he did start to map multiple aspects in one city plan. In addition, he achieved what he had always wanted and what no architect had accomplished before him: to illustrate socio-economic forces within the city with the same objectivity as the geographical map.
Otto Neurath’s Pedagogical Convictions
From Picture Statistics to Picture Education

Neurath’s ultimate goal always was to enable everyone to ‘participate in a common culture’ and he fought to eliminate ‘the canyon between educated and uneducated people.’ In this search of ‘humanizing’ knowledge therefore, graphic education had to be scientifically and pedagogically probed in relation to the intended audience. The vehicle for this refinement became the Museum—it was where new tools were invented and tested. And they travelled from there, as exhibitions, catalogs and matrices, to museums and into classrooms.

While the invention of new media for ISOTYPE did not change the language of picture statistics much, they were additional instruments through which this language could be articulated. Concretely, this meant a shift from exhibiting solely quantitative maps on paper, toward providing a set of items that could be used to inform the broad public, ranging from magnetic boards to short films and the Museum itself. The alteration from using solely charts towards a wide variety of media was also reflected in a change of name: the word Bildstatistik (picture statistics) was replaced by Bildpädagogik (picture pedagogy) better known as Picture Education. Picture Education was also written as P. E. to form i.s.o.ty.P.E. abbreviation.

Between 1925 and 1932 the ‘Museum of Society and Economy’ started an extensive collection of their own commissioned photographs. As a result of the Museum’s collaboration with Vienna’s ‘Professional Support Bureau and the Viennese Chamber of Labor’ employees at the Museum studied the life of the worker and labor environments meticulously. But staff of the Museum did not only go out to picture work environments, prospective wage earner were also invited into the Museum to gain an overview of various job possibilities. Progressive sequences—lantern slide shows—of work scenes were also depicted which created a narrative on the duties of the hairdresser, the locksmith, the optician, the tailor, the carpenter, the blacksmith and the factory worker. These small narratives were headed by a title and a credit slide as well as a ‘lead image.’

The most interesting results however were possibly achieved during the Museum’s work with students. By the end of the 1920s, picture education became a part of the Viennese school reform. Initiated by the social-democratic government of Red Vienna, the school reform tried to weed out antiquated teaching methods that were considered debris of the monarchy.
The Vienna method was from then on probed in various school types, but mostly in *Hauptschulen* (middle schools: 10–15 year olds), elementary schools (6–10 year olds) and kindergartens (3–6 year olds). While different teaching materials were used to engage various age groups, drafting of picture statistics was taught at all levels. Surprisingly, this led to the understanding that picture statistics were often more easily appropriated and correctly employed by younger students.

When confronted with drawing the statistical chart, ‘How many children stayed at home on the weekend and how many went outside?’ Neurath remarked that teens were inclined to solve these problems in an all too detailed and naturalistic way, if the instructor did not specifically request symbolic depiction. He attested on the drawings:
In an all-girls’ class, for instance, one will find series of (drawn) girl-(figures), whose little dresses feature all kinds of details. Braids and such animate the composition. The girls, who stay at home, look outside the window, whose drapes are affectionately drawn out. The lead images give reason for picturesque activity. All too easily they lose the character of statistic free symbolism.29

The technique of drawing picture statistics, however, proved apt for children in elementary schools. Research in child psychology had shown that during the years of elementary school and earlier, children were very capable of inventing symbols and designing them in an abstract way.30 Neurath attested to this in Bildstatistik und Schule:

In one […] case a child indicated the ‘Sunday in the open-air’ with the tree symbol adjacent to a mushroom symbol, omitting [the symbol] of children walking outside. Asked why he chose the tree and the mushroom, he answered absolutely in terms of best picture education: the tree alone could indicate a park in Vienna; with the mushroom it becomes clear that it is a forest.31

In general, children quickly grasped the method of drawing quantitative rather than geographical maps. However, ISOTYPE was still not for everybody. Neurath knew and actually intended this. It was not taught in gymnasiuims, secondary schools or at universities, it was kept from institutions that drew on the upper class. First and foremost, ISOTYPE was provided to those
who needed it most, a non-specialist audience. And in this instance, the apparent simplicity of the Vienna Method was unique; because it empowered the weak, it gave the ones who could not read the chance to participate, and it considered the adult just like the child and those with any kind of disadvantage or disability.\footnote{32}

When the school material started to travel, so did the Museum’s exhibitions. And it was for this reason that some rather famous architects took notice of Neurath and invited him to be the first non-architect member to advise them on how to create a didactic map of the city.

Nobody knew what they were getting themselves into, until after they boarded a steam ship that carried them toward Athens and the most defining congress of architecture and urbanism of the 20th century: CIAM 1933.

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**CIAM as Catalyst for the 1937 Map**

Neurath and ‘The Functional City’

CIAM IV, titled ‘The Functional City’, took place on the cruise ship SS Partis II en route from Marseilles to Athens between July 29 and August 12, 1933.

With the goal to map 32 cities in terms of housing, working and leisure zones as well as routes of transportation, the CIAM architects were drawn to Neurath’s expertise on cartograms and they hoped he would help them to enhance their visual language for illustrating the city. Neurath on the other hand was attracted to CIAM as a platform, because it presented an opportunity to launch an interdisciplinary professional language on a large scale. In addition, Neurath was in close contact with the architects Josef Frank and Magarete Schütte-Lihotzky, who both belonged to the CIAM’s left wing. Therefore the original CIAM declaration, drafted by one of CIAM’s left wing members, resonated with Neurath’s understanding of urbanism. It stated:

The idea of modern architecture includes the link between the phenomenon of architecture and that of the general economic system. Town planning is the organization of the functions of collective life; the redistribution of land, the indispensable preliminary basis for any town planning, must include the just division between the owners and the community of the unearned increment resulting from works of joint interest.\footnote{33}
With CIAM IV however, its left wing became less influential.

The election of the Dutch architect and city planner Cornelis Van Eestern as CIAM’s chairman in 1930 was crucial to CIAM politics, because he symbolized the neutral compromise between the opposing (Swiss)-German and (Swiss)-French camps. While the (Swiss)-French camp headed by Le Corbusier thought of architecture more along the lines of Fordist production and æsthetics, the (Swiss)-German camp, including Hannes Mayer and Hans Schmidt, perceived the architectural tasks at hand in purely functionalist terms. Some of the left wing camp certainly also dismissed capitalist modes of architectural production. Van Eesteren’s mild nature and his will to mediate between different actors contributed to his aptness as chairman.

A further quality that prepared Van Eesteren for the preparations of CIAM IV was his double role as architect and urban planner. In 1929 he was called to serve in the Urban Development Section of Amsterdam’s Public Works Department where he started to work on an extension plan for the city. For this purpose he drew out maps generating a comprehensive design strategy. Since Van Eesteren had completed three model maps for the city of Amsterdam, it was sensible to use their logic and organization as the basis for maps of ‘The Functional City.’

The first map in 1:10,000 sought to show existing conditions in a city, recording industrial and housing zones, as well recreational areas. The second map, drawn at the same scale, analyzed transportation networks, and the third, at 1:50,000, captured ‘the city in its regional setting, including areas of public and private open space, and additional information on all four [Corbusian] functions of dwelling, work, recreation and transportation.’

Van Eesteren created the model maps and 72 symbols that would help clarify the given information. At a preparatory meeting in Berlin, during which the Berlin Building Exposition took place, a contribution of the ‘Museum of Society and Economy’ received special attention from the CIAM members due to its comprehensive designs. It was then that Sigfried Giedion suggested collaborating with non-architect specialists for CIAM IV, namely Otto Neurath. Although preliminary meetings between Neurath and Van Eesteren had taken place before 1933, Giedion notified Neurath to join the congress on the Patris at last minute.

Van Eesteren had done his best to develop a comprehensive graphic system in preparation of the congress. He was, however, unable to unite his 72 symbols in a coherent way and mixed conventional architectural drawing
Fig. 13


Fig. 14

CIAM Delegates on Board of the Patris, 1933, source: gta archive, CIAM Archive, ETH Zurich.

Fig. 15

Le Corbusier on Board of the Patris, Background, Three CIAM Model Maps, 1933, source: gta archive, CIAM Archive, ETH Zurich.
methods with symbols. Therefore Van Eesteren hoped that Neurath’s speech would clarify certain graphic hurdles. This was especially important since the beginning of a publication of CIAM’s maps was anticipated as soon as the CIAM delegates would return from the Congress. Neurath’s speech was held in Athens on August 4, where the maps were exhibited at the Athens’ Polytechnic University.

The Patris left Marseilles on July 29, 1933. The first three days on board were dedicated to discussions and analyses of the delegations’ maps. Le Corbusier held an introductory speech, addressing the question of how the maps could achieve at concrete conclusions.

The next day, Cornelis Van Eesteren addressed the relationship of effective illustrations of urban analyses and their translation into design proposals in his speech ‘Methoden des funktionellen Städtebaus (Methods of Functional City Planning)’. He explained how data had been extracted and to which urban proposals these analyzes led. He accompanied his lecture with the extension plan for the city of Amsterdam as an example.

On the collection of data, he said:

In the extension plan, one only has to take into consideration the entities that require an advantageous position in relation to the entire body of the city. These are the objects that appear insular in every city: hospitals, mental institutions, cemeteries, crematories, etc.
But he also stated:

On the basis of technical details, like railways and shore connections, solutions were found and extensive reports were drafted. For the expected population a prognosis was made and a minimum as well as a maximum were determined, for both cases the plan should propose housing possibilities.\(^{39}\)

His speech was followed by Neurath’s ‘L’urbanisme et le lotissement du sol en representation optique d’après la méthode viennoise’ (*Town Planning and Lot Division in terms of Optical Representation Following the Viennese Method*).\(^{40}\) Neurath’s answer to mapping densities in a city was still what he had always pledged: they should not be mapped into the drawing, but they should be shown in a separate supporting chart. Presenting the image ‘Men Living on a Unit of Space in Town’, he reiterated:

If one wants to show the density of inhabitants in the large cities of the world using our method, they would be characterized by monuments, for example, Paris by the Eiffel Tower and Notre Dame, London by the bridge over the
Thames, etc. The population density will be represented by black or colored figures. At first glance, one will notice that while in Anglo-Saxon cities, for example, there are fewer inhabitants per 100 square meters than in the cities of Central Europe. I do not enter into considerations of whether dwelling in one- or two-floor buildings determines this situation.

This solution was of course disappointing to the architects, because it did not allow for density to have a spatial implication. Neurath also insisted that actual maps did not even have to be drawn up at all and that cartograms served the cause of mapping the city even better than maps with spatial precision.

It is not always necessary to show these graphics on geographical maps; it often suffices to use geographical diagrams. The diagram facilitates observation. I think that we could better represent many facts studied at this congress through similar diagrams [to the ones I’ve shown] rather than through plans or geographical maps.

To some, this statement must have felt disconcerting, since they had spent days and weeks in preparation of their precise city maps.

At last Neurath showed plans on the city development in Damascus, produced for the Atlas Gesellschaft und Wirtschaft in 1930, to illustrate the topic of the Congress more closely. These maps were however lacking any kind of paired information like combinations of spatial implications and symbols, or implied socio-political and demographic data.

But Neurath’s speech, despite its lack of new insight, was of course accurate in its criticism of the CIAM maps. It identified their shortcomings by calling out their lack of a uniform system of symbols. Furthermore, it pointed out that they were not apt for the public at large. To remedy this, Neurath suggested the usage of wallpaper cut outs and symbols on paper, which schools had been able to order through the Museum.

Although Neurath’s speech was disappointing, he was elected to serve on various committees and a collaboration between CIAM and the Museum in Vienna was planned before returning to Marseille. On August 12, upon arrival in Marseille, a first meeting of the publication commission, consisting of Van Eesteren, Sigfried Giedion, László Moholy-Nagy and Otto Neurath took place. Earlier the English delegation had questioned the ‘scientific
legitimacy’ of CIAM’s resolutions, which also affected this first meeting.

For Neurath illustrating CIAM’s resolutions was a chance to spread his international language of signs widely. Therefore he wanted to rework some of the Congress’ material. Giedion’s idea, however, was that only the Congress material should be used, so that the Congress could proceed faster. This caused a dispute between Neurath and the architects.

Neurath, on one hand, advised that the resolution should be shown in simple statements with newly produced fragments of plans illustrating the resolution’s singular focal points. Moholy insisted that CIAM’s maps were ‘impressive’ and best displayed the resolution’s origin as well as its process. In conclusion, the commission decided that a small publication should contain the resolution with ‘images and explanations’ and that the larger publication required ‘in depth reassessment with perfect optical representations’.

In the near aftermath of the congress, Neurath was eager to get to work. Van Eesteren, however, wrote a letter to Moholy-Nagy confessing that he was really happy Moholy had ‘so actively participated in the congress’, in particular

Fig. 18  **Left Hand: Charts of Damascus**, ca. 1929–1930,
source: *Technika Chronika*, gta archive, CIAM Archive, ETH Zurich.
in a conversation with Neurath, because otherwise they ‘would have certainly fallen victim to his rather limited system’.45

An upheaval occurred in November of 1933, when Neurath was notified late of the second get-together in Paris. He issued a short letter to Le Corbusier’s CIRPAC (Comité international pour la résolution des problèmes de l’architecture contemporaine) voicing his discontent.46 When he did not hear back from CIRPAC for three weeks, he finally decided to confide in Van Eesteren: ‘Please tell me how all of this should be understood in your opinion. If prominent members of your CIRPAC do not attach importance to the collaboration with us, I would prefer to withdraw my institute, but not without maintaining a personal friendly memory of you and your kind way of conduct with us.’47

Nobody replied to Neurath until five months later. During this time Van Eesteren was severely sick. When he finally wrote back in May of the following year, he stressed, however, that as soon as Neurath made concrete suggestions on the basis of the plan of Amsterdam, he would still present these results to CIRPAC.48 A meeting between Van Eesteren and Neurath followed this letter.

During the months of Van Eesteren’s sickness, Neurath had his own problems. In the winter of 1933/34, he left Vienna for a visit at the ‘Isostat’ in Moscow. In February, the Austrian Civil War broke out. Representatives of the Viennese social democratic government and those affiliated with it were imprisoned. When the police came to search Neurath’s office at the ‘Museum of Society and Economy’, Marie Reidemeister warned Neurath not to come back to Vienna and they arranged to meet in Prague, from where they immigrated to Holland and finally settled in The Hague.

Van Eesteren was honest in giving Neurath a second try in 1934. In a letter to Giedion, issued a couple of days after his meeting with Neurath in Amsterdam in May, he wrote that he was still of the opinion that ‘something must grow’ from the collaboration between the congress and Neurath.49 Concretely, he thought of the exhibition ‘The Functional City’ that he planned to show in Amsterdam where the next CIRPAC meeting would take place. He still hoped that Neurath could advance his symbols for city planning.

In preparation for an exhibition titled ‘The Functional City’ which was held in Amsterdam in 1935, Neurath’s interest and Van Eesteren’s enthusiasm for the collaboration rekindled. They met frequently between October 1934 and February 1935. Neurath tried to work on the symbols and maps, indentifying some of the major spatial problems. ‘One should possibly combine
density of population, number of apartments, floor heights etc. [by means of symbols]’ Neurath wrote.50

The final death blow to the collaboration came with a presentation Neurath gave for the architecture collective ‘de 8’ which included Van Eesteren. The meeting did not draw much attention and many architects left displeased with Neurath’s speech.51 Neurath on his part, was highly disappointed that Van Eesteren did not show up. He wrote a last letter stating that he was very sorry about his absence, because Van Eesteren ‘was always so mediating.’ 52 He concluded: ‘Everything can be solved given some consideration, but neither is it only a graphic task nor is it solely that of an architect; it requires an intermediary … TRANSFORMATION … But this is an old song I have already whistled and jingled to you in different variations.53 ‘The Functional City’ exhibition in Amsterdam opened in July of 1935. Neurath was never credited anywhere, although some charts were modeled after his suggestions.

Why did this collaboration between Neurath and CIAM fail so catastrophically? For one, Enrico Chapel has very precisely assessed the complication of Neurath targeting a different audience than CIAM. He stressed that from the beginning, Neurath and the CIAM architects aimed at diverse target groups and they also ‘expected totally different reactions.’54 Chapel continues:

Neurath invented his system within the framework of a global visual communication programme, with a view to ‘humanize’ knowledge for the greater benefit of the general public; the architects sought to internationalize an established body of knowledge; their principal targets were the decision-makers in the field of urban production.55

This is certainly relevant, since Le Corbusier for example conceived of the purposes of CIAM IV transnationally. This ‘meant working closely with large interests with the capital to implement his overarching vision of social and architectural transformation’ as Mumford has argued in his CIAM Discourse on Urbanism.56 But in general the architects wanted to pride themselves with their technical expertise and with the fact that they had found the means of representation that were specific to their discipline. Again, Enrico Chapel has put it precisely in saying:

In the first place, one should not underestimate the difficulty of applying a pictorial method that was not designed with town planning in mind […]
This system, which visualized social phenomena and economic data, failed to account for a whole range of dimensional and more generally spatial parameters, which are nonetheless indispensable to any study carried out prior to the intervention of urban space.57

Kees Somer supports Chapel’s assessment in stating that the CIAM architects saw their maps ‘as practical instruments’ and ‘their attention remained focused, on the reality of urban planning, which they had investigated with an immediately operational purpose: the improvement of the planning and design of the environment in which people live.’58 These observations are crucial because they precisely describe the difference between the map as an architectural heuristic device and the map as representational medium: and this is the divide that could not be overcome by Neurath and the architects in the framework of CIAM IV.

The 1937 Map—City Planning
From City Planning to Architectural Record

In 1937, two years after the end of his failed collaboration with CIAM, Neurath published his first socio-political map of a town, originally titled City Planning. The title is more charged than one might assume at first glance, as it suggests a concern with actual ‘planning’ rather than just a sober analysis, which would have been the typical mode of operation for Neurath.

The great breakthrough of the 1937 map was the overlap of spatial parameters with hatches and pictograms. This overlap was certainly missing in the map of Damascus that Neurath had presented on the Patris, and it was also missing in all his quantitative charts of the world. While the ISOTYPE symbols presented altered concise syntax, the 1937 map also effectively clarified how to successfully employ ‘wallpapers’ and how to abstract spatial implications. In fact, the 1937 map was one of the first that mapped space with precision, which eventually enabled it to show first traits of the map as architectural tool.

Admittedly, when comparing Neurath’s map to Van Eesteren’s model map I of Amsterdam, Neurath’s approach in mapping the city still looks relatively abstract. But given a closer reading it becomes apparent that Neurath actually managed to supersede Van Eesteren’s approach in creating an insightful tool.
Among CIAM’s three model maps, model map I of Amsterdam lends itself best to a comparative study, because it depicts existing conditions in a city and accounts for housing, work and leisure zones in a manner closest to the content of Neurath’s map.
In a first and most obvious instance Neurath’s hatches are more developed than Van Eesteren’s. ISOTYPE hatches could be inverted due to their simplicity and indicate two different, but clearly spelled out things in one map. Van Eesteren’s hatches on the other hand employed a multitude of different manners of hatching, so that his charts became impossible to read without an index.

The indication of density was not successfully addressed by either map. Van Eesteren used numbers to indicate additional social factors in the plan, but they did not provide a general understanding of the relationship between statistics and space. Neurath, on the other hand, did not even try to address this issue, since he stayed true to his principle that quantitative information should be kept separate from the map. ‘Architects who are always closely connected with making floor plans and maps mostly intend to show social facts on maps, but in a great many cases we have to give preference to other methods of representation’, he criticized in _Architectural Record_. In his text Neurath reiterated this by showing density charts of different cities, something he had already demonstrated on the Patris by the example of Damascus.

On a second level, the comprehensiveness of Neurath’s symbols was also greatly improved, since a way was found to differentiate various types of buildings by simple means. Houses, factories, and big halls like railway stations could be distinguished by the basic shape of their symbols. Whether a space was located outdoors or indoors was indicated by black and white backgrounds. In addition, Neurath gave his symbols a background so they could be read as a symbol only. He also showed them in elevation, which made them clearly more abstract and identifiable as a symbol.

Van Eesteren’s symbols on the other hand, are ‘driving’ or ‘floating’ in all kinds of directions, which makes the plan very literal. In addition this makes it difficult to understand what the symbols imply: is this a real ship or is this an area for ships?

And thirdly, there was the issue of spatial abstraction, which had always been Neurath’s weak point. When analyzing Neurath’s map the discrepancy in scale is unsettling. The map seems to depict an urban environment and it indicates urban institutions (hospital, factory) yet the size of the city seems too small, too trimmed, to be an actual city.

Unfortunately Neurath did not often discuss maps individually, in fact there is no hint in the literature that the 1937 map derived from a real city. The general assumption has always been that it is a generic representation.
This is logical, since Neurath argued for years that rules in city planning were best illustrated by means of showing small generic parts or cut-outs. Yet, how does one illustrate a generic city or invent a city from scratch? This would seem to be a fairly complicated task for someone who had no such specific training.

What counters the generic theory is that Neurath usually drew from actually found social and economic facts. So why would he make an exception with the city? Why would he not treat the city as a spatial social fact? In addition, the 1937 map clearly seemed to be ‘Neurath’s attempt at [contrasting] the language of “The Functional City”’ and that would suggest working with an actual city. After all, CIAM specifically set out to map more than thirty actual cities in the world. But as for being the illustration of a real city, the 1937 map was too out of proportion, and as generic it was too specific.

It seems that to some extent both theories are applicable: The 1937 map is indeed generic, but there is reason to believe that the generic cut-out was drawn on the basis of a significant city. It was a city meaningful to Neurath, a city that made sense in contrast to Van Eesteren’s Amsterdam, namely The Hague, Neurath’s new city, the city where he continued his legacy.

It seems that in the end Neurath realized that spatial givens were important to take into consideration, even when depicting the city. However, he kept this realization a secret, because it was most important to emphasize that such
infrastructure could exist with slight differences in every city in the world.

In order for the map to be a valid response to CIAM it needed to be a place that possibly incorporated all aspects of ‘The Functional City’; housing, workplaces, recreational areas and various transportation networks. Obviously, such a place was hard to find in only a small cut-out of a city. Therefore modifications had to be made: spatial transformations.

The charts above, first depicting an actual plan of The Hague and lastly depicting the 1937 map, suggest that the trained statistical transformers were able to transform the particularities of space. They seem to suggest that from the actual city, a good transformer would move on to draw out a larger city block and scale it down. Then the transformer might morph a river into a sidewalk and some housing blocks into a river. The transformer might also copy an airfield from the far south of the city and insert it straight up north into the fictional city, where it fit best alongside a major transportation route. Then, he might also do the same with a lake from the outskirts of the city. Finally, the transformer could start drawing out actual greenery in the city. He might also invent some greenery and reshape some housing blocks and move them to where they fit best. And if he is a gifted transformer, he will eventually arrive at a generic city.

The combination of spatial implications and socio-political factors alone was one big step, but to actually work on the basis of a real city while at the
same time making such spatial transformations signifies one step towards the operative. Van Eesteren was never able to improve his symbol dictionary despite his dedication. Neurath alone did make a step forward: he started to develop his first and last map of a city and moved toward city planning.

But let me be clear: Neurath never did one thing: he never combined quantitative and spatial maps. That would have been a too suggestive move, inviting seductive design conclusions and singular decisions. So when the question was posed in the beginning if Neurath perceived of the city as an agglomeration of social facts, then the answer is yes, he did. He believed that these social institutions in a city could and had to be mapped in the city, that in fact they needed to be drawn out so that people could come to an understanding of their built environment. But still, he never thought of the maps, as means of making precise design decisions.

Nonetheless he illustrated in the generic map of The Hague a city how he envisioned it: as small town by the water, fifty percent greenery, fifty percent urban fabric, possibly reminiscent of the Viennese settlement movement. But Neurath also stressed the city’s important institutions: working areas and leisure zones, hospitals, kindergartens and playgrounds as well as factories. And they were integrated in housing zones, in great contrast to how the CIAM architects had envisioned the city during CIAM IV. More than only creating an altered illustration of the city, Neurath also represented a piece of the city as he projected it.

Neurath referenced the CIRPAC in this text only once, in a footnote. He stated that ISOTYPE standardization could be compared ‘with various attempts at architectural representation, e.g. with the stimulating proposals of the CIRPAC made by Van Eesteren.’ It is unclear if that mention was really meant as a tribute to the ‘stimulating proposals’, or if it was meant to parallel his own work to that of CIAM, mention of it, he might have felt, was long overdue.
Postscript

In an interview conducted for this research on Neurath, Rem Koolhaas confirmed that he was familiar with the work of Arntz and Neurath and that he had been influenced by it. On occasion AMO’s maps even seem to have much in common with Neurath’s maps, although AMO’s certainly uses both, operative maps as a means of design, and those that communicate precise statements about the world.

‘But doesn’t a liquid, completely globalized world, also require more liquid maps?’ I asked Koolhaas during the interview, ‘ones that apply a fundamentally different logic, than the ones from the 1920s and 30s.’

‘How would you imagine that?’ he asked me. ‘Are they in real time, are they alive?’ And then he answered:

The promises of the digital are short-lived. In many cases before the promise can establish itself, the decadence of it already prevails, or the commercial prevails, or the trivial prevails. It has been an incredibly difficult domain in which to retain precision and to retain integrity. In certain cases exactly against this fluidity and against this immediate abuse of every idea, that the Internet […]

Fig. 23  World of IKEA, Image courtesy of AMO.
seems to suggest, [we create maps that are] at least momentary freeze frames of particular conditions.63

‘I think we [make maps] … as interpreters at a moment of great political and ideological confusion’ Rem Koolhaas said at the end of the interview. ‘To some extent we adopt a language, not so much ironically, as a statement that there once was clarity, but the clarity is currently gone.’

Sometimes I wonder what Neurath and Van Eesteren would say if they saw that today ‘their maps’ have finally been altered for making precise statements, while at the same time being effective design tools. I think they would be very satisfied. Only Otto Neurath might ask Rem Koolhaas, about his ultimate purpose.
Notes

2 Otto Neurath, ‘Visual Education: A new Language’, Survey Graphic (1937): 25. ‘When will the Middle Ages be at an end? As soon as all men can participate in a common culture and the canyon between educated and uneducated people has disappeared.’
4 These are all photographs of other photographs or publications that Otto Neurath collected in the N_Files. These are N_421, N_425, N_430. ISOTYPE Archive, Department of Typography, University of Reading, Reading, UK.

6 Otto Neurath, ‘Städtebau’, 240. ‘Wie wird die kommende Stadt aussehen? Vor allem arbeitet an ihr die moderne, großorganisierte Industrie, der weltumspannende Handel. Hafenanlagen, Bahnhöfe, Silos, Lagerhäuser, Fabriken, kühn geschwungene Hochbahnen, Eisenkonstruktionen kennzeichnen die kommende Stadt, Wolkenkratzer recken sich stolz empor, an bestimmten Stellen durch bestimmte Zwecke bedingt, einem Gesamtbild unter Umständen durchaus harmonisch eingefügt. Wie aber werden die Wohnungen verteilt sein?’
7 Otto Neurath, ‘Städtebau’, 240. ‘Es geht darum, nicht nur die Industrie- und Wohnbauten richtig zu verteilen, Wohnungen mit den Verkehrswegen richtig zu verknüpfen, es geht auch darum, das so Geschaffene architektonisch harmonisch zusammenzuführen, die Stadt als eine einzige architektonische Einheit anzusehen!’
8 Otto Neurath, ‘Städtebau’, 240. ‘Was für Architekturideen leben nun in den
Architekten und Organisatoren, was für Architekturideen werden von den breiten Massen aufgesogen?


11 Otto Neurath, ‘Kommunaler Wohnbau’, 52. ‘Die Neubauten zeigen die verschiedensten Formen, wie sie eben entstehen, wenn in toleranter Weise die breiten Scharen der freischaffenden Architekten sich betätigen können … .’


14 Otto Neurath, ‘Autobiography’, 100. ‘When controversial problems are presented in print, people expect some kind of bias from the outset, in a way which they would not expect from looking at geographical maps. Isotype is bound to be as neutral as maps and to provide material for free discussion from any point of view. Isotype symbols have fewer positive or negative associations than the printed or written words of a language. You cannot write in a neutral way without being boring, but you can present a neutral picture which is nevertheless attractive.’


Otto Neurath: Mapping the City as a Social Fact?


21 Whenever I have capitalized the word ‘Museum’ it means that I am referring to the ‘Museum of Society and Economy’.

22 Otto Neurath, ‘Gesellschafts- und Wirtschaft im Lehrbild’, *Österreichische Gemeindezeitung*, May 1, 1927, 44. ‘Man muss nun darangehen, festzustellen, welche Lösungsweisen uns zur Verfügung stehen, es muss der Bereich der Darstellungsarten abgegrenzt werden. Leuchttafeln, Magnetkarten, Zeichenfilme, die alle bedürfen methodischer Pflege. Man muss allmählich feststellen, was man so darstellen kann, was nicht; welche Vorteile das ruhende statistische Bild vor all dem hat. Die Wirkung von statistischen Bildern, die abwechselnd aufleuchten, ist noch allzuwenig untersucht.’


24 Otto Neurath, ‘Bildhafte Pädagogik im Gesellschafts- und Wirtschaftsmuseum in Wien’, *Museumskunde, Neue Folge III* (1931): 125–9. Neurath used the term Bildstatistik all throughout the 1920s and well into the 1930s. Although pedagogy had always been an element of Neurath’s aspirations, it became the most important goal in the early 1930s when *Picture Education* replaced *Picture Statistics* for the first time in an article’s headline in ‘Bildhafte Pädagogik’. For the change in article headlines see Robin Kinross, index to Band 3 *Gesammelte bildpädagogische Schriften*, by Otto Neurath, edited by Rudolf Haller and Robin Kinross (Vienna: Hölder-Pichler-Tempsky, 1991) v–vi.


26 See Note to Illustration 2.24 and 2.25 in N. Vossoughian, *Global Polis*, 77.

27 Images are at the Otto and Marie Neurath Isotype Collection, University of Reading,
Department of Typography.


32 Otto Neurath, ‘Visual education’, 28. ‘This visual method has special uses in teaching public health lessons, child care, safety, and so on, adults and to children, and in teaching retarded or handicapped children. The International Foundation for Visual Education is working along these lines in many countries.’


Cornelis Van Eesteren, ‘Funktioneller Städtebau’, 1152. ‘Im Generalplan hat man nun die Lage der grossen Einheiten anzudenken welche eine gute Situation im Bezug auf den ganzen Stadtkörper verlangen. Es sind dies Objekte, die in jeder Stadt vereinzelt vorkommen wie: Krankenhäuser, Irrenhäuser, Friedhöfe, Krematorien u. s. w.’


Neurath’s speech was printed in Technika Chronika which is available at the gta archive at the ETH, Zurich.

Otto Neurath, ‘L’Urbanisme’, 1153. ‘Si l’on veut montrer la densité d’habitation dans les grandes villes mondiales d’apres notre méthode, celles-ci seront caracterisées par des médaillons, p. e. Paris par la tour Eiffel et Notre Dame, Londres par le pont sur la Tamise, etc. La densité d’habitation sera représentée par des figurines noires ou colorées. A première vue on constatera alors que dans les villes anglo-saxonnes p. e. il y a par 100 m², moins d’habitants que dans les villes d’Europe Centrale. Je n’entrerai pas dans des considérations pour savoir si le fait de l’habitation sur un seul ou sur deux étages détermine cette circonstance.’

pourrions mieux représenter une quantité de faits étudiés à ce Congrès par des schémas semblables, plutôt que par des plans et des cartes géographiques.’


44 M. Reidemeister, ‘Protocoll’, 2. ‘Die grosse publikation nach gruendlicher durcharbeitung mit vollkommener optischer darstellung.’


vorziehen, mit meinem Institut auszuschließen, nicht ohne Ihnen und Ihrer liebenswürdigen Art des Verkehrs mit uns eine persönliche freundliche Erinnerung zu bewahren.


51 Kees Somer, Cornelis van Eesteren, 179.


viel Zeit für solche Sachen haben könne, beantworte ich mit dem Hinweis darauf: er solle auch die Zeit nicht auf so was verwenden, sondern das eben hiefür ausgebildeten Spezialisten überlassen. Das ist aber das alte Lied, das ich Ihnen in verschiedenen Variationen schon vorgepiffen habe und vorgeklimpert habe.’


56 Eric Mumford, CIAM, 20. ‘But avoiding revolution, of course meant working closely with large interests with the capital to implement his overarching vision of social and architectural transformation. Such interests transcended national borders, and he was prepared to welcome capitalist internationalism in the service of social rationalization and reform along Taylorist lines.’


58 Kees Somer, Cornelis van Eesteren, 179.

59 Otto Neurath, ‘Architectural Problems’, 58. ‘Architects who are always closely connected with making floor plans and maps mostly intend to show social facts on maps; but in a great many cases we have to give preference to other methods of representation. We must avoid accumulating maps showing social data; it is more instructive to combine maps and pictographs. This leads us to a use of a symbol dictionary which contains symbols applicable to both maps and pictographs. This is the basis of visualization more widely applied.’

60 Otto Neurath, ‘Architectural Problems’, 59. ‘The symbol, representing stations, factories, kindergartens, and other buildings are in black with a white design in the middle.’

61 Nader Vossoughian indicated that the 1937 map was Neurath’s way of illustrating the functional city in his subtitle to 4.4., N. Vossoughian, Global Polis, I however, think Neurath solutions really wanted to contrast the Functional city.

62 Footnote to Otto Neurath, ‘Architectural Problems’, 57. ‘See examples in Otto Neurath, Basic by Isotype, Kegan Paul, London, 1937, We can couple ISOTYPE standardization with various attempts at architectural representation, e.g. with the stimulating proposals of the CIRPAC made by Van Eesteren.’

In the interwar years of the 20th century, the philosopher, sociologist, and economist Otto Neurath (Vienna 1882–Oxford 1945) gained international recognition for his (r)evolutionary approaches to employing museums and exhibitions as instruments of enlightenment and empowerment. Neurath, convinced that in what he called the ‘Era of the Eye’ visual means would provide powerful and egalitarian modes of communication, wrote in 1925:

Modern man is conditioned by the cinema and a wealth of illustrations. He gets much of his knowledge during leisure hours in the most pleasing way through his eyes. If one wants to spread knowledge, one should use means similar to modern advertisements.¹

Neurath founded and directed the Gesellschafts- und Wirtschaftsmuseum (GWM, Social and Economic Museum, 1925–1934), part of the new structures to help carry through the socialist politics of the Red Vienna. Neurath’s key innovation in this context was the Vienna Method/Isotype,² a method to systematically think about and prepare predominantly visually structured informational settings, for which he introduced the expression ‘visual language’. Isotype-work—in its full visionary scope—would mean carefully designed, ‘orchestrated’ settings for communication (museum, exhibition, film, book, wall-chart, etc.) using ‘collages’ of graphic, pictorial and other representations (text, image, object, media) in international cooperation for visual education.
In Vienna, and later in the Netherlands (The Hague, 1934–1940) and in England (1940–1945; Oxford, Isotype Institute from 1942) Neurath worked with a (changing) interdisciplinary team of experts—a fact he always underlined. Among others, there were well-known figures such as Gerd Arntz (1900–1988), the GWM’s graphic designer, and Josef Frank (1885–1967), the museum’s architect. From 1925 onwards, Marie Neurath (1898–1986) worked in the GWM-team. She became the principle ‘transformer’ (trustee of the public, audience advocate), a decisive position in the Isotype team, and she was also instrumental in the preparation of *Rondom Rembrandt* (Around Rembrandt, 1938).3

For quite obvious reasons—one being Neurath’s forced departures, but also the ephemeral quality of, and lack of archival structures for museographic materials—evidence of the museum and exhibition work is scarce. Still, the concepts and circumstances behind *Rondom Rembrandt* are reliably documented. Important primary materials of this art-sociological visualisation are held at the Isotype Collection of the University of Reading.4

In the last decades there has been considerable interest in Isotype, with discussions mostly concerning questions of graphic communication and design.5 The concepts, and broader implications of Isotype, as exemplarily evidenced in museum and exhibition work,6 had remained outside the focus. Pictograms, employed all over the world, indeed are the easy to reproduce and successful ‘trade-mark’ of Neurath’s. An exploration of Isotype work restricted to the graphic and diagrammatic applications and not exploring the museum and exhibition work, however, does not offer comprehensive treatment of Neurath’s socially relevant ‘tools for thinking’.

More recently, the diverse ‘turns’ (pictorial, spatial, medial), as well as globally apparent pressures and problems (issues of economy and ecology, rise of nationalism and fundamentalism, lack of education and literacy) and new opportunities (availability of internet technology and visual media) have pointed at the relevance of, and (help to) re-establish interest in Neurath’s work with the visual and visual communication.

Today ‘the museum’ is discussed as part of the social institutions which (together) are systems of order that perpetuate, preserve, and legitimise codes and practices (material and immaterial) of a collectivity. Even in economically oriented debates, the arts and culture today are seen as most important, as social glue—giving the foundations for everything else in society. In this,
[T]he function of the museum [...] is to provide us with a central arena of sociability, [...] the agora, the common place.7

Museum and exhibition work constitutes culturally created and culturally vested methods which involve power-linked narratives.8 Their active and passive uses are learnt in performative acts. The very moment of actually experiencing the (predominantly visually structured) museum/exhibition presentations is defined by the meeting of the (mix of; often incompatible) ‘narratives’ developed in the (institutionalised, anonymised) cultures, and the preconditions brought in by the individual (learner/user).9

In this context, Neurath’s Isotype museum and exhibition work, with coordinated thematic programming, and based on close attention to what was happening in the actual visits, excelled in several still (r)evolutionary and relevant features: Exhibitions were shaped so as to open access for the population at large and provide ‘a common language’. Isotype proposals were geared at traditionally underserved museum audiences, at empowering and engaging them actively in practical politics—in a truly democratic effort breaking up the usual museum hierarchies. Work was carried out in a team (including scientists, technicians, designers, educators), the processes were monitored in order to produce meaningful offerings, useful tools, as well as integrated procedures of self-reflexivity (of the institution). This overall attitude was embodied in the key position, the transformer, responsible for choosing relevant information, and an appropriate and attractive visual language.

Neurath was not interested in merely ritual and affirmative use of social institutions, such as museums and exhibitions. The Isotype enterprise involved not only targeted use of subject expertise, newest technologies and structures, but also new and egalitarian concepts. This was connected to Neurath’s democratic quest to ‘develop and employ a conception of knowledge as an instrument of emancipation’,10 and was meant to treat problems bewilderingly apparent in the turbulent first half of the twentieth century. Neurath’s progressive museum work—serving the entire society—just as his philosophy, was inextricably linked to pedagogical theory, to the social sciences, and political thought. Neither these larger topics, nor the prevailing conditions of that historical time and era, among others the decisive practical politics in the Red Vienna, are treated here.11

First in this essay, I briefly explore Neurath’s notions of visual education, visual language, and learning, and introduce Isotype, authoritatively
described in Neurath’s *Bildpädagogische Schriften* and in the précis exposition *International Picture Language* (1936). Next, using the art-related exhibition *Rondom Rembrandt* as a practical example of ‘picturing social facts’, and with a focus on audience orientation and audience development—central museological concerns—I enlarge on the Isotype approach. Here, applications of Isotype strategies in the preparation of pictorial statistics and pictorial charts are examined in more detail. As *Rondom Rembrandt* proposed new aims for museum work, and new practices for discussing art topics, part of this essay also touches on basic issues concerned with art museum work. With this, in a second strand, I implicitly argue that today’s ‘museum’—a specific conceptual framework, a shaped social tool, and designed interface (i.e. pictured social fact), which at the same time also functions as a shaper of social facts—is still being challenged by Neurath’s Isotype work.

**More than Meets the Eye:**

**Otto Neurath’s Concern with ‘Visual Language’ and ‘Visual Argumentation’**

Neurath often referred to the overriding importance of the visual in the tools used for the communication processes he sought to provoke. His advice is proverbial: ‘A picture says more than a thousand words’, ‘What can be shown with the help of a picture should not be said by words’, or ‘words divide, pictures unite’. Neurath emphasised that scientists using the most advanced techniques for discussing work-results were doing so in optical representations, with photographs to render visible sound waves, astronomical phenomena, the spectres and structures of crystals, to trace the behaviour of ants, of children. Such factual visual rendering of a specific given situation was what Neurath called ‘optical protocols’. Also three-dimensional models, with possibilities of change, enlargement, re-assembling, for example the globes employed in astronomy or geography, formed part of what Neurath called ‘pictorial education’.15

Propagating the use of visual education and visual aids, and pointing at their potential, Neurath stated:

> School has to take note of omnipresence of pictures, if the effect of the street is not to become overruling. [...] The schools like all old organisations are rooted in the past—pictures are for those without education.  

15
Neurath’s and his team’s work of the 1920s was meant for the ‘uneducated masses’, for those without academic skills, such as reading and writing, and no time and/or energy left after a long day’s work hours. According to Neurath, the diagnosis was clear: Factual information should preferably be conveyed visually, informative pictures (using pictograms/symbols as the basic element) and models should be part of a comprehensive and universally applicable Isotype approach.

However, what Neurath ultimately aimed at with the use of the visual was not the quick and ‘effortless’ transfer of information—although a key moment—most important was its potential for procuring egalitarian learning opportunities. As Neurath explained in the 1940s, education should not only concern the delivery of knowledge. He wrote:

>The social pattern which permits more than one opinion etc. is the ‘democratic pattern’. The transfer of the scientific attitude is not mainly concerned with knowledge but also with the creation of certain habits, sincerity of research and integrity of arguing. That implies not only thinking of how to pass examinations but also of deliberating on various possibilities of arguments, in short, how to become ‘meditative’ on certain subjects.\(^{17}\)

This kind of learning entailed: To analyse observations, develop a concept by taking into account many diverse aspects and integrating diverging viewpoints, to look at human interdependencies. Neurath aimed at an open approach/attitude, respecting a democratic principle, which lies in the potential to modify and to negotiate. He also wanted to secure that prejudices should not gain the upper hand, and excluded any claims for absolute truth. He held visual means to be especially well suited for this endeavour, more democratic, open for diverse readings, not dependent on book learning.

>Visual education leads to internationalisation much more than word education. One can use the same visual arguments connected with explanatory words in various languages, even with various remarks on the same visual material. Visual education is related to the extension of intellectual democracy within single communities and within mankind, it is an element of international social planning and engineering.\(^{18}\)

Neurath explained that it was the social settings, as experienced in the GWM’s exhibitions, the active use of factual information offered, the language
developed in the comparisons, and the exchange of views, which were decisive for the transfer of such an attitude. The practical museum and exhibition work—covering a period of roughly twenty-five years—was crucial for the development of Isotype, its scope and variety.19

In order to clearly link the ‘what, why, who and how’, audience orientation had already become a key factor in the GWM’s work in Vienna. For this, the transformer was introduced—the expert ‘knowing exactly what potential visual resources there are to solve any given problem of presentation [...] of translating the scientific specialist’s intentions into visual reality.’20

The transformer guided the GWM-team to make sure that the latest educational and scientific findings were acted upon, that the visualisations would be attractive, ‘speak’ to, and convey the exhibition content, engage the users, and make them use the information.21 The exhibition development processes were monitored, and the results were evaluated and discussed to improve future work (Figs. 1 and 2). This Isotype-methodology provided for the self-reflective attitude necessary to deliver effective and ‘visually enticing’ environments. These concerns were shared with the users.

As a didactic and pedagogic approach, Isotype would not only require the close observation of the visually organised messages, but entail active analysis of the ‘optical protocols’ by the learners, the use of the arguments developed in discussions, and sometimes practical application of their own Isotypes (charts, displays made by the learners).22 In the charts, both message and possible interpretability were basically formulated. However, formulated so as to make the user integrate them into existing concepts. Aesthetic experience,
activities of direct observation (apprehension, contemplation), and a situation of discourse developed from that, should not be circumvented.

Neurath’s *Bildpädagogische Schriften* do not contain a systematic exploration of the concepts visual, visuality, visual education, communication, or visual argumentation. These terms generally relate to complex competencies such as decoding, consuming and creating visual messages, ranging from very conventionalised everyday uses (e.g. traffic signs) to the visual media as individualistic and artistic categories conveyed in complex structures of visual/image-arrangements (e.g. painting, image, picture, stage set, film, exhibition, collage; using tone, colour, composition to create a story, atmosphere, emotion). Although it is well known that the visual is not as clear and clean as a word-/text-based language, several characteristics of ‘language’ are found: communicative potential, parts and arrangement-structures, Saussurean langue/parole contexts, diachronic and synchronic aspects, etc. Neurath often described the Isotype museum work (aims, methodology) in the context of visual education (Bildpädagogik). Also in *International Picture Language—The first rules of Isotype* (1936) museums and exhibitions are treated prominently, especially in the part ‘Grouping Pictures With Other Things’ (pp. 65–73). Museums and exhibitions figured as constitutive elements in the plans for the Mundaneum, an international support-network for integrated visual education started in nucleus version in the early 1930s, and were repeatedly referred to in Neurath’s manuscripts of the 1940s, ‘Visual Education’, and ‘Visual Autobiography’.

In addition to the ‘auxiliary’ verbal languages (as BASIC), Neurath saw ‘Isotype as a visual language’ which had to perform a different task, that of
‘conveying visual arguments and visual information [...] to reach [...] the masses spread over the surface of the earth’.27

The full use of the rules of the ISOTYPE system will make a complete change in our ways of teaching. [He saw it as a] guide to deeper knowledge and to science, without the danger which is so frequent in education by words: that of taking note only of details and seeing nothing of the general view. If the general view is given by teaching pictures, it will be kept in mind.28

In 1942, in a letter to Julian Huxley (1887–1975) Neurath again put forward these utopian ideas. He wrote:

Visual Education can be made much more “neutral” than education by means of words. For international purposes therefore, Visual Education is a proper tool. [...] Experience taught us, that [...] People usually enter exhibitions, look at charts, less hesitantly than they would read periodicals of a different “faith”. Another point: You may look at pictures without particular efforts.29

These plans with a global scope did not develop further. Otto Neurath died in December 1945.

When discussing Neurath’s use of the concept ‘pictorial/visual language’, several basic assumptions cannot be overlooked: Neurath repeated time and again that the ‘pictorial/visual language’ was not a (normal) language, was not to be understood without supplementing words from a natural language:

What we have to do with here, however, is a picture language, which is not able to give the story by itself, but only with the help of a normal language.30

This refers to the text-elements (necessary to clarify the potential factual statements of the pictogram-arrangements) providing the momentum for the visually observable ‘arguments’ to be performed in language interpretations—the diverse actualisations by the users (verbal comments, deductions).

The ISOTYPE picture language is not a sign-for-sign parallel of a word language. It is a language, which may be put into words in different ways. The units of the picture language have different senses (HK: meaning) when they are in different positions.31
It is not possible to give a word for every part of such a picture or a statement for every group of parts.\(^{32}\)

Propagating Isotype as a visual language for supporting an argument (in a lecture, school teaching, notice boards, shop windows, newspaper illustrations, brochures, slide-presentations, etc.) Neurath implied using all media available for visually presenting information (photographs, films, books, posters, exhibitions, museums, etc.), referring to all in sum as the ‘orchestrated’ tools for visual information and communication, and explained:

Some of the visual devices have mainly to serve as entertainment, advertisement or propaganda. Others have systematically to bring over some habits and attitudes from one group of the population to another—mainly from the older to the younger generation—in a rather argumentative way. This kind of transfer may be called “visual education”.\(^{33}\)

Pointing at a fundamental phenomenological orientation of visual education, Neurath underlined that visual education enforces a more human approach than education through writing, as it deals with things that are within everyone’s grasp:

[It] is neutral and satisfies the feeling of having knowledge in common, which in turn implies having a medium in common, international, neutral, etc.\(^{34}\)

Symbols are not very dependent upon any fashion. Therefore they are not only international but also as it were, “inter-tempera”.\(^{35}\)

For international purposes, a stringent system of conventions would be needed for creating a common atmosphere for people with different languages, occupations, and outlooks, as ideas had to be communicated and transferred over time, space, and cultures.\(^{36}\)

This work of Neurath’s had already begun at the GWM in Vienna. Besides the transformer methodology, the Isotype-approach offered a range of visual materials characterised by the pictorial statistics, the Isotype Exhibition Technique for ‘visual argumentation’\(^{37}\), and a set of ‘Rules to keep in Mind’ concerning the structural organisation of exhibitions (with chapters, redundancy). The principles and procedural rules of Isotype-designs were
routinely documented and systematically developed to render best-suited visual statements. Thus, established best practice influenced the production of the next task at hand, producing a complex pictorial language in a semiotic approach, which allowed for both continuity and flexibility.

The practical organisation and didactic support needed to spread this encompassing Isotype approach is echoed in the composition of the kits for the GWM’s travelling exhibitions. These consisted of a series of charts with pictorial statistics (produced in a modular system), a manual with instructions for how to place and mount them (arrangement and overall structure, intended viewing position, organisation of information), and the support materials, such as booklets and slides for working with visitor-groups.

In short, everything [was] geared towards quick orientation and easy retention of information.

The ‘Isotype Exhibition Technique’ pointed out ‘rules’ for the visualisations, and for relating to the interests of the users more generally (among others): express in words only what cannot be visualized, avoid monotony, aim to satisfy varied interests, avoid overcrowding, unify charts and models, emphasize experiences of daily life. Neurath’s basic ‘rule’ in this context reads:

A picture made according to the Vienna method shows at first glance the most important aspects of the subject; obvious differences must be at once distinguishable. At the second glance, it should be possible to see the more important details; and at the third glance, whatever details there may be. A picture that has still further information […] is from the point of view of the Vienna school, to be rejected as pedagogically unsuitable.

The charts (pictorial elements, captions) had to be as clear in their ‘visual statements’ that these ‘three steps’ were sufficient to allow for various processes of observing, decoding, and recombining specific visually conveyed ‘information’. Pictograms and images used were without renderings in perspective, without hues or special reference to the optical of colours. But colour coding, and the ‘tactile’ qualities of lines and outlines were purposefully employed.

For Otto Neurath ‘reading’ a well-prepared Isotype chart was as easy as counting, grouping, and measuring—but had to be learned:
Reading a picture is like making observations with the eye in everyday experience: what we may say about a language picture is very like what we may say about other things seen by the eye. For example: the man has two legs; the picture-sign has two legs; but the word-sign ‘man’ has not two legs.41

The chart ‘Development of Amsterdam’ and the title page from the Rondom Rembrandt exhibition (cf. figs. 3, 4), and a New Year’s greeting card (fig. 5) provide good examples for different Isotype applications and the visual language.
The ‘Development of Amsterdam’, basically a ‘classical’ pictorial chart, uses symbols (pictograms), a guiding image (evoking a context necessary for the intended interpretation—here the coat of arms of Amsterdam), very little text (establishing that each of the man symbols represents ten thousand inhabitants), and is organised in vertical (time) and horizontal (amounts) axis/coordinate.

The title page of the exhibition-booklet (fig. 4) shows a different combination of text (two words) and five pictograms: the characteristic signature-like ‘R’ (used for Rembrandt, and for his artwork), the silhouettes of a man with palette and paintbrush (painter), of a man with backpack (migrant), two silhouettes a ‘Dutch’ house (home, living) and a sailing-ship (commerce); the last two also used in the New Year’s greeting card (evoking other interpretations).

Also the New Year’s Greeting, ‘ISOTYPE 1940’ (fig. 5) combined symbols, ‘like words’, with text elements (the heading; three words for the location: ‘The Hague Holland’; and the sentence: ‘The International Foundation for Visual Education wishes you a Happy New Year’). The visual arguments are rendered in the customary clear-cut imagery of Isotype, without painterly quality in the visual elements or composition. These symbols, partly also used in other interpretational contexts, e.g. in the Rondom Rembrandt charts, help to formulate other statements here. Most conspicuously the ‘logo’ of Isotype (the ‘figure holding a chart’) is repeated five times. For this specific purpose ‘put’ in ‘boat’-shapes ‘going’ in different directions, it holds up charts with symbols representing Isotype work, i.e. evoking the range of subjects treated by the International Foundation for Visual Education. There ‘are’: a worker
(stone-mason, inspired by an Egyptian hieroglyph); elements of pictorial statistics; a sailing-ship (commerce); a locomotive (traffic); an elephant (evocative of Neurath’s ‘pictorial signature’); an outline map of, and two symbols for ‘living’ in the Netherlands (silhouettes representative of a ‘Dutch’ house and of a windmill).

This incomplete and rough description—not mentioning e.g. colour, proportions or composition—clearly demonstrates how cumbersome a (necessarily not exhaustive) ‘translation’ of the visual message into words is, whereas the image is ‘open-ended’, and in its totality instantly given to the viewing capacity of the observer. Neurath often discussed these questions and propagated Isotype—visual education—as one possibility among others:

Frequently it is very hard to say in words what is clear straight away to the eye.
It is unnecessary to say in words what we are able to make clear by pictures.
[…]. Education has to put the two together, and a system of education has to see which language is best for which purposes.43

Isotype charts employed communicative elements from the linguistic and the pictorial, the text and image repertoires,44 and delivered a controlled, intermedial configuration for synoptic observing—rather than merely picture- or word-based, and/or temporally consecutive information. The potential for diverse interpretational approaches and the informative content developed was decided by the connections elicited from the users, not based on (previously internalised) knowledge of a subject or disciplinary systematic. This meant that conclusions about the meanings of the information presented were largely left to the viewers, as they actively had to study the information and seek relationships—a natural activity for scientists which was to be evoked also from the newly initiated users—confident, curious, and positive in a ‘club atmosphere’. Thus an Isotype exhibition was a dynamic, and process-oriented tool for argumentation where the verbalizations were delivering different ‘meditations’ and not finite conclusions.

The aim was not to deliver a product in legible signs, but to engage the users to actively ‘read’ (observe and combine) the visually conveyed facts, to argue a case from the information delivered, sensitive for and respectful of other viewpoints. The aim was to foster enfranchisement and empowerment, a tolerant and meditative ‘attitude’.
In *Rondom Rembrandt*, for example, the user was not told what was ‘to be seen’ in the works of Rembrandt, or about the complex research system and terminology used by art historians. Rather the exhibition provided opportunities to relate to the works of the ‘legendary’ Rembrandt on everyday terms. This enabled the user to establish confidence, to take the time, look, see, learn vocabulary, find out about possible categorisations and concepts, compare, meditate, and talk about the experience. Neurath coined a specific term for such a sense-based and egalitarian approach. He called it ‘humanising’, as opposed to a paternalistic ‘popularising’.

The exhibition *Rondom Rembrandt* provides an exceptional and ‘condensed’ example for how this Isotype-approach was applied for treating art-related matter.

**The Art-Related Exhibition *Rondom Rembrandt***

*Rondom Rembrandt* produced in Holland in 1938, was revolutionary in several aspects. Focussed on audience orientation, addressing hitherto underserved audiences, it proposed new approaches for engaging with art: There were new topics, a new type of venue, and a new funding scheme. Taken together and taken seriously, these had/have the potential to challenge established traditions of art history and conventional museum work. Neurath circumscribed the underlying socially/educationally founded rift like this:

There are people who are interested in Rembrandt’s paintings, drawings, etchings etc. [… They] may enter a museum or buy a book […]. There are others, who heard of Rembrandt, are interested in the famous man, like some of his pictures, but do not know how to come into closer contact with him.

*Rondom Rembrandt* was meant for those ‘others who [had] heard of Rembrandt’. As Neurath wrote:

In The Hague, Rotterdam, and Amsterdam we set up exhibitions in department stores. They were visited by thousands of people who ordinarily would not have gone to a museum.

These unusual locations underlined the effort to provide egalitarian opportunities for seeing pictures (art works) and for thinking and talking about them as
something other than ‘holy relics’. It made the act of ‘going to exhibitions’
easy and part of everyday concerns, a possible ‘cultural habit’ for the man
and the woman ‘in the street’. In the same vein, the key visuals used in *Rondom Rembrandt*
pointed at practical measures relating to the visitors’ life-circum-
stances (production and consumption of goods, transport processes, commod-
ity-features of specific historical times, Rembrandt’s family and influence in
society). This overall theme is beautifully ‘enacted’49 in the title page to the
accompanying exhibition booklet (fig. 4). The synchronic method and Isotype
methodology as had been applied to practical subject matter in the GWM’s
previous work (health, housing, social and economic development) was used
to conceptualise Rembrandt’s life and time. In argumentative and visual lan-
guage-like technique of presentation it made ‘the hero approachable’.50

Neurath did not try to directly change the classical art museums, but made
use of museum displays. Rembrandt’s works, as would have been known to
everyone in 1938 in Holland, were on show in the Rijksmuseum in Amster-
dam and the Mauritshuis in The Hague, while the exhibition was held at the
‘Bijenkorf’.51 Thus the originals in the traditional museum collections seem
to have provided the specialised disciplinary context.

*Rondom Rembrandt* was mainly organised with pictorial charts and made
extensive use of photographic reproductions (of artworks).52

As a whole it showed how an interest in the arts and an understanding of a
certain historical period could be developed by combining a well-arranged,
language-like technique of presentation.53

Not presupposing specialist knowledge or vocabulary, *Rondom Rembrandt* did
not primarily refer to customary categories of art appreciation, such as
painterly achievements or æsthetic qualities in Rembrandt’s works. In a social
historical perspective it embedded the artist, his work and innovations in the
changing circumstances—economic, technical, and social—of his time (figs.
6, 7, and 8).

The ‘language-like’ Isotype features included: a coherent system for exhi-
bition layout, design of individual elements (charts with pictorial statistics),
arrangements of photographs (reproductions of paintings) and maps, colour-
coding, interactive games. Pictograms (quantities) were used for: Rembrandt’s
works, (artistic) genres, pupils/artists, students, goods, or commerce. In some
occurrences (arranged in rows/groupings of amount pictures) these ‘asked’ for
Fig. 6

‘Rembrandt and his family’,
(chart from the exhibition Rondom Rembrandt using photographs),
(1938), I.C. T 1698,
Isotype Collection,
University of Reading.

Fig. 7

‘Rembrandt and his family’ and ‘Apprentices and painters influenced by Rembrandt’,
spread (pp. 8 & 9 from the booklet Rondom Rembrandt), (1938),
I.C. 3/2 -15, Isotype Collection, University of Reading.
counting, e.g. number and placements of (Rembrandt’s works in museums), economies (Rembrandt’s, art-market, general), population (of Amsterdam, Leiden), or students (which showed ‘at one glance’ how distant Rembrandt’s time was; cf. fig. 3). Lead images established a clear visual connection—for example the Dutch interiors (reproductions of paintings by other artists) to the respective social backgrounds of commissions for Rubens vs. Rembrandt (fig. 18).

Some practices of the specific discipline art history were also employed for the *Rondom Rembrandt*-presentations. These concerned observational skills (comparing, rating) and aimed at establishing a concept of chronology and stylistic development for Rembrandt’s oeuvre.
Fig. 10

‘Rembrandt in his painted selfportraits’
(chart from the exhibition Rondon Rembrandt using photographs),
(1938),
I.C. T 1687, Isotype Collection,
University of Reading.

Fig. 11

‘Changes in Rembrandt’s techniques’
(page from the booklet Rondon Rembrandt),
(1938),
I.C. 3/2, Isotype Collection,
University of Reading.
Referring to these charts (collage of photographic reproductions with ‘sequenced’ self-portraits of Rembrandt’s, fig. 10; his renderings of hands and faces, fig. 11) which helped to discern changes in Rembrandt’s style in the course of the different periods of his career, and to the colour coding (fig. 12), Neurath wrote:

This […] taught many things, you see immediately alterations in his gesture, in his personality […] how his brush is changing, from the first paintings to the last. We subdivided his life line, and gave each of these subdivisions a particular colour, from the young man’s green to the old man’s brown. These colours lead the visitor through the exhibition, the reader through the booklet.54

Neurath explained how this was attempted by showing ‘the brushwork’ in photographs of enlarged details of Rembrandt’s works (fig. 11), or with other synoptic collage-arrangements (fig. 13), and gave a reason, why:

[Also] the layman who now learns what research means […] likes that, assumed, that this knowledge does not ask for long hours of studies.55

The colour coding kept aware of fundamentally important background information (historical time and changing surroundings) without producing ‘visual noise’.

If we had not done this, we should have had to label all his etchings and paintings with their dates, thus burdening the visitor with more detail than he could absorb.56

Describing how the background of Rembrandt’s time was visualised in this exhibition, Neurath wrote:

What was his time, a visitor may ask? Where? […] You may show a picture of Leyden, which presents the town as an industrial one. An ISOTYPE brings a short history of the textile production in Leyden, the maximum period is identical with the Rembrandt period. You may present old colour prints, or paintings of old Amsterdam, and of Rembrandts Amsterdam—very nice and impressive town views.57
Fig. 12

‘Rembrandt’s paintings in the Netherlands’
(page 11 from the booklet *Rondom Rembrandt*),
(1938),
I.C. 3/2, Isotype Collection, University of Reading.

Fig. 13

‘Apprentices and painters influenced by Rembrandt’,
version with paintings indicating the contemporary background
(chart from the exhibition *Rondom Rembrandt* using photographs),
(1938),
I.C. T 1699 from 3.2-14.

Neurath first related to the interests and capacities of the envisaged users (which questions might arise? what subject-knowledge should be expected?) and in a second step suggested (appropriate) means of visualisations to choose from (a blend of Isotype and conventional images).

Organisational schemes of certain charts were specific to the *Rondom Rembrandt* exhibitions, and some charts, although treating the same topic differed in the versions for the exhibition and the booklet respectively. Examples are:
Rembrandt’s chronologically arranged self-portraits (figs. 10, 14), a chart relating to his time and contemporaries (figs. 15, 16), a map indicating the distribution of his works (figs. 12, 17), or the charts comparing art activities and markets of Rembrandt and Rubens (figs. 18, 19).
Fig. 16

‘Contemporaries and important events of Rembrandt’s time’, chart from the booklet (with signatures; pictograms for commerce, whaling, etc.), I.C. 3/2-42, Isotype Collection, University of Reading.

Fig. 17

Rembrandt’s Paintings in the Netherlands (chart from the exhibition Rondom Rembrandt using photographs), (1938), I.C. T1708, Isotype Collection, University of Reading.
The ‘visual weight’ of the pictograms rendered the extent of the artists’ thematic specialisations, and the text established the percentage-relation to their complete œuvres. Specific symbols (not difficult verbal terms) were used for the artistic genres (portrait, landscape, religious and mythological paintings). In the exhibition version, the additional lead images (showing a likely historic placement of the artworks) served as clues for the artists’ respective markets. In the booklet, this information is not visually conveyed.

In addition to the observational tasks, and as a special attraction, simple games (‘question and answer’ machines, devices for self-testing) were developed for the *Rondom Rembrandt*-exhibitions (cf. fig. 20). These provoked curiosity and engaged the users (physically as well as mentally) who were asked questions concerning the exhibition and would find out if their answer was right or wrong.
Fig. 19

Chart from *Rondom Rembrandt* booklet, comparing Rembrandt’s and Rubens’ subjects of paintings, using pictograms (1938), I.C. 2034, Isotype Collection, University of Reading.

Fig. 20  *Photograph of mock-up exhibition situation*, c. 1938, I.C. 5/15 (detail, T 1814), Isotype Collection, University of Reading.
Neurath underlined the importance of such concrete, practical provisions for interactivity and involvement, and pointed out that these had already been introduced by the GWM in Vienna. He also reported that the Rembrandt exhibition in department stores was ‘visited by ten thousands of people, who have been very interested in this new type of exhibitions and this new type of booklet’ and pointed at the deliberate combination of individual events, particular pictures, and analyses in detail, with environmental material, in the two different, but corresponding versions.\

In the booklet—with considerably more text—charts and photographs (some in symbol variants, as technically required with regard to viewing-size, reprographic-quality, cost of printed matter) and corresponding text were especially carefully matched. Marie Neurath described this as a new way of ‘bring(ing) text and pictures intimately together’. After the successful *Rondom Rembrandt*-project, a series of ‘Around [other well known artists]’ was envisaged, using this ‘pictures and text’ approach.\

The intentions behind such Isotype-enterprises can be summarised as follows: to make an art topic easily accessible—physically, intellectually, and emotionally. This concerned the use of unusual venues, as well as the democratic ‘visual language’ and the flexible and impressive visualisations of concepts. The text of the exhibition booklet ends as follows:

By [i.e. with the help of] only this booklet and the Isotype pictures one does not get to know Rembrandt: but maybe through his works. May this small collection be inspiring to visit the museums and to better get to know the Dutch Golden Age which also was the century of its greatest artist.

This conveys two especially pertinent points, namely as Neurath writes, with the booklet and the Isotype exhibition ‘one does not get to know Rembrandt: but maybe through his works’, and that the pedagogical task set out for the Isotype work was to engage, kindle interest, and inspire to go further.

Obviously (more than 70 years later), it is not possible to ascertain what *Rondom Rembrandt* ‘meant’ for the users. It possibly enabled the untrained lay-users to understand and use new terms, to work out categories of art appreciation, provided time for conversations, and with this helped them develop competencies for experiencing art. One effect seems clear: *Rondom Rembrandt*‘s presenting and networking these themes and diverse contextualisations in a dynamic and uncommon production structure/environment.
(as offered in the department stores), vastly enlarged the potential for learning and ‘meaning’. It touched new ground and provided an example of integrated and sustainable audience-orientation, a component necessary for (responsible) public presentations in museums and exhibitions.

The quality and success of the *Rondom Rembrandt* exhibitions had not gone totally unnoticed. In 1946, Paul Rotha, the influential British film-maker, had been invited as a speaker to the British Museums Association’s Annual Conference. In his discussion of visual communication techniques, Rotha reported on ‘the well-known work of the Isotype Institute’. He specifically pointed at its efforts in creating a ‘picture language’ and ‘orchestra of instruments for visual education’, and as an outstanding example mentioned *Rondom Rembrandt*.62

Still, there seem to be no other contemporary reactions or direct influence of this project in its own time. We have to keep in mind, however, that often Neurath’s work did not fit his contemporaries, as he was ‘not afraid of taking up untimely issues’.63 *Rondom Rembrandt* took place shortly before the Second World War, an extremely difficult epoch for European societies, and the venues, the department stores, put it (at least mentally) far from peer review or a disciplinary art historical or museological context.64

More recently, picture historian Astrit Schmidt-Burkhardt introduced a reproduction of a *Rondom Rembrandt* chart (fig 7; the Rembrandt family-chart) to discuss Gerd Arntz’s graphic style. Although earlier in the book she had referred to Neurath’s ‘Wiener Methode’ (Isotype), the connections were not made clear, and the underlying notions (exhibition purpose, user-context, language-like visualisations, team work) were not pointed out in relation to the Rembrandt-chart.65

What is seen in an image (artwork, diagrammatic chart, etc.) does not only depend on the competencies brought to the encounter but also on the socially developed and embedded instruments.66 This has to do with competencies in ‘languages’ or ‘language dependent’ communication systems (traditions), with trespassing customary disciplinary boundaries, and with attitudes. Neurath proposed a forum of research that draws upon the expertise and methods of several of the relevant disciplines—art history, perceptual psychology, anthropology—without presuming any one of these to be a complete explanatory model, but with the understanding that each must retain the rigour of its methods and yet be open to other approaches.

The most concrete revolutionary quality of Neurath’s museum work was its decisive and stringent perspective of the ‘future user’, its ‘constructivist’ and
collage-like work-method, corresponding to his basic concept of ‘orchestration’. In this work of ‘humanising’ specialist/expert work, to make it approachable and understandable for the average user (the broad masses without academic training), special importance was given to visual communication.

**Museum Work and Visual Argumentation**

In the Western world, systematic learning and the transfer of information are (not only seemingly) coupled to spatially and visually structured concepts (departments, sections, scripts, segments and strata) and ‘pictured as social facts’ in specific spaces (school, library, museum, laboratory, university). The breakdown of such conceptions (representative and constitutive), and the realisation of the fact that these are mental and communal (constructions/restrictions) and undergoing constant shift, is pushed by the new technologies offering new conversations, and characterised by the qualities and the ‘fluidity’ of the virtual and immaterial. Such traditions and conceptions are also challenged by taking seriously Neurath’s historic, but still provoking, ‘orchestrated’ enterprises.

The transinstitutional and cross-media aspects of visual culture, where museums and exhibitions figure prominently, make the museum a pre-eminent site for contested views of identity, power, and control. We are used to think about viewing images and media as a process of socialization in specific culture settings: who gets to produce images? Who gets to consume them, who can do both?

Within this complex, the art museum has traditionally played an important role in the transferral of art practices, and according to Pierre Bourdieu (1930–2002) has functioned as a legitimizing central higher authority. There, in the museum, which takes out of the original context of production and use, neutralises and re-loads with other qualities, the æsthetic disposition is produced and reproduced. As such, the art museum has also functioned as a socially distinguishing authority, as a ‘marker’ between pertaining and being locked out—heightening the social status of its patrons. Also more recent art-sociological research implies that the relationship between demographic background and consumption of art has not changed since that recorded by Bourdieu. The majority of the population lacks imperative empowerment and access to the ‘performed’ code. The museum is reserved for the affluent
and better educated. What is happening there is ‘shared’ within a specific segment of society—those capable of specialised (not necessarily academic) discourse, implying connoisseurship and rituals, with clear links to economic power and art markets. These ‘distinguishing’ differences can be internalised to a degree that they seem ‘natural’. However, they have to do with education, acquired competencies, and habits.  

Contrary to ‘pure’ art history concerned with intra-disciplinary refinement (discussions of iconology or iconography), a sociologically oriented art-science/art-studies (visual culture studies) not only takes into account the history of production, but the history of reception as well as that of the media for perception. In this context, *Rondom Rembrandt* can justly be seen as an important historical example. The traditions sustaining ‘distinction’ and perpetuating inequality as identified by Bourdieu’s work, were certainly worked against by *Rondom Rembrandt*, with its clear orientation at lay-audiences, in not art-related surroundings, and by introducing everyday common concerns, topics and questions, also echoed in the French sociologists’ research. Bourdieu identified similar clues as had been devised by Isotype-methodology, as pertinent and successful categories for establishing possible recognition formations for non-specialised audiences. *Rondom Rembrandt* proposed and carried through a previously unknown sociological structural approach and introduced novel observational categories, and with this, broadened the social base for meaning.

Research into the conditions or the results of museum/exhibition use had barely started in Neurath’s times. Also in this respect the GWM work must be seen as an early and exceptional example. Innumerable surveys and evaluations of museum visiting and learning have been undertaken since. These have delivered relatively stable pictures of audiences and visiting patterns, and confirm many of the less formally secured observations of an earlier date—as made by Neurath.

Nowadays research concerned with learning and communication in museums, based on constructivist epistemology emphasizes the dynamic and complex relationships between learning and social contextualisations. It also clarified that the learner’s own perception of learning and of her/his individual situation in this process constitutes an influential component of learning, and underlines the importance of incorporating appropriate ‘conceptual frameworks’, as well as of providing assistance for the users to ‘make sense’, and applying principles of interpretation and learning, to museum displays.
Neurath did not narrowly focus on the visual within the boundary of traditional humanistic scholarship, or ‘high culture.’ His concept surpassed what has been divided into ‘high’ or ‘fine’ art and ‘low’. He related to informational design, museums and exhibitions, books, films, architectural concerns, and employed the most diverse media and strategies in his Isotype work, using the visual for (visual) communication. Today, the visual is often studied in such a less bounded fashion, as the new paradigm of ‘visual culture’ represents a holistic and encompassing approach to the visible world. As expressed in his ‘visual autobiography’ and often underlined by Neurath—also by the conglomerate materials and strategies he referred to—the worthiness of visual material or practice, as an object of study, depends not on its inherent art-qualities, but on its place within the context of the whole of visual cultures. Neurath encouraged looking at matter under scrutiny from many sides and considering all implications, as a meditative mood and democratic ‘scientific’ attitude should imbue all of society.

Contemporary museum discourse is characterised by (verbalized) ethical notions and concepts such as inclusivity and democracy, by interdisciplinary, multifocal, co-operational and international structures. This again evokes Neurath, who pointed at social contingencies, renounced all foundationalist conceptions, and definitely related sustainable advancement of societies to a general sharing in democratic and egalitarian structures, and to an increase in
the quality of the lives of the many. Neurath aimed for an inclusive democracy and underlined that provisions for learning, communication and exchange were necessary. He saw museums/exhibitions, predominantly visually organised, as constituting powerful tools with great potential for playing an active role in this painstaking process of general advancement. 

For museums and exhibitions the main question is: How to start a comprehensive scheme and then to reach the detail, what’s the argument and not what does the director want to present. Single objects on view should be linked by illuminating schemes. 

Indeed, museums, through their educational power can be important engines for social change. By some museum workers, education has been addressed as ‘the essence of museums’ and as ‘the most potent weapon at our disposal’. In practice, however, realisations are often confined to a pragmatic attitude, aiming at peer review levels, and frictionless implementation within the limits of the already accepted.

More than half a century after Neurath’s critical work, the newer findings confirm his methodological approach, the importance of the visual, and, most importantly, that it is the fundamental aspects, touching on the structures and characteristics of the traditional museum, which need to be rethought and changed, in order to provide for more relevant institutions, for a ‘museum for the future user’ engaged in the important business of ‘picturing social facts’.
Notes

2 After 1934, the initial name Vienna Method of Pictorial Statistics was given up in favour of the acronym ISOTYPE – International System of TYpographic Picture Education.
4 The material from the Isotype Collection is referenced here as: I.C. followed by the archival reference number (e.g. I.C. 3.2/42).
6 Cf. This article is a revised version of a paper given at the workshop ‘Picturing social facts. On Neurath’s visual language. Gesellschaftliche Tatsachen darstellen. Zu Neuraths Bildersprache’ in the framework of the 33rd International Wittgenstein Symposium in Kirchberg, Austria, August 8, 2010. An extensive treatment of this aspect of Neurath’s Isotype work is found in Kraeutler 2008.
7 Gopnik 2007: 3.
11 For a contextualisation of Otto Neurath, the philosopher, sociologist, political economist, historian, and information on his life and work, see Stadler 2001.
13 Cf. the topic of the Neurath-workshop at the Wittgenstein Symposium 2010 (see note 7).
18 Neurath 1996: 331.
19 Neurath: ‘The Isotype-method was developed as the result of practical exhibition work’ (Neurath 1991: 417).
23 The term ‘visual literacy’ is used to mean experience with the workings of visual media coupled with a heightened conscious awareness of these workings. Four consequences are commonly said to flow from visual literacy: comprehension of visual media, transfer of cognitive skills from the interpretation of visual media to other tasks, awareness of visual manipulation, and æsthetic appreciation (cf. Raney 1997: 15).
24 Neurath 1936.
26 Neurath was concerned with Basic English, Esperanto, Interglossa (Neurath 1996: 335); Basic English is a restricted language, limited to 850 English terms, cf.: Neurath 1936 (reprint 1980: 6).
30 Neurath 1936: 16.
31 Neurath 1936: 18.
32 Neurath 1936: 19.
34 Neurath 1996: 333.
37 Neurath 1936: 65–73; 1991: 275, 594–595; Marie Neurath 1974: 130; Cf. the teaching strategies identified in Raney (1971). The clear case for visualisation, visual literacy, and visualisation skills as core skills and essential to thinking has often been argued (Kress and Van Leeuwen 1996; Pink 2006; Sturken and Cartwright 2001).
39 Neurath 1991: 197 (italics as in the original).
40 Neurath 1973: 223 (1925). An abbreviated version of this is used as the introductory paragraph to the chapter ‘The Chief Points of the ISOTYPE System’ (Neurath 1936: 27).
41 Neurath 1936: 20.
43 Neurath 1936: 26–27.
44 Both information modes are basically differently structured, employ different sets of elements and rules—disjunctive symbolic orders/structures—and imply activating respective modes of recognition, use, combination (cf. Krämer 2009: 157–159).
47 Cf. Neurath, ‘Around Rembrandt’ (I.C. 3.2/42). This typescript was written in English, i.e. not Neurath’s mother tongue. No changes in vocabulary, spelling or punctuation were made in the transcripts used here.
48 Neurath I.C. 3.2/42.
49 Cf. the caption used for this image in Neurath and Kinross 2009: 57.
50 Neurath I.C. 3.2/42 (italics as in the original).
51 *Rondom Rembrandt* was sponsored by the Dutch department store De Bijenkorf (on the occasion of Queen Wilhelmina’s 40 years’ jubilee) for simultaneous showing in the sales venues of three of its branches, 1–15 September 1938. The main outlet is situated just across the ‘Gracht’ (canal) from the Rijksmuseum.
52 Cf. Laurie 1932.
53 Neurath, I.C. 3.2/42.
54 Neurath I.C. 3.2/42; Cf. footnote 30.
55 Neurath I.C. 3.2/42.
56 Neurath I.C. 3.2/42.
57 Neurath I.C. 3.2/42 (capital letters as in the original).
58 Neurath I.C. 3.2/42.
59 Marie Neurath in Marie Neurath and Robin Kinross 2009: 59.
in Vienna. The talk for the MA was about ‘The film and other visual techniques in education’ (Rotha 1946: 141–145).

64 Enquiries regarding possible material evidence or documentation of the exhibitions had been directed to the Bijenkorf Archives (Amsterdam City Archives), the Rijksbureau voor Kunsthistorische Documentatie (The Hague), and the Rijksmuseum (Amsterdam). These pointed out that Rembrandt-exhibitions had been organised by the Rijksmuseum in Amsterdam in 1935 (centenary) and in 1938 (letter from Rijksmuseum, Amsterdam, NL, of November 30, 1990). The Rijksmuseum’s library has a copy of the *Rondom Rembrandt* exhibition-booklet.
66 Kastner 2009: 106.
69 Bourdieu and Darbel 2006: 74.
72 See the overview in Kirchberg 2005.
75 Kraeutler 2008.
76 Neurath 1996: 312.
**Literature**


Raney, Karen. *Visual Literacy. Issues and debates, Report on the research project ‘Framing visual and verba Experience’, a collaboration between Middlesex University and the Arts Council of


Permission for reproduction of photographic and other documentary materials used for this article is gratefully acknowledged. The full credit reference is: Otto and Marie Neurath Isotype Collection, Department of Typography & Graphic Communication, University of Reading, UK.(http://www.reading.ac.uk/typography/)
The potential of Isotype for communicating to diverse, international audiences is generally attributed to the simplified imagery it employed to produce compelling and easily understood visual explanations. While it frequently supported and was supported by verbal language, Isotype’s ‘picture language’ circumvented linguistic complexities and the obstacles to communication they created. The emphasis placed on the international application of Isotype is embedded in its name and in the title of Otto Neurath’s *International picture language*, the book that describes Isotype most fully. But how effective was Isotype when deployed beyond the modernised West where it was mainly used? An answer does not come readily to hand since very few opportunities arose to test it in the developing, non-Western world during more than four decades of Isotype activity. One opportunity, however, did arise through work in British colonial West Africa. Between 1952 and 1958 commissions were undertaken in Sierra Leone, Nigeria and the Gold Coast (Ghana), countries then moving towards independence (figure 1). Those in Nigeria, for its Western Regional Government, were the most substantial and provide some evidence of how Isotype fared at the further reaches of the international sphere its inventors hoped it might serve.

Before the Isotype Institute’s contact with Nigeria, its director Marie Neurath had never visited Africa; nor had her late husband Otto. But Africa was, in key respects, fundamental to Isotype. It was there that knowledge about economy, governance, health, agriculture and much else was urgently needed; and there that conditions of sub-literacy or illiteracy were thought at once most suitable and most challenging for visual education. Such conditions offered the
possibility of testing the claim that visual education in general and Isotype in particular—conceived and, by 1940, deployed only in Europe and North America—could function effectively beyond the West.\(^3\)

Despite the lack of opportunities early on to test Isotype so far afield, a substantial meeting with Africa did draw near in 1943 that hints at how it might have been used in this context. That year Otto Neurath and the Isotype Institute became involved in plans for a travelling exhibition about Africa, initiated by the British Colonial Office (figure 2). A proposal for the exhibition, titled ‘Human life in Africa’, was written by Neurath; it was informed by the view that Africa should not be placed in ethnographic isolation but instead seen as having much in common with Britain. Human knowledge in both places was essentially comparable if not always developed to the same extent. This view is seemingly reinforced by the proposal’s display strategies that make no concession to differences among those attending the exhibition, whether in Britain or in Africa. A meeting with the Africans should therefore take place on (more or less) equal terms through communication techniques able to reach a variety of audiences. As Neurath insisted, ‘the cosmopolitan pure human approach should prevail.’\(^4\)

By the early 1950s, and after Otto Neurath’s death, Africa was finally met when Marie Neurath and the Isotype Institute became involved in publishing initiatives there. These were being pursued by the London-based book packaging company Adprint; it, in turn, had been encouraged by the British Colonial Office, which ‘wanted parts of West Africa … linked by magazines and books’.\(^5\) The work would be handled through a new Adprint subsidiary, Buffalo Books. The Isotype Institute had already contributed to numerous Adprint publications since the early 1940s and Buffalo Books was an...
The first project was a prospective colour magazine named *Forward*, developed in consultation with several West African governments (figure 3). A trial number was produced in English and vernacular languages, and incorporated articles, illustrations and comic strips by West African writers and artists; Isotype contributions included illustrated diagrams. Despite its encouraging blend of content, *Forward* made it no further than its trial number, issued in the Gold Coast (Ghana). But other, related initiatives were already well underway, now with the government of the Western Region of Nigeria.
The 1950s were a unique period in Nigerian history. Over the course of the decade the country made increasing gains in self-determination until, in 1960, it achieved full independence from Britain. Much of Nigeria’s growing independence during the 1950s was exercised regionally, and of its several regions the governance of the Western Region was by some distance the most politically and socially progressive. In 1953, the British Government convened one of a series of conferences intended to strengthen Nigeria’s constitutional footing in the period leading up to its anticipated independence. One of the Western Region’s delegates was Obafemi Awolowo who, as Minister of Local Government and leader of the ruling Action Group party, shaped the region’s political programme (figure 4). While in London he was introduced to Isotype and the possibilities it held for communicating his government’s programme of reform to the Western Region’s people.8

In her memoir ‘What I remember’, Marie Neurath recalls her first contact with Awolowo:

One day Awolowo … was expected. Foges came to me with a short text by him and said: ‘I would like to make clear to these people that they need visual methods in their country; read through this text quickly and make drawings for its main theses; not that [Awolowo] wishes to illustrate it; he should just see how pictures would help him.’ So I read quickly, plucked out a few points, and made some pencil sketches on slips of paper. I was there when Awolowo arrived in his Yoruba robes, together with his private secretary. After a while
my sketches were given to him; he looked at them quietly and began to talk with his secretary; ‘how could we best use them?’

The sketches shown to Awolowo included simple visualizations of federal structures, indirect and direct elections, political hierarchies, and constituency make-up (figure 5). His response must have offered cause for optimism, as shortly she afterwards wrote ‘It is a pleasure to see how quickly these highly intelligent representatives grasp the roughest of my sketches, and how the method seems to appeal to them’. Awolowo’s ‘grasp’ suggests that he quickly understood Isotype and the possibilities it held for the Western Region.

Some months after her meeting with Awolowo, the Western Regional Government invited Marie Neurath to Nigeria to develop a programme of public information. Her title would be ‘Visual Aids Expert’ and she would be based in the regional capital Ibadan. A first trip would take place from June to September 1954, with a second planned for the following year. Both trips would take her away from London and the Isotype Institute for lengthy periods. That she accepted such arrangements as necessary (though she declined a first proposal of a single 6-month stay) indicates her understanding of the importance of local immersion. While this was no doubt a practical arrangement, giving her direct and on-going contact with ministers and civil servants in the Western Region, it also enabled her to experience conditions on the ground. She could observe how, where and by whom visual aids were used—if at all—before resolving on how Isotype work might be best designed and integrated into the local scene.
Fig. 6

*Education for all in the Western Region*, front cover, Ibadan: Western Regional Government, 1955, 204 × 163 mm.

Fig. 7

*Education for all in the Western Region*, pages 2-3.
Among the first items on Marie Neurath’s itinerary after arriving in Ibadan were visits to primary schools. The visits headlined in regional newspapers and the accompanying articles describe what she saw of education both in the capital and in nearby villages. She encountered a range of visual aids made by pupils that dealt with topics such as water supply, imports and exports, geography, health, agriculture and basic maths; and she was impressed by their efforts. Another experience had even more direct consequences:

Already in London I had been given a ‘white paper’ on education to read …. From this I had designed a large summary chart; it went straight into the wastepaper basket after I had walked through the streets of Ibadan; why should these people have to struggle with my chart? I made a booklet of 16 pages out of it; problems, tasks, solutions were shown step by step. This format was retained for all the other subjects.

The booklet to which Marie Neurath refers, *Education for all in the Western Region*, was the first in a series that would explain the government’s plans for social reform and betterment in simple and direct terms (figure 6). Booklets were commissioned by ministers in connection with their portfolios and became known as ‘White Paper’ booklets. For each booklet, effort was initially directed towards identifying and detailing themes. Designs then evolved through a series of mock-ups with visualizations and texts that depicted and narrated existing circumstances in the Western Region and how reforms and new initiatives would lead to improvements in the lives of all. The aim was to explain rather than instruct. Work was mainly done in the Ministry of Education where Marie Neurath was given an office. Throughout the process ministers and civil servants played an important collaborative role in shaping content, reviewing design work in progress and resolving details of a specialist nature.

The results can be seen in the printed booklets. In the first spread of pages in *Education for all*, for example, a blend of local content with Isotype technique plays out in a scene whose function is to introduce the benefits of education (figure 7). Pictograms are integral to the scene but among them are figures whose profiles are naturalistic and whose clothing is in the Yoruba style. The figures assume postures typical of village living: a child sits on the ground, a woman with a child strapped to her back kneels over a cooking pot, a chicken pecks the ground. The houses as depicted are made of mud, straw
and timber, or cement block and corrugated iron. These locally identifiable elements are then brought together using a familiar Isotype strategy: comparison. Parallel village scenes each include a box that frames a child’s development with and without education; alternative outcomes and the material benefits of education are made plain. Text is precisely keyed to the graphic arrangement and reinforces the pictorial narrative.

In a second example, *Better farming for better living in the Western Region*, the visual argument again begins with local elements: crops and agricultural processes indigenous to the Western Region (figure 8). These are shown on subsequent pages in scenes and contexts that are at once familiar to farmers (the booklet’s intended audience) and newly configured to illustrate how cooperation and partnership with the government would bring about change (figure 9). Graphic sequences present farmers and officials facing problems and finding solutions; comparisons show improvements in methods and productivity. Throughout, text is structured in parallel to graphic matter, further explaining scenes or clarifying issues. As in all of the booklets, the English is plain and clear. This was no doubt done to accommodate audiences of mixed reading abilities, but also in anticipation of the text’s translation into the vernacular Yoruba, in which specialist terms might not be available.17

By the end of her first visit, Marie Neurath had completed work on several booklets and agreed their design and accompanying texts with government officials. When she returned to the Western Region in late February 1955 for a second three-month stay, proof copies of several booklets were in hand (figure 10); these she was eager to try out on their intended users.18 She again visited schools where, at one school, *Education for all* was handed out to several classes. The pupils reacted to it with enthusiasm and curiosity. Notes taken by their teachers record the pupils’ understanding of graphic comparison, before-and-after scenarios and relative advantage or improvement. The notes describe classroom scenes in which teachers led the looking and reading, but where pupils also gathered around and pointed to the booklet’s pictures. These interactions sometimes led to more detailed teaching demonstrations or to complementary activities.19 *Better farming for better living*, on the other hand, was tested out on farmers, though exactly where and how these encounters played out is not clear. Marie Neurath did venture into a forest one day to a nearby village where she gave the booklet to a family, to study their reactions. They were intrigued and asked to keep
Fig. 8  *Better farming for better living in the Western Region*, pages 2-3, Ibadan: Western Regional Government, 1955, 204 × 163 mm (single page).

Fig. 9  *Better farming for better living in the Western Region*, pages 14-15.
it. Reflecting on her experiences, she concluded that in general the booklets functioned best when they were looked at collectively (as in schools), then taken home and absorbed there.20

Other work completed around the time of Marie Neurath’s second trip to the Western Region included a series of ‘poster-leaflets’ on health topics, designed for use in surgery waiting rooms (figure 11). These had been conceived the previous August while Marie Neurath was in Benin City to learn more about health care provision. There she visited a leprosarium, a hospital, several first aid stations and a surgery. Seeing the surgery’s waiting room ‘crammed full’ of patients returning again and again with the same complaints, she suggested producing educational pictures with which medical assistants could explain to patients, while they waited, the nature of their condition and how it could be prevented. ‘They would then perhaps grasp what they were doing wrong and how they should do it better.’21 She consulted the resident doctor (Ogunlesi) about which health care themes he considered most pressing and with him decided to address four: food, water, leprosy and tuberculosis. Poster-leaflets in a 2-fold format were then produced in English and Yoruba. Unfolded, they could be displayed on a wall; folded, they could be taken away and studied at home. The poster-leaflets again combine locally familiar figures and scenes with graphic configurations typical to Isotype.
In places, generalised pictograms work side-by-side with specific ones; in one instance (‘Leprosy’) ‘Nigerian man’ examines ‘Isotype man’ to assess his condition (figure 12).

Among the projects completed by the Isotype Institute in the Western Region, those associated with election processes should also be mentioned. The work involved the design and production of posters and booklets for regional elections. The booklets gave instructions on how to register for the election, and how and where to vote; the posters variously identified registration and polling stations, and illustrated the voting process. A poster was also made to
explain the Western Region’s structure of government; it is unusual in that it is the only design among all the Nigeria work that relies wholly on generalised pictograms. Overall, the programme of information on voting was considered a success, as attested by a government minister who informed Marie Neurath that voter turn-out in the Western Region had been double that in the Eastern Region. He was convinced that Isotype deserved the credit.23

Apart from the work so far described, Marie Neurath undertook another initiative during her second visit: the establishment of a Visual Aids Office in Ibadan. A memorandum was drawn up detailing how a team of local workers would be recruited and trained.24 The team would include a teacher, who would act as the transformer, an artist, and a technical assistant. Training the team would be in the hands of Marie Neurath. Crucial to the new office, as she saw it, was the need to test work on the local population. It is clear that she harboured some doubts about the effectiveness of Isotype work in the Western Region up to that time: after remarking ‘Our visual material should be understandable to the literate, and easily explained to the illiterate’, she admitted that ‘How far it fulfils these claims has still to be tested.’ To find out, she suggested setting up a permanent exhibition site where designs could be shown and public’s reactions noted. She also recommended conducting tests in locations where she herself had done so, including at schools in villages and towns, in hospital waiting rooms, among village farmers and in adult education classes.

Considerable efforts were made by Marie Neurath to find candidates for the Visual Aids Office. The tone and phrasing of the memorandum, however, suggest that she was not entirely optimistic about the prospects:

In the course of training, a number of such pamphlets [i.e. like those already made by Isotype] should be produced by the Nigerian trainees under the supervision and guidance of members of the Isotype Institute. The rate of such production will obviously be handicapped; unsatisfactory work will have to be repeated; unsuitable trainees will have to be replaced.

But the initiative never got that far, as no suitable candidates were found. Whether for this reason or for other political or financial ones, the government gave only qualified support to the plan, and by the end of Marie Neurath’s second stay the possibility of establishing a local office and training scheme had been given up on. Efforts continued in London where
a promising candidate was identified. Surviving documents record the heavy programme of training he embarked on; it involved intensive exposures to cultural products including films, exhibitions and books, and instruction to develop his critical and artistic faculties. But for reasons that are not clear, this initiative also faltered and came to an end.25

These, then, were the main projects completed in the Western Region by Marie Neurath and the Isotype Institute, as part of the Buffalo Books partnership.26 In retrospect, the Isotype Institute’s engagement there was brief but significant. The Nigerians were undoubtedly enthusiastic about this new and colourful visual method, and the Isotype Institute produced work of a high standard. After 1957, however, the projects fell away. It may be that the programme of public information had simply fulfilled its brief, culminating in the 1957 regional elections. Thereafter and in the run-up to Nigerian independence (1960), one might surmise that more immediate political concerns occupied the attention of the Western Regional Government at the expense of projects like those it commissioned from Isotype.

In her memoir, Marie Neurath offers little by way of summary. She remarks only that

it was good that we were able to have this experience. Otto had said that we were creating the method not, finally, for the Viennese, but rather for the Africans, and so it proved. That we had to alter the symbols for man, woman, house and so on in the process, was within the scope of the rule that the symbols should ‘speak’, that is, be immediately understandable. The international character was maintained in the basic approach.27

This approach, of course, was Isotype’s underlying techniques of graphic explanation whose effectiveness had been demonstrated through long application. But Marie Neurath also points out what may at first seem paradoxical in Isotype: that to enhance its international effectiveness, it had to take on a more local flavour, its existing elements (pictograms and other visualizations) requiring variations that were identifiably of the place. This international character was based not on inflexible universality but on negotiated accommodation: the familiar had to be adopted if Isotype was to be usable.28

If one returns to Otto Neurath’s *International picture language*, one sees that his notion of Isotype is similar to Marie Neurath’s summary statement. It is of an approach intelligible to all, but one that was flexible, that could
produce specific meanings, and where necessary could be supplemented or updated. What is missing though is the extent to which international differences needed to be afforded, as Marie Neurath later discovered through her contact with Nigerian audiences. And this suggests something else that goes unacknowledged in *International picture language*: that if Isotype was to indeed function internationally, it needed to be taken places and created there. The envisioned demands of the Nigeria work surely compelled Marie Neurath to experience the place and meet the people—the subject experts. When reading her recollections, one realises how much of it is devoted not to the work itself but to descriptions of a country that was very different from any she had previously encountered. Flora and fauna fascinated her, as did people and places, and her many encounters with Nigerians young and old were clearly experiences she wished to preserve. They show her getting to know the place, knowledge that was surely crucial to getting the work right.

Finally, the Isotype Institute’s work in the Western Region of Nigeria demonstrates the challenges of operating internationally. The several instances of Isotype’s export to distant places—geographically or culturally—show that spreading it so far afield could be difficult, whether in the Soviet Union, North America or Africa. The right conditions of commission, application and dissemination were essential before it became usable in these places; and thereafter its long-term success was hardly assured. Especially problematic were local offices for making work based on Isotype principles; where they could be established and suitable locals recruited (neither of which happened in Nigeria), considerable time and effort were needed to secure good working practices. But would the work go on being done correctly? And how long could an office continue when financial resources became scarce or the political situation unstable? These mundane contingencies also make up Isotype’s international character or, at the very least, are a consequence of it. They contain the risks of spreading it internationally while highlighting how much was in fact achieved under the circumstances.
Notes

1 For a fuller exploration of the putative language aspects of Isotype, see Christopher Burke’s essay ‘The Linguistic Status of Isotype’ in this volume, 31–58.


4 ‘Human life in Africa’, first draft, July 1943, Otto and Marie Neurath Isotype Collection, University of Reading (hereinafter ‘IC’) 1/44. Neurath’s proposals were produced for Rotha Films, with which the Isotype Institute was to collaborate. Although the proposal and associated planning documents refer to an undifferentiated Africa, there are indications that the Colonial Office was directing ‘Human life in Africa’ towards Britain’s West African colonies. Plans for the exhibition were eventually abandoned. Neurath continued to pursue the idea, however, through correspondence and exchanges with Sir Hanns Vischer of the International African Institute in London (see IC 1/6 and 1/11). Arrangements were made for Neurath to meet African students at the institute to discuss Isotype and visual education; it is not clear if this meeting ever took place, following Vischer’s unexpected death. I am grateful to Christopher Burke for drawing my attention to these documents.


6 Buffalo Books was set up to undertake projects in the developing world and was a partnership of expertise between Adprint, the Isotype Institute and the printers Purnell & Sons (which owned Adprint); ‘Reaching the people’, draft text for a Buffalo Books capabilities booklet, c. 1956, IC 3.2/178 (typescript). The Weiner Library material (cited above) also contains notes about Buffalo Books, though
these are faulty in places, as suggested by Wolfgang Foges, who recorded them some 30 years after the events described and without supporting documents. Although Foges was also the managing director of Buffalo Books, day-to-day operations were in the hands of Frame Smith.

7 ‘[Forward] was well received by the public, and editions in several local languages were issued by the Gold Coast Vernacular Literature Bureau. The experiment proved, however, that under the conditions of marketing and distribution obtaining at the time, the regular issue of such a periodical, however well suited to its purpose, was not at the moment an economic possibility.’ ‘Reaching the people’, cited above. Related initiatives in the Western Region of Nigeria were likely connected with Forward; evidence comes from a colour supplement (printed proof) depicting government structures and activities in the Western Region, together with notes and rough drawings, all of which remain among the Forward working materials. The notes outline plans to visualise a series of development issues in the magazine, issues that would comprise much of the Nigeria work subsequently (discussed below). IC 3.2/165.

8 That Marie Neurath met Awolowo in 1953 (August) in London cannot be fully confirmed by documents in the Isotype Collection. Their meeting at that time is surmised by Awolowo’s presence at the constitutional conference in July and August; and by Marie Neurath’s report soon after of a first meeting with an unnamed Nigerian minister; see Obafemi Awolowo, Awo: the autobiography of Chief Obafemi Awolowo (Cambridge: Cambridge University Press, 1960), 180; and Marie Neurath, letter to Waldemar Kaempffert, 23 September 1953, IC 1/47. As leader of Action Group, Awolowo was, in effect, the Western Region’s prime minister; in October 1954 he was formally named Premier.

9 ‘What I remember’, unpublished typescript, 94–5, IC, unaccessioned. This text was written in 1980 in German, and translated into English in 1982 by Robin Kinross. It bears some relationship to a shorter text written by Marie Neurath in 1986 which focuses on her visual education work; the latter has now been published as ‘Wiener Methode and Isotype: my apprenticeship and partnership with Otto Neurath’ in Marie Neurath and Robin Kinross, The transformer: principles of making Isotype charts (London: Hyphen Press, 2009); the account of the Nigeria work in the latter is considerably briefer than in ‘What I remember’.

10 IC 3.2/165. The sketches are grouped together with a minority report issued by Action Group for the 1953 conference. This is probably the text handed to Marie Neurath by Foges; it covers issues similar to those she sketched.

11 Marie Neurath, letter to Waldemar Kaempffert, 23 September 1953, IC 1/47.
This in keeping with earlier Isotype projects, in the Soviet Union and to a lesser extent in the United States, both of which involved Marie Neurath and others in lengthy stays abroad while work was planned and (in the Soviet Union) made locally.

Southern Nigerian Defender (22 July 1954; lead story), Nigerian Tribune (22 July 1954), and Daily Times (24 July 1954); the articles excerpt or reproduce in full a text apparently supplied by the government’s press office. IC 3.2/169 (newspaper cuttings and typescript).

‘What I remember’, 95–6, cited above.

Marie Neurath recorded how the commissioning happened: ‘I had a discussion about my work in the house of Awolowo, the prime minister; I first had to design a booklet about schools—general education was just being introduced—together with the minister of Education, Awokoya. During the discussions, the minister of agriculture, Akinloye, said that he wanted to have a book too. The minister of health, Ighodaro, soon introduced himself as well; Chief Akran gave me access every time I needed any help; I probably spoke with him most when I was preparing the more general booklet, “Paying for progress”.’ ‘What I remember’, 95, cited above.

It is notable that new pictograms were devised for the peoples of the Western Region despite the availability of existing pictograms of Africans. The latter, used in a succession of Isotype charts representing the world's human groups and incorporating highly generalized physical features, clothing and headwear, were clearly not relevant to the specificity of the Nigeria work. See, for example, Gesellschaft und Wirtschaft (Leipzig: Bibliographisches Institut, 1930), plate 96.

Here, and throughout the work for the Western Region, graphic arrangements were designed with sufficient space to allow for English texts to be substituted with Yoruba. One might regard this feature—present in nearly all Isotype work (whether it was made use of or not)—as a specifically international one that accommodated language variations.

For most of the Nigeria projects, design work was done in the Western Region, while print-ready artwork was completed later in London. In this respect, work arrangements were similar to those adopted in the late 1930s, when design work done by Otto Neurath and Marie Reidemeister in the offices of the National Tuberculosis Association in New York was subsequently made print-ready at the International Foundation for Visual Education in The Hague.

‘What I remember’, 98, cited above. The notes made by teachers, written on small sheets of paper, were given to Marie Neurath afterwards; IC 3.2/171.
20 ‘What I remember’, 98, cited above. It appears that Marie Neurath was not present when *Better farming for better living* was tested on farmers.

21 ‘What I remember’, 97, cited above. A precedent for this idea can be found in remarks made by Otto Neurath some years before: ‘Sometimes one has to give health instruction or information on agriculture or on citizenship, without having time for preparatory teaching. To influence sub-literates posters and picture sheets combined with the minimum of words may be used with advantage.’ Otto Neurath, ‘Visual education’, 264, cited above.

22 It appears that a first booklet, *Voting in the Western Region of Nigeria* (1955), was produced in preparation for regional elections in 1956, and a second booklet, *Registration and voting in the Western Region of Nigeria* (1956), for regional elections in 1957. There is no record of how the booklets were distributed; the posters were apparently used on-site at registration and polling stations.

23 ‘What I remember’, 98, cited above; the minister was Rotimi Williams, then Minister of Local Government.

24 ‘Memorandum on training for visual education’, typescript, IC 3.2/171. Quotes that follow are from this source.

25 IC 3.2/172; the candidate was J. Isi Afiari.

26 There were a number of other, mostly minor, projects undertaken in the Western Region that are not discussed here, as well as several publications produced for the Gold Coast (Ghana) and Sierra Leone. Throughout all the work in West Africa, it is broadly accurate to attribute design elements to the Isotype Institute, and production (project management, international liaising and logistics) to Buffalo Books, and Frame Smith in particular.


28 Marie Neurath articulated this most fully in ‘Isotype’, *Instructional science*, vol. 3, no. 2 (July 1974): 147: ‘Becoming citizens of the world we gradually recognised that our symbolism was often international for western man only. More than before I recognised this when I had to work out ways of informing the Nigerian people about health, education, agriculture, voting etc., in visual terms. Man, woman, house, plants, markets, trees … all had to be drawn in a different way to be understandable in that country. Also the approach, the speed of information, the colour scheme, the ways to catch the attention—all had to be different.’ Similar remarks occur in her article ‘The origin and theory of Isotype’, *Year book of education* (1960): 117, where, in reference to the Nigeria work she states: ‘Every chart has to represent a familiar visual background—adherence to the method
cannot go so far as imposing an alien background on those unable to share one’s experience of it.’ These latter remarks occur in a section titled ‘The universality of Isotype’, though it is notable that here Marie Neurath refrains from describing Isotype as ‘universal’, preferring ‘international’ instead; she only goes so far as to describe Isotype as ‘an elaboration of the child’s approach which is more or less universal ….’ However, in her article ‘Otto Neurath and Isotype’, Graphic Design, 42 (June 1971): 19, she writes: ‘The method and the approach are, I think, more universal than the symbols are. I had to discover this when I worked for Africans for some time. I had to make things clear to them, and I could not force our “international symbols” on them. … When things are equal all over the world the symbols can be the same.’

All images except figures 1 and 4 are taken from material in the Otto and Marie Neurath Isotype Collection, University of Reading.

This essay is part of ‘Isotype revisited’, a research project conducted in the Department of Typography & Graphic Communication, University of Reading, and funded by the Arts & Humanities Research Council (UK).
The starting and the reference point for this article lies in Otto Neurath’s Isotype (International System of Typographic Pictorial Education) which was developed as an international picture language from the late 1920s onwards up to Neurath’s untimely death in 1945. Even eighty years after its rapid construction phase, Isotype remains a huge source for inspirations and a reference point for promoting visualization in a most comprehensive way, albeit within the restrictions and constraints of the technological settings of the 1920s or 1930s.¹

In the subsequent article, three major issues will be addressed. The first part provides an assessment of the relative importance of visualization in contemporary science and society and gives a preliminary answer to the question whether visualization should still be considered as an important scientific or societal topic. The second issue deals with rapid changes in information and communication technologies and a general drift towards a digital information and knowledge base. Within these great transformations the question will be answered whether Neurath’s mode of Isotype-production should be adapted or accommodated to today’s scientific or societal environments. Finally, the third topic deals with a relatively new visual medium which can be classified as visual data analysis (VDA). VDA is a new visual way for analyzing complex micro data sets in the social sciences within a comparative framework.
1

A New Kind of Visual Science

The first major issue for this article lies in a preliminary assessment of the contemporary relevance of visualization in science on the one hand and in society on the other hand.

Turning to the first part of the question it is interesting to note for historical reasons that Otto Neurath’s Isotype was viewed by his friends and colleagues from the Vienna Circle or from the Unified Science-movement as an interesting and stimulating way of communication which however was situated outside the domains of scientific analysis proper. Within science, visualizations in the form of Isotype-diagrams were mostly seen as illustrations without any cognitive surplus value.

Several decades later the assessment of a marginal impact of visualization within the scientific domain has changed dramatically. Again for historical reasons it is intriguing to see that one of Otto Neurath’s fiercest opponents in economic, societal or planning arenas, namely Friedrich August von Hayek, would have become his strongest ally in the field of visualization within scientific fields. In 1967, Friedrich August von Hayek wrote a rather neglected article entitled ‘The Theory of Complex Phenomena’ (Hayek, 1967) which was published several years later as a small booklet in German ‘Die Theorie komplexer Phänomene’ (Hayek, 1972, reprinted 1996). In this article, Hayek developed a typology of complex phenomena and processes which he clearly differentiated from their simple counterparts. Table 1 lists the results of Hayek’s distinctions between simple and complex phenomena or processes across several dimensions. It turns out that Hayek’s differentiations are almost identical to a more recent dualistic conceptualization of a phase transition from Science I, the science of theoretical physics and of relative simplicity to Science II, the science of the life sciences and of relative complexity. Both Hayek’s typology of simple and complex phenomena and the Science I-Science II-typology focus on patterns, pattern recognition and pattern formation as the core-elements of analysis. But a shift from laws to patterns, almost by necessity, implies that the role of visualization must have increased significantly.

According to Table 1 complexity science alias Science II proves to be pattern-based, and stands in a striking contrast to the law-based paradigm for simple phenomena and processes under Science I.
Table 1  **Friedrich August von Hayek’s Main Distinctions between Simple (Science I) and Complex Phenomena (Science II)**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Simple Phenomena (Science I)</th>
<th>Complex Phenomena (Science II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of Complexity</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Measure of Complexity</td>
<td>Small number of Variables</td>
<td>Large number of Variables</td>
</tr>
<tr>
<td>Bonds between Variables</td>
<td>Causal Relations</td>
<td>Degree of Complexity</td>
</tr>
<tr>
<td>Specification Schema</td>
<td>Laws</td>
<td>Patterns</td>
</tr>
<tr>
<td>Mode of Analysis</td>
<td>Covering Law-Model</td>
<td>Pattern-Recognition and Pattern Formation</td>
</tr>
<tr>
<td>Forecasting</td>
<td>Law-based</td>
<td>Pattern-based</td>
</tr>
<tr>
<td>Leading Science</td>
<td>Theoretical Physics</td>
<td>Evolutionary Biology and Complexity Sciences</td>
</tr>
</tbody>
</table>

As a consequence, it can be stated for the science domain in general that the importance of patterns and, thus, of visualizations has increased dramatically over the last decades and, in all probability, will continue to do so in the future. Visualization in science has moved from the cognitive margins and from a mere by-product of algorithmic analysis to the core mode of scientific investigations.

The growing importance of patterns and visualizations within the increasingly dominant life sciences and the sciences of complexity is accompanied by another series of shifts and phase transition that separate today’s social science work environments and practices from Neurath’s office and Isotype-environments in the 1930s or the early 1940s. Within the sciences in general and the social sciences in particular three major changes or phase transitions occurred during these decades simultaneously in the domains of epistemic cultures⁴, laboratories⁵ and research infrastructures. In all three instances a profound shift occurred towards digital or cyber-contexts, manifesting themselves in digital or cyber-epistemic cultures, in digital or cyber-labs and in digital or cyber-research infrastructures.⁶
For the subsequent discussion it becomes of utmost importance that the daily routines of social scientists are more and more embedded in a digital or cyber-environment which, of course, has strong repercussions for traditional or analogue communication tools like Isotype as well.

2

Visual Media and Visual Settings

Turning to the second part of the initial question, viz. the contemporary societal relevance of visualization, a few concepts need to be introduced, namely the notions of visual media and of visual settings. The concept of a medium will be used in a rather specific manner far from the current social science or humanities frameworks and it follows closely to a proposal by Douglas R. Hofstadter (1997) who defined a medium in the following way:

A medium is a vehicle for patterns, a propagator of distortions, a transmitter of disturbances. […] A linguistic medium is a carrier of messages. (Hofstadter 1997: 181)

Hofstadter goes on to introduce the notion of linguistic media by specifying that

a linguistic medium is definable as: a language restricted by a set of constraints that are not so tight as to preclude the expression of arbitrary meanings (Hofstadter 1997: 182)

Thus, different languages can be seen as instances for a linguistic medium. One can easily see that in Hofstadter’s understanding a medium, linguistic or otherwise, is very closely linked to notions like rule systems, production systems, grammars or programs.

In this spirit, a visual medium can be described as a visual configuration ‘restricted by a set of constraints that are not so tight as to preclude’ the formation or the recognition of arbitrary visual patterns. Thus, the notion of pattern formation and pattern recognition stands at the core of visual media. Additionally, rule or production systems, broadly conceived, for pattern formation or for pattern recognition can be understood as specific instances of visual media.
Table 2  **The New Multiplicity of Visual Media, Settings and Utilization Contexts**

<table>
<thead>
<tr>
<th>Societal Systems/Networks</th>
<th>Visual Media and Utilization Contexts</th>
<th>Visual Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Visual Education and Visual Learning in Primary, Secondary and Tertiary Education</td>
<td>Schools and Institutions of Higher Education</td>
</tr>
<tr>
<td>Science</td>
<td>Complex Visual Analysis, Visual Data-Mining and Exploratory Visual Analysis, Visual Languages for Animal-Man Communication, etc.</td>
<td>Digital Science Labs</td>
</tr>
<tr>
<td>Economy</td>
<td>Visual Occupational Learning</td>
<td>Work-Places</td>
</tr>
<tr>
<td>Information and Communication</td>
<td>Visual Modules in Newspapers, Journals, Books, etc; Visual Components in User-Surfaces of Information and Communication Technologies (ICT)</td>
<td>Private Households; Public Spaces, etc.</td>
</tr>
<tr>
<td>Arts and Culture</td>
<td>Visual Artistic Media</td>
<td>Museums, Exhibitions, Art Galleries, Public Installations, Cyber-Settings, etc.</td>
</tr>
<tr>
<td>Life Worlds</td>
<td>Visual Communication (Various Sign Languages, etc.)</td>
<td>Private and Public Spaces</td>
</tr>
<tr>
<td>International Communication</td>
<td>Visual Information Systems, Visual Language Learning, etc.</td>
<td>Public Spaces; Large-Scale Organizations, Traffic Networks, etc.</td>
</tr>
</tbody>
</table>

Settings, finally, can be defined as spatio-temporal domains in which media can be utilized. From a functional point of view, these settings can be split into major societal systems like education, science and technology, culture and so on. From a holistic viewpoint, settings can be attributed to forms of life or to any spatio-temporal specification like households, work-places, public spaces, etc. Otto Neurath’s Isotype can be seen, thus, as a visual medium which has been very successfully applied to different settings like education, culture or science. Moreover, Isotype has been created as a weak rule system with a small number of explicit rules and a large number of implicit routines.

Turning more specifically to contemporary visual media, the most important point to be emphasized lies in the rapid proliferation of a large wave of new visual media which are supported by digital information and communication
technologies. Digital visual media have programs as their underlying units and their general output lies in visual patterns. Table 2 presents an overview of the startling number of new visual media. Moreover, from Table 2 it becomes clear that these broad scope of new visual digital media offers strong support for the claim that the 21st century will become the century of the digital or, alternatively, of the cyber-eye, following the 20th century as the century of the eye (Otto Neurath).

3 The Limits of Isotype in the Cyber-Age

In view of the shift to patterns, complexity science and to digital or cyber-research environments on the one hand and a new wave of digital visual media and settings across society on the other hand it is worthwhile to contemplate the question whether Isotype as a homogeneous picture language should be adapted or accommodated to the new digital environments across science and society. Probably not unexpectedly, the answer is clearly negative. Basically, three groups of reasons can be given why Isotype cannot and should not be revitalized within the current cyber-contexts.

The first group of reasons against a digital version of Isotype is linked to the overwhelming proliferation of new visual digital media across very different functional settings and with highly heterogeneous user-groups. It is not only difficult to imagine that a single visual medium like Isotype can be meaningfully applied across all these different settings and user-groups, it turns out to be impossible that a single visual medium is capable to fill out all new visual niches. Turning to the science domain alone one is confronted with a very large number of different visual media and with widely differing utilization contexts which make it outright impossible to develop a single visual medium to account for all these different utilizations. Thus, Isotype would need to be developed as a family of different visual media, unified sufficiently by family resemblances in design principles across these different media.

While the first set of arguments against a digital Isotype still allows the building of an Isotype family of visual media, the second group of reasons excludes the possibility of such a digital Isotype-family altogether. The second set of reasons has to do with Isotype as a symbol-based visualization instru-
ment or as a picture language. Neurath was fully aware that Isotype was not a complete language when compared to a linguistic medium. In his visual autobiography Otto Neurath himself remarked that

> there are many reasons why Isotype cannot be developed as a ‘complete language’ without destroying its force and simplicity. Our daily language, even in primitive societies, is to some extent richer than our Isotype representations can be. (Neurath 2010:104)

Nevertheless, a symbol library lies in the core of Isotype and constitutes its *differentia specifica*. But from Table 2 it becomes rather obvious that many of the new visual media and settings produce only abstract patterns and do not or, in most instances, cannot rely on symbolic arrangements. In fact, the concluding sections of this article will introduce a visual medium for the social sciences under the name of visual data analysis (VDA). Most of the data-transformations in VDA would be impossible if one were to rely on the symbol library simply because many of the usual data dimensions or variables like trust in institutions, life-satisfaction, political attitudes, policy issues, etc. cannot be symbolized in an adequate manner. Accordingly, one is faced with the following dilemma: Removing or downsizing the importance of the link to the Isotype-library of symbols would change Isotype to something fundamentally different which no longer can be regarded as an accommodation or an adaption, but as a clear break with the Isotype-past. Keeping the link to the Isotype-library of symbols excludes Isotype for most of the current visual media and settings.

The third group of reasons against a digital version of Isotype comes from the limitations and restrictions of the new digital visual media themselves. The high aesthetic surplus value of Isotype-pictures was achieved through an artistic transformation of objects to self-speaking or self-explanatory symbols. This transformation process required time and the final product was very carefully produced as a single and unique piece. The contemporary online-settings for visual media operate with hundreds and more users, distributed globally, who expect instant visual results. Additionally, computer screens and printers make it almost impossible to achieve this aesthetic Isotype-surplus due to inherent limitations in screen or printing resolutions which become particularly evident when using large numbers of small symbols. Finally, Isotype was based on a closed technology where observers were confronted with a pre-given set
of visual stimuli, carefully prepared and crafted by the Isotype-team. In sharp contrast, contemporary visual media are essentially grounded in open technologies where users are expected to create the visual outputs most suitable for them in a relatively short amount of time of a few seconds only.

Thus, in the brave new cyber-worlds Isotype remains a vital reference point for visualization goals or for a comprehensive listing of potential comparative advantages of visualizations due to two decades of intensive interactions with numerous observers and users. But Isotype would be lost in transformation from its original mode of analogue manufacturing to the current digital production environments.

4

A Basic Outline of Visual Data Analysis (VDA) and Its Four Main Contexts in the Social Sciences

Subsequently, a new visual medium will be introduced which has been designed for the social sciences and which belongs to the new components in a digital social science lab. This new visual medium allows and supports a visual online-analysis of societal changes, observed or simulated, in a comparative framework. This new visual medium which has been established under the name of visual data analysis (VDA) is based on survey or panel data from a varying number of countries. The primary goal of VDA lies in a visual analysis of patterns which are produced by suitable VDA-programs. Over the last years a new VDA-program has been produced which runs under the name of WISDOMIZE and which is currently available online in its version 2.0.

VDA is one of the new media and settings where the Isotype restrictions become very obvious. Usually, the variables in the micro data sets use concepts which fall beyond the reach of the Isotype-library. Instances like, for example, life satisfaction, trust in institutions, work flexibility, or values do not have counterparts in the Isotype symbol library. Additionally, the European context for VDA requires a large compilation of different countries on a single screen which makes it almost impossible to use any type of symbols because the available space for a larger quantity of symbols is much too small.

Visual data analysis can be undertaken within four different data contexts which can be specified with the help of two independent dimensions. The first dimension is time and can be divided into single points in time or into multiple
time points. The second dimension can be described as the unit of analysis and can be divided into single units or into multiple units. Units can refer to regions, populations or to both regions and populations. Figure 1 exhibits the four main data contexts for VDA.

With the help of Figure 1 the four different data contexts can be described in a more detailed manner.

- The first context is focused on a single unit $u$ for a single point in time $t$. In order to become comparative one needs at least a small number of dimensions or variables which are to be compared within this single case-context.

- The second data context is still restricted to a single unit, but uses at least two points of observation $t_i$ ($i = 1, 2, \ldots, T$). Thus, the second context is the most elementary instance for a comparative study of changes.

- The third data context uses at least two different units $u_j$ ($j = 1, 2, \ldots, U$), but is restricted to a single point in time $t$. The third context may be seen as the paradigmatic case for comparative analysis.

- Finally, the fourth data context comprises at least two units and two points of observation. The fourth context becomes the most complex one for comparative analyses with $t_i \times u_j$ data sets.
These four data contexts can be used for various forms of pattern recognitions. In principle one can distinguish between two main types or groups of patterns which exhibit important attributes of a data set. These two main groups can be divided into elementary patterns like extreme values, variances or deviations from the main value and into complex patterns like similarities, coherences or distances.

5 Patterns and Prototypes within the Visual Data Analysis

With respect to the two groups of patterns for the different data contexts each group contains a small number of specific patterns. In sum, one can differentiate currently between three elementary or simple patterns and four complex patterns which, in combination, constitute the field of visual data analysis. However, each of these elementary or complex patterns is able to address specific questions and to provide an open and observer-dependent amount of visual answers.

With respect to the group of elementary patterns one can list the following three main instances:

- **Extreme values**: Patterns for a quick recognition of extreme values and outliers in a given data-set. In this area a number of variables or variable groups as well as of units can be selected and the extreme values of this data set become visualized.

- **Deviations from an average or a reference value**: Patterns for a rapid insight into higher and lower than average concentrations or, alternatively, into lower and higher formations for a given reference value. Once again, a number of variables or variable groups as well as of units have to be chosen by the user and an average or reference value has to be specified.

- **Variance**: Patterns for a fast identification of the statistical spread in a given data set. These visualizations are mainly, but not exclusively based on scatter plots which have become the main field of visual analysis for variance features.
The group of complex visual data analyses comprises at present time four different patterns:

- **Similarities**: Patterns for a quick detection of grades of similarities or dissimilarities between sub-populations in a data set. In this instance n dimensions or variables must be selected and at least two sub-populations \( n(s_i) \) for each unit must be specified.

- **Coherence**: Patterns for a rapid cognition of interrelations between several data groups. Here one has to select at least two dimensions, but preferably two data groups with \( n \) and \( o \) dimensions which can be visually analyzed for their visual positive or negative correlations.

- **Clustering**: Patterns for a fast identification of groups or types in a data set. In this case, one needs \( n \) dimensions and \( u \) different units in order to find groups or clusters in a given data set. Usually one is capable of selecting two, three or more visual clusters within a given \( n \times u \) dataset.
• *Distances:* Patterns used for the quick detection of multidimensional distances across relatively large sets of dimensions. Here one needs d different domains within a given data set where each domain contains preferably a constant number of dimensions.

The gallery of patterns in Figure 2 exhibits six cases of visual data analysis within the first data context, namely for a single time point and a single unit. The data come from the European Social Survey (ESS) which can be considered as the European best practice for comparative data production.11

Aside from data contexts and elementary or complex patterns one can distinguish between different visual prototypes which visualize a given data set in a specific manner so that it can provide visual answers for specific research questions. From Figure 2 one can see that visual prototypes can be classified with labels like an extreme value-prototype, a deviation-prototype (deviations from a mean or a reference value) or as the data-square or data rectangle-prototype. In general, each prototype can be used for one or more elementary or complex patterns and each elementary or complex pattern comprises one or more visual prototypes.

Table 3 lists the three basic components for VDA, namely data contexts, patterns and prototypes.

<table>
<thead>
<tr>
<th>Data: Elementary and Complex Data Contexts</th>
<th>Patterns: Elementary and Complex Patterns</th>
<th>Prototypes: Elementary and Complex Pattern Generators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Unit, Single Point in Time</td>
<td>Extreme Values Deviations from Mean or Reference Value</td>
<td>A Small Set of Pattern Generators for One or More Elementary or Complex Patterns</td>
</tr>
<tr>
<td>Single Unit, Multiple Points in Time</td>
<td>Variances</td>
<td></td>
</tr>
<tr>
<td>Multiple Units, Single Point in Time</td>
<td>Similarities Coherence</td>
<td></td>
</tr>
<tr>
<td>Multiple Units, Multiple Points in Time</td>
<td>Clustering Distances</td>
<td></td>
</tr>
</tbody>
</table>

Table 3  **Basic Components of Visual Data Analysis**

From Otto Neurath’s Isotype to Multiple Worlds of Visual Media
In this section two examples for a complex visual data analysis will be provided and analyzed in some detail. The data come, once again, from the European Social Survey (ESS) and the pattern to be studied visually has been labeled as coherence-analysis. With respect to the data, two different domains have been selected, namely trust in five different institutions, namely the national parliament, the legal system, police, politicians and political parties. The
second domain falls under the heading of social capital, including happiness, life satisfaction, health and four specific dimensions for social capital. Figure 3 provides an overview of visual coherence analyses within the four different data contexts where the third and the fourth data context fall under the heading of complex visual data analysis.

As can be easily seen from Figure 3, these patterns provide visual answers to different research questions with respect to underlying coherences between the domain of trust in institutions on the one hand and social capital, broadly understood, on the other hand.

- The first data context provides answers for the coherence between two data groups within a single unit, in this case Austria. Here a competent observer is able to find out whether one can identify a coherent pattern between the two data groups within a single country, in this case in Austria. Obviously, for Austria the coherence between trust in institutions and social capital is weak at best.

- The second data context gives visual clues on dynamic coherences and on answering the question whether two groups of dimensions exhibit a coherent or incoherent dynamic pattern. Clearly from Figure 3 one can see that in the Austrian case no dynamic coherence can be identified and both data groups show a very different dynamical pattern.

- The third data context looks for coherences at the European level for a single point in time. Here one can observe a weak coherence between these two domains across Europe. Countries which are strong in trust in institutions turn out to be strong in social capital as well, although one can find several exceptions to this general pattern.

- Finally, the fourth data context provides visual answers for dynamic coherences at the European level. Generally, one can see that no dynamic coherences can be identified because in many instances positive changes in one domain are accompanied by negative changes in the other domain and vice versa.

Finally, Figure 4 exhibits a gallery of visual patterns for assessing multidimensional socio-economic distances in Austria (data contexts I & II) and in
Europe (data contexts III and IV). The data set comes, once again, from the European Social Survey. This time, seven domains, namely migration policies (1), asylum-policies (2), media utilization (3), participation and citizenship (4), trust in institutions (5), social capital (6), and working conditions (7) have been selected and seven independent dimensions have been selected for each of these domains. Finally, for each of the 7 dimensions x 7 domains the coloring was undertaken in a distribution-dependent way. Take trust in parliament as one of the 49 dimensions used in Figure 4, then the countries which fall
under the upper third of the distribution were colored in blue, countries in the middle third with ocher and countries in the lower third with red. In this way, each of the 7 domains x 7 dimensions in each regional unit was colored either in blue, ocher or red. Consequently, countries with predominantly blue (red) colors are positioned in the upper (lower) third of the European distribution in most of the 49 dimensions. Multidimensional socio-economic distances across Europe can be identified visually by finding countries or regions with mostly blue colors on the one hand and mostly red colors on the other hand. For the third data context in Figure 4 one can see, for example, that Denmark and Poland are the countries with the biggest socio-economic differences across the 7 x 7 dimensions. More specifically, the four data context offer visual clues for the following set of research questions.

• Within the first data context an observer gets visual patterns with respect to socio-economic distances between several domains in a single country, namely in Austria. Here a competent researcher is able to find out visually which of the ESS-domains differ most within Austria. As it turns out, the fifth domain (trust in institutions) and the seventh domain (working conditions) exhibit the biggest differences within Austria.

• The second data context offers visual clues on the dynamics of these seven domains and, thus, on the socio-economic distances with respect to the changes in these seven domains. The second data context in Figure 4 shows for example that the second and the sixth domain exhibit the biggest differences within Austria.

• The third data context looks for socio-economic distances across Europe in a highly multi-dimensional context. Observing the third data context more closely one will recognize, for example, that Scandinavia shows very big socio-economic differences to Eastern or South-Western Europe.

• Finally, the fourth data context offers visual patterns for dynamic distances at the European level. This time it remains a task for the reader or observer to identify socio-economic distances with respect to the changes in the seven domains.

With Figures 3 and 4 the preliminary overview on a new visual medium for visual data analysis in the social sciences has come to an end. It should be emphasized that VDA offers a quick detection of characteristic features especially in large-scale European or global data sets. Moreover, VDA can be
combined with traditional statistical analyses or with qualitative data analyses. In this way, visual methods like VDA close the ensemble of social science methods to a closed triad.

7 Towards Worlds of Visual Media and Visual Settings

Otto Neurath as a fervent optimist with respect to new technologies would find himself today in local and global contexts which are characterized by a striking discrepancy between an enormous proliferation of new visual media and the absence of high quality visual designs especially suited for these different settings. In all probability, Neurath would explore these different visual media and settings and would produce innovative visual solutions which would be situated well beyond the classical Isotype-approach.

Isotype as a unified symbol language and as a visual medium across different settings in science or society is definitely dead within today’s cyber-environments. But several of the general design principles still live on and it would be a fascinating second-order task to see whether today’s worlds of visual media adhere to these general standards and principles on the one hand and are able to fulfill the comparative advantages inherent in visualization. In this sense, Neurath’s Isotype remains a vital and critical reference point for the current visual cyber-environments as they have been developed so far and for the visual media and settings still to come.

Notes

1 On Neurath’s Isotype, see Neurath, 1991, 2010 or Müller, 1991a,b.
2 On this point see especially Müller, 1991b.
3 On the distinction between Science I and Science II, see Hollingsworth/Müller, 2008 or Müller/Toš, 2011. For a wider discussion of this distinction, see Boyer, 2008, Mayntz, 2008, Nowotny, 2008 or Sornette, 2008.
4 On the notion of epistemic cultures see especially Knorr-Cetina, 1999.
5 Laboratories in a very general way can be seen as the spatio-temporal settings in which epistemic cultures manifest themselves. See especially Latour/Woolgar, 1979 or Knorr-Cetina, 1984.
6 Otto Neurath would have been a keen observer of this process because already in the early 1940s he proposed a so-called *Gelehrtenbehavioristik* which was characterized by him in the following way, taking sociology as reference point: ‘Sociologists deal, among other things, with tools and tales, with the language of magic, theology, jurisprudence, economics, and pedagogics; but also with the language used by the sociologists themselves, with their statements and their habits, i.e. with the behavioristics of sociologists […] We have fine questionnaires as far as preliterate tribes are concerned but hardly any when we try to ask sociologists how they themselves behave in arguing and writing. Since sociological predictions are directly connected with actions which create what has been predicted, the difficulty is very understandable. More than in other sciences, taboos and old folklore come into the picture when human actions are under consideration.’ (Neurath 1970: 42 p.)


8 As an Isotype-transformer one is usually faced with the following dilemma. Even for seemingly empirically observable dimensions in social science data sets like political attitudes or social capital one can either invent new symbols which, however, are no longer self-explanatory and have to be described for observers separately or one abandons the search for appropriate symbols altogether and loses, thus, the power of visual arrangements. In general, even moderately theoretical terms are not only difficult, but outright impossible to visualize in a self-evident manner. (For a detailed discussion, see Müller, 1991a)

9 On visual data analysis (VDA) see, for example, Müller/Reautschnig, 2010.

10 For a deeper understanding, visit the wisdom homepage under www.wisdom.at and look under the category of visualization in order to proceed to WISDOMIZE 2.0.

11 On the European Social Survey (ESS), see, for example, Jowell *et al.* (2007) or Toš/Müller *et al.*, 2009.

**Literature**


Boyer, R. (2008), ‘The Quest for Theoretical Foundations of Socio-Economics:


Out of the Wild

Bart Lootsma, Innsbruck

Out of the Wild is a research project by the chair for architectural theory of the University of Innsbruck. In the beginning, students and staff from the Platform History, Theory and Criticism of the Academy of Fine Arts in Vienna were involved as well and played a crucial role in its setup. Out of the Wild tries to find continuities in architectural thinking that came out of the Viennese Settlers’ movement after the First World War. It tries to figure out if and how these ideas spread and were developed further and if they have a potential for architecture and urbanism today and in the near future. The project centres around three Austrian-born architects and theoreticians: Otto Neurath (1882–1945), Friedrich Kiesler (1890–1965) and Christopher Alexander (born 1936) but also investigates personalities, ideas, projects, events and movements in their vicinity. An important tool in this research is a website, www.outofthewild.eu, which allows us to visualize both direct synchronous relationships between people and events as well as relationships and developments in time. The idea and structure for this website were developed by architecture students and staff of the Academy of Fine Arts in Vienna and the University of Innsbruck. Michael Hofstädtier from Ovos web design programmed it. The website consists of a database, a customized Content Management System (CMS) and a web interface, which not only allows to store and present events and contents in a range of different formats, but also to visualize the relationships between these different contents/events in history and between each other. This enables a new and more complex view of these relationships.
The project is called Out of the Wild as an inversion of the title of the 1996 non-fiction book by Jon Krakauer and the Sean Penn movie that was based on it from 2007, in which the young American Chris McCandless, probably influenced by the great Romantic American tradition of Henri David Thoreau and Jack London, leaves civilization behind to survive on his own in nature. At the end of the book, after having tried in vain to return to civilization and shortly before he dies from eating poisoned plants and starvation, the main protagonist writes down as a last entry in his diary that ‘Happiness is only real when shared’ (Krakauer 2007). This sentence seems almost an echo of Otto Neurath’s dictum that ‘The sum of world happiness is too small. It must be made bigger.’ (Neurath, as quoted by Vossoughian, in a lecture at the University of Innsbruck, 2008) Out of the Wild seeks a way to turn a tradition or urbanism that is based on liberal individualism, as it became heavily promoted from the nineteen seventies on, into forms of urbanism that seek synergies and also try to address shared needs and desires, without returning to classical collectivist examples.

Surveys

Scientific methods in architecture and urbanism became increasingly important in Europe after the First World War. They ranged from empirical aesthetics to functional analyses. Taylorism and Fordism left their traces from France to Russia, as Jean-Louis Cohen has demonstrated in Scenes of the World to Come (Cohen 1995). Of course, statistics have played an important role in Western Europe and its colonies for centuries. As Ian Hacking remarks, ‘Every state, happy or unhappy, was statistical in its own way. […] Visionaries, accountants and generals have planned censuses in many times and places.’ (Hacking 1990, 16) However, with the explosive growth from cities to metropolises at the end of the nineteenth century, the survey became increasingly important for urbanism and soon became a crucial role in the planning and design process all over Europe. Therefore, it is no surprise that all key urban projects that were developed in the aftermath of the First World War were largely driven by statistics. These statistics tied projects, which were often presented as visionary and from the nineteen fifties on dismissed as ‘utopian’ to the everyday reality of the city. Le Corbusier, for example, presented his ‘Contemporary City for Three Million Inhabitants’ from 1922
in his *Œuvre Complete* (Le Corbusier 1964) accompanied by quantitative comparisons to other cities and four facsimile images of his sketchbook that were largely filled with statistical calculations. It was a city for three million inhabitants because Paris had 3,000,000 inhabitants in 1922. The program for Le Corbusier’s ‘Contemporary City’ was distilled from extrapolations of the actual program of the city of Paris. In *Großstadtarchitektur* (Hilberseimer 1927) Ludwig Hilberseimer criticised Le Corbusier’s ‘Contemporary City’ for not giving an adequate answer to the given numbers and continued in one breath with his proposal for a ‘High Rise City’ from 1924, that was developed as a remedy to cope with the increasing congestion in the centre of the city of Berlin.

Setting up a new department for city development in the nineteen twenties, advised by architect Cornelis van Eesteren, the social democratic aldermen of the city of Amsterdam decided for a scientific approach from the beginning. First, in 1928, Th. K. van Lohuizen, an urban planner specialized in surveys was hired and only after that the architect Cornelis van Eesteren. With their surveys they were able to prove that the inner city of Amsterdam could largely survive in the state they found it. After that, from 1929 on, they developed the AUP, the famous general extension plan of Amsterdam, which was realized with minor adaptations until the year 2000.

What these projects had in common was that, in the first place, they all sought remedies for the congestion of the cities centres, which was due to their explosive growth; and second, that these solutions departed from the assumption that it would be possible—among many other things—to realize large-scale infrastructural and industrially produced building projects by mobilizing large scale municipal, state or industrial investments. The way this capital could be mobilized and the internal organization of these projects differed from case to case, depending on the ideological view of the architects and politicians involved. The Saint Simonist Le Corbusier had the industrial elite dominating the centre; the socialist Hilberseimer sought to delimit the alienation of work by proposing neighbourhood units, in which dwelling was placed immediately on top of industry; and Van Eesteren and Van Lohuizen, working for the social democratic city council, distributed all functions as equally over the Amsterdam as they could.

Otto Neurath, as the ‘architect’ of the Viennese Settlement Movement, shared some essential characteristics with his notorious colleagues, in particular his belief in scientific methods and statistics. However, radically
different from them, statistics were not the immediate, unquestionable basis to produce a program for experts to produce an urban project but rather an educational tool for the masses, to help them shape their own individual lives and to understand what they voted for. Also, different from most of his colleagues at the time, Neurath departed from issues that played in the periphery of the city of Vienna – the centre having been organized before the First World War with the Ringstrasse and the large infrastructural works planned by Otto Wagner. Also, initially, Neurath had a very different take on the industrialization of the housing production, as he did not immediately depart from large, abstract quantities of housing and other functions needed, but from the smallest possible, concrete unit: the individual hut built by the settlers themselves. This was related to his belief to be able to continue after the collapse of the economical system during the war with an economy in kind, in which there was no money involved. Different from his colleagues in the rest of Europe, he sought therefore for a ‘Converse Taylor System’. Different from most of his colleagues, Neurath did not propose to tear cities down or create artificial land to form a tabula rasa to build upon but worked with the situation he found, which he tried to improve in small steps, almost as in his famous metaphor in which the body of knowledge is compared to a boat that must be repaired at sea:

We are like sailors who on the open sea must reconstruct their ship but are never able to start afresh from the bottom. Where a beam is taken away a new one must at once be put there, and for this the rest of the ship is used as support. In this way, by using the old beams and driftwood the ship can be shaped entirely anew, but only by gradual reconstruction. (Neurath, in: ‘Anti-Spengler’ [1921] 1981, 184)

Whereas most modernist approaches to urbanism have increasingly become criticized from the nineteen fifties on just because of their abstract approach that tried to build cities from scratch, Neurath’s contribution to urbanism, notwithstanding a revival over the last couple of years, has almost been forgotten. There are many reasons for this. Soon in the nineteen twenties, ‘Red Vienna’ also chose more collective approaches, because large-scale collective projects proved more efficient in solving the housing problem. After 1934 many people involved left Austria to live in exile. As the project OUT OF THE WILD wants to show, this did not stop the theoretical impulse the ideas of
Otto Neurath and the Viennese Settlers Movement had given architectural and urban thinking in the work of notable other Austrian-born architects and theoreticians, such as Friedrich Kiesler and Christopher Alexander, to be developed further. Today, this tradition might have more potential than more established modernist approaches in architecture and urbanism.

**Shantytowns**

Today, we are confronted with new tasks and challenges for architecture and urbanism. The need for more sustainable lifestyles presents some of those. The way we analyze and calculate the ecological footprint of a house today reminds one of the way Otto Neurath unravelled the ‘Rootstock of a Settlement House’ (Vossoughian 2008, 56). Other tasks and challenges arise as consequences of the postcolonial era. Globalization does not just consist of increasing flows of people, data, money and goods all over the world. It also means that we cannot blend out the increasing percentage of settlements in the world that consist of shantytowns any longer. They are part—and with over fifty per cent of the world population living in them a large, an ever-increasing part it most certainly is—of the context of architecture. The way shantytowns are built, hut after hut by the people themselves, bears striking similarities to the situation in Vienna after the First World War. Therefore it is unavoidable that architecture and urbanism will have to rethink their roles in the world, putting themselves in the service of the people who live there. Large-scale modernist housing programmes, like they were still successful in Hong Kong and Singapore in the nineteen fifties and sixties, are not possible any more today because of the immense investments needed. Looking at the increasing amount of quasi temporary camps in our cities—the refugee centres, the homeless sleeping in tents in Paris and in the United States, the Roma in Italian cities, the victims of earthquakes in Italy and Turkey, the victims of Katrina in New Orleans; or looking at the explosive increase of informal settlements in Turkey and in the former Yugoslavian countries, etc., etc.—this context inevitably comes closer and closer. Retroactive legalisation of illegal and informal extensions of cities, as largely financed by institutions like the World Bank and the European Union, is an unavoidable task. It is however only the first step in the direction of another form of mental amnesty that will allow us to start working on these shantytowns in proactive ways.
Otto Neurath

More than any other historical example, Otto Neurath and the Viennese Settlement Movement from the period immediately after the First World War might help us to find new perspectives for dealing with this situation. In 1919, Vienna was in a desperate state and hundreds of thousands of families, both from outside the city and from the city itself, sought refuge around allotment gardens and in the periphery to avoid starvation by growing their own food.

For many observers of the city, these Zigeunersiedler or ‘gypsy settlers’ were the ideal citizen-planners in that they relied on know-how and instinct, utilizing everything around them, from urban refuse to trees and captured prey, in order to assure their survival. They illustrated the power of community as an agent of urban reform, and as a force that had the potential for improving life in the metropolis more broadly. (Vossoughian 2008, 17)

The governing Social Democratic Party accepted and supported this movement reluctantly, but still almost from the beginning, as it knew it could not afford any collective infrastructure and wanted to build upon the self-supporting energy of the settlers. For Neurath, who had been working on theories related to the socialization of economy in Vienna after becoming general secretary of the Research Institute for Gemeinwirtschaft in 1919, this was an ideal opportunity to put his ideas into practice. As a key player in the Austrian Settlement and Allotment Garden Association, the Public Utility Settlement and Building Material Corporation (GESIBA), the Settlement and the Housing and Construction Guild of Austria, Neurath looked for a ‘Converse Taylor System’, in which he tried to combine ‘bottom up’ and ‘top down’ strategies borrowed from industry (Vossoughian 2008, 29). In the diagram of the ‘Rootstock of a Settlement House’, Neurath dissected a settler’s house in all its components and traced them back through different forms of production to their origins in the reigns of minerals, plants and animals. A diagram in similar style unravelled the organization of an industrial company, in which many did standardized work on raw materials to produce products, from which only a small part of the company profited financially. As long as Neurath could, he maintained an economy in kind, in which people paid for their houses by performing collective duties, for example building the houses, the roads and other necessary infrastructure. Architects like
Adolf Loos, Josef Frank, Margarethe Schütte-Lihotzky and many others were also involved in this ambitious and successful undertaking and developed new housing typologies and building systems that unskilled workers could deal with. Information and communication, in the form of newspapers and exhibitions were important aspects of Neurath’s approach and became even more crucial to him after he left the Settlers Movement. From 1928 on, together with the artist and graphic designer Gerd Arntz he developed Isotype, a sign language that allowed communicating statistical data about the city—and later on about the world—in a simple and striking way, in order to make the citizens understand the complex organisation of their city.

**Friedrich Kiesler**

The Settlers Movement and Otto Neurath were deeply anchored and well known in the Viennese society in the nineteen twenties. Many young Austrian architects and thinkers more or less grew up with the movement and the ideas that belonged to it and tried to give them a place in their own work—even if they might also develop in other directions. One of them is Friedrich Kiesler, who might be an important link between the early theoreticians of the Settlement Movement and more contemporary thinkers.

Kiesler claims that he worked with Adolf Loos to assist on the Settlement Movement in 1920. This has never been confirmed and is unlikely, as Loos became Director of the Siedlungsamt only in 1921. Still, this claim shows that Kiesler was well aware of the Settlement Movement and keen on being associated with it. Kiesler left for New York to settle there already in 1926. According to an entry in the diary of his wife Stefi Kiesler at the Kiesler Foundation in Vienna, Kiesler met Otto Neurath there in 1933. A copy of Neurath’s book *Modern Man in the Making* from 1939 can be found in Kiesler’s private library in the Kiesler Foundation in Vienna. Although Kiesler has been associated with artistic movements from De Stijl to Surrealism, the esoteric and irrational overtones of which seem difficult to relate to the strict positivism of the Vienna Circle, the participatory aspects of the Settlement Movement or Loos’ craftsmen-inspired traditionalism, there is also a continuous more down-to-earth and strangely pragmatic tendency present in his work, notably in his theoretical writings. With his writings on Correalism and Biotechnique, Kiesler showed himself a strong defender of
multidisciplinary, scientific design approaches to avoid building design would ‘continue to exist as a series of disparate, overspecialized, and unevenly distributed products’ (Kiesler [1939] 1996, 92–120).

Under the title ‘Magic Architecture’—a title that might be confusing in this context—over the years he produced a series of texts and manuscripts for books that try to root architecture and urbanism in the everyday. Taking a distance from mystical inspirations, according to Kielser ‘Magic Architecture’ was to be distinguished from ‘Dream Architecture’, he wrote already in 1936 ‘it is not an expression of escape into religious solitude (resignation)’. For Kiesler, Magic Architecture is the expression of the creativeness of man, but not in isolation. Instead,

[it is the emphasis on participation. [...] Magic architecture is not dream architecture, like that of temples or castles; it is the architecture of everyday, every-night reality. Magic architecture is a tool of realistic life. [...] Magic architecture is a generator. It can operate on any scale. Any cell of habitation is a nucleus for a power house of joyful living. Neither wealth of cash, nor that of building material, nor social power are needed to accomplishing the most with the least. [...] Magic architecture is of course, unthinkable without its socio-logical roots in a society of free will and sacrifice. (Kiesler 1996, 34)

In the nineteen fifties, Kiesler tried to turn the original short essay into a book, which never came beyond the stage of manuscript. In this manuscript, which finds itself in the archives of the Kiesler Foundation in Vienna, he tried to root architecture in the landscape and as an evolution of animal nests. The manuscript, which is richly illustrated with clippings from popular scientific magazines like National Geographic, shows many examples of anonymous architecture, preceding Bernard Rudofsky’s—also a native Austrian—Architecture Without Architects, which was published in 1964 on the occasion of an exhibition under the same title in the Museum of Modern Art in New York (Rudofsky 1964). In the manuscript of a book he started working on in the nineteen fifties but which was left unfinished, Kiesler returned to the themes of ‘Magic Architecture’. In this manuscript he struggled notably with the question where the animal function of shelter stops and architecture begins, but still tried to distinguish it from the Dream Architecture. Crucial is however that Architecture (written with a capital A) is not implemented from above but comes out of the everyday. Or, as Kiesler
formulates it in the unpublished manuscript that is equally titled ‘Magic Architecture’, a book he was working on in the nineteen fifties but was never published, as it finds itself in the Kiesler Foundation in Vienna: ‘Architecture must wait.’ The manuscript can not only be read as an attempt to continue the lessons from the Settlement Movement and the gradual improvements architects like Loos, Frank and Schütte-Lihotzky tried to make on the huts they found, but also somehow as an attempt to reconcile the collective architectural values as they were realized on a large scale in Europe in the nineteen fifties with American urbanism, which always departs from the individual house.

**Christopher Alexander**

Intuitively, we can immediately understand the work of Christopher Alexander as a continuation of certain aspects of the Settlement Movement, particularly if we think of the participatory tendencies, and of the analytical and philosophical work of Otto Neurath, if we think of Alexanders *A Pattern Language* as an encyclopædia consisting of architectural protocol sentences. In the tradition of the great architectural encyclopædias of the nineteenth century, like those of Eugène Emmanuel Viollet-le-Duc, it is also a handbook, a manual with which one can build his or her own house, neighbourhood or city. Also Alexander’s fascination for diagrams recalls that of Neurath. Already in ‘Notes on the Synthesis of Form’, with which he took his PhD in Architecture from Harvard in 1964, Alexander dissected the design process by means of tree diagrams that recall Neurath’s ‘Rootstock of a Settlement House’. In the appendix ‘A Worked Example’, Alexander demonstrated the functioning of his interpretation of the design process by means of an Indian village, in other words by means of an example from vernacular architecture (Alexander, 1964). Alexander’s patterns in *A pattern Language*, 1,166 numbered examples of architectural situations from the large scale of a region to the small scale of ornaments and building components like bricks, read as an even more ambitious dissection of a larger whole. Intriguing is that Alexander already reserves the idea that some of the patterns might be updated in the course of time, depending on the number of asterisks that are placed behind them in the header:
You see then that the patterns are very much alive and evolving. In fact, if you like, each pattern may be looked upon as a hypothesis like one of the hypotheses of science. In this sense, each pattern represents our current best guess as to what arrangement of the physical environment will work to solve the problem presented. The empirical questions centre on the problem—does it occur and is it felt in the way we have described it?—and the solution—does the arrangement we propose in fact resolve the problem? And the asterisks represent our degree of faith in these hypotheses. But of course, no matter what the asterisks say, the patterns are still hypotheses, all 253 of them—and are therefore all tentative, all free to evolve under the impact of new experience and observation. (Alexander et al. 1977, XV).

As such, Alexander’s thinking reminds us not just of Kiesler’s evolutionary concept of Magic Architecture, it also recalls Neurath’s ship metaphor once again. Still, even though Alexander was born in Vienna in 1936 and raised in England, where he studied Mathematics and Architecture at Cambridge University, he and Neurath never met and one will not be able to trace immediate references to either Neurath or the Settlement Movement in Alexander’s work. References to other Viennese logical positivists, such as Ludwig Wittgenstein (Alexander 1964), do appear, just as to Friedrich Kiesler, notably to the ‘Chart of Need-Evolution in Technology’ that is related to Kiesler’s theory of Correalism (Chermayeff and Alexander 1963). Alexander invested a great deal of his energy and ideas in building with unprivileged groups, such as in his Mexicali Project from 1975 in Baja California and the Previ project in Peru from 1976.

**Conclusion**

The way ideas and traditions travel in history is, particularly in a globalized world, not necessarily a linear process. They travel through literature and persons and often arrive at their final address only through a detour. They are taken up and congested, bend to different peoples’ needs, only to be taken up and reworked again, only hoping to find themselves back as improved components in a new, more or less plausible whole. *Out of the Wild* might enable us to figure out how certain ideas as they were developed in the Viennese Settlement Movement travelled in time from one protago-
nist to another, maybe not always directly but maybe even through other
Austrian-born protagonists that we hardly mentioned or did not even mention
in this article yet: Josef Frank, Herbert Bayer, Karl Popper, Paul Feyerabend,
Ludwig Wittgenstein and many others. The plausibility of the hypothesis that
a continuity of thinking from Neurath to Alexander exists is high, because the
migration of thoughts is traceable through the connections of the Austrians
in exile. For now, the website www.outofthewild.eu is the only medium that
allows us to map these complex relationships.

What we did discover until now, apart from the immediate relationships
discussed above, is that the correspondences between Neurath, Kiesler and
Alexander mainly revolve around themes that deal with conceptions of
organization, wholeness, endlessness, participation and happiness. Different
kinds of diagrams are important communicational tools in both analysis and
design. All three are important predecessors and pioneers in the development
of computer software, parametric design and the Internet. If we would be
able to prove these continuities, would it be possible, maybe with the help
of new computer technology, to once again transform the ideas of the Viennese
Settlement movement into methods that have a better chance of success?
Maybe that is too much to ask. But even if we will not be able to solve that
problem, we might at least open doors to a different sensibility in think-
ing about architecture. Because apart from the quest for more sustainable,
worthy living conditions for the largest part of the population, the question
how architecture, Magic Architecture, as a more intelligent form or organisation
develops out of the everyday reality of the built environment, remains the key
question of what architecture is or could be—and thereby it might attract the
attention of the profession.
References


On the Theory and History of Diagrams

Zur Theorie und Geschichte der Diagramme
Zwischen innen und außen.
Für eine Pragmatik des Diagrammatischen

Steffen Bogen, Konstanz

**Vorüberlegungen**

Mein Text folgt einer einfachen Versuchsanordnung: Gegeben sind drei Beispiele, die in unterschiedlicher Hinsicht als Diagramme klassifiziert werden können. Im Vergleich der Beispiele sollen nicht nur augenscheinliche Differenzen systematisiert, sondern auch Gemeinsamkeiten aufgezeigt werden. Die so definierte Qualität des Diagrammatischen sollte sich auch in anderen Zusammenhängen wiederfinden lassen, etwa auch dort, wo man eher von Bildern als von Diagrammen sprechen würde. Wenn ich als Kunsthistoriker solche allgemeinen, im Kern philosophischen Thesen entwickle, bleibt die Argumentation doch durch meine Herkunft geprägt. Ich versuche starke Beispiele zu wählen, die ein entscheidendes Reflexionspotential für eine Theorie des Diagrammatischen bereithalten.¹


Zwischen innen und außen. Für eine Pragmatik des Diagrammatischen

Abb. 1

Leonhard Euler

*Logische Diagramme* aus:
*Lettres à une Princesse d’Allemagne sur divers sujets de physique et de philosophie*,
Frankfurt u. Leipzig, 1774

Abb. 2

Leonardo da Vinci

*Diagramm zum Hebelgesetz*

1493


Wichtig ist der komplementäre Faktor der Rezeption: die gesetzten Spuren müssen als etwas wahrgenommen werden, was sich nach bestimmten Regeln hervorbringen, verändern und in der Vorstellung in Beziehung setzen lässt. Erst dann wird aus der graphischen Einschreibung eine diagrammatische Operation. Man muss relevante Eigenschaften der Spuren auswählen und zueinander in Beziehung setzen. Man kann zum Beispiel auf topologische Nachbarschaften von Flächen oder den Schnittpunkt von Linien achten. Man kann Linien mit einer Bewegungsrichtung ausstatten und Positionen gedanklich verschieben und aufeinander abbilden usw. Wichtig ist, dass dabei verschiedene Eigenschaften ein und derselben Spur in ein Verhältnis

__Abb. 3__

William Playfair
Kurvendiagramm
zu den Exporten
und Importen
Englands im
18. Jahrhundert
aus: The commercial
and political atlas and
Statistical breviary,
London, 1786
zu verschiedenen anderen Spuren gesetzt werden können. Dabei können Beziehungen entdeckt werden, die bei der Setzung noch gar nicht bedacht worden sind. Im materiellen Kontinuum der graphischen Fläche sind sie jedoch festgehalten. Das macht das Diagramm zu einem Experiment des Denkens: Im Auswerten kann man darüber nachdenken, welche Relationen notwendig aus den Regeln der Setzung folgen, selbst wenn man beim Einschreiben noch gar nicht alle Beziehungen überschaut hatte.


Nun wird man einwenden, dass dies für jeden graphischen Akt gilt, auch für das Schreiben oder freie Zeichnen und Kritzeln, und daher nicht für eine diagrammatische Operation allein charakteristisch sein kann. Man beachte freilich, dass das, was diagrammatisch ist, auch nach der bisherigen Definition, nicht ausschließlich durch die graphische Einschreibung erzeugt wird, sondern sich erst im Akt der Rezeption entfaltet. So wäre es auch verkehrt, Schreiben und freies Zeichnen kategorisch von der diagrammatischen Einschreibung trennen zu wollen. Sinnvoller ist es, nach diagrammatischen Anteilen im Schreiben und Zeichnen zu fragen.

Über die phänomenologische Definition hinausgehend, gilt es ein semantisches und pragmatisches Potential des Diagrammatischen zu klären. Es entsteht dadurch, dass das regelgeleitete, graphische Wechselspiel von innen und außen in Analogie zu Referenzhandlungen gesetzt wird. Bei aller Unterschiedlichkeit der Beispiele scheint mir das zentrale Thema einer diagrammatischen Operation die Unterscheidung zwischen dem, was in einer bestimmten Situation durch die Vorstellung noch frei bestimmt werden kann, und dem, was durch die (angenommene) Übereinstimmung von Vorstellungen mit den Regeln der
materiellen Wirklichkeit bereits festgelegt ist. In Eulers Kreisen geht es zum Beispiel um die Frage, ob man sich Cs vorstellen darf, die A sind, und Cs die nicht A sind, wenn man festgelegt hat, dass manche As B sind und alle Bs C (Beispiel: manche Logiker (= A) haben Läuse (= B). Alle, die Läuse haben, kratzen sich am Kopf (= C). Kann es dann Leute geben, die sich am Kopf kratzen und Logiker sind, und Leute, die sich am Kopf kratzen und keine Logiker sind?) Im Hebelgesetz geht es um die Frage, durch welche frei gewählten Abstände und Gewichtsverhältnisse man ein Gleichgewicht der Kräfte herstellen kann. Playfairs Diagramme wollen klären, was sich aus den erhobenen Daten für die Zukunft schließen lässt: ist zum Beispiel die Vorstellung begründet, dass Import und Export stets gleichmäßig schwanken?

Die Stärke der diagrammatischen Operation besteht darin, dass die Unterscheidung zwischen dem, was nach den Regeln der Einschreibung bereits festgelegt ist, und dem, was sich noch frei bestimmen lässt, nicht einfach voraussetzungsfrei behauptet wird, sondern pragmatisch, im Umgang mit dem Papier, wie in einem kleinen Experiment getestet werden kann. Hierbei sind die entscheidenden Faktoren ja bereits beisammen: Das Außen der hinterlassenen Spuren und das Innen der Kompetenz, Spuren mit Bezug auf übergeordnete Regeln setzen, wahrnehmen und auswerten zu können. Die schwierigsten Probleme der Welt, so die Hoffnung der Diagrammatiker, lassen sich auf diesen Raum minimaler Bewegungen und Spuren herunter brechen. Dort lässt sich testen, was sich noch frei bestimmen lässt, wenn andere Vorstellungen bereits nach bestimmten Regeln zu Papier gebracht worden sind. Dabei baut sich ein ikonisches Verhältnis auf zwischen dem, was wir uns innerhalb und mit der graphischen Setzung vorstellen können, und dem, was in einer Referenzsituation denkbar und möglich wäre. Ist es möglich, Feuer zu finden, das kalt ist? Ist es möglich ein Rad so zu drehen, dass sich ein anderes Rad dadurch in die gleiche Richtung dreht? Ist es wirtschaftlich sinnvoll, die Einnahmen unabhängig von den Ausgaben zu steigern? Die Freiheit, die das Diagramm in der Rezeption lässt, wird zum Indikator für den Spielraum, den eine Kultur in der Welt auszuschöpfen versucht. Das ist der Kerngedanke, der in den folgenden drei Beispielen entwickelt werden soll. Mit der Frage nach dem Diagrammatischen, das die Beispiele gemeinsam haben, sollen also zugleich ihre Differenzen deutlich werden.


lassen Kreise nach Belieben rotieren und stellen uns dabei vor, Räder in beliebige Richtungen drehen zu können.

Der Lehrsatz nimmt dann allerdings auf eine Erfahrung Bezug, die aufgezwungen sein soll und nicht mehr frei bestimmt werden kann: Ist die Bewegungsrichtung eines Rades frei gewählt, dreht sich ein angrenzendes Rad auf eine bestimmte Weise mit. Man denke etwa an zwei ineinander greifende Zahnräder. Die Drehrichtung des zweiten Rades kann nicht frei und unabhängig vom ersten Rad bestimmt werden. Der Mechaniker soll lernen, seine Vorstellungskraft entsprechend einzuschränken.

Der Text leitet diesen Satz aus einer Reihe von diagrammatischen Operationen her. Ich verdeutliche dies, indem ich die imaginäre Transformation des Diagramms durch sukzessiv hinzugefügte Pfeile veranschauliche (Abb. 5). In der Abbildung sind die zusammengestellten Formen des Diagramms als Phasen einer gedanklichen Transformation der graphischen Form zu verstehen, die mit \( t_0, t_1, t_2 \) usw. bezeichnet sind. In \( t_1 \) wird zunächst eine beliebige Drehrichtung eines Rades angenommen. Diese Drehbewegung wird dann gedanklich in zwei Teile geteilt (\( t_2 \)). Es entsteht die Form eines Rades, dessen gegenüberliegende Seiten „sich in verschiedene Richtungen drehen“ (eine Formulierung, die ich dem Text der Problemata Mechanica entnehme). Verschiebt man diese Drehbewegung an die Kontaktstellen \( \Gamma \) und \( \Delta \), lassen sie sich auch auf die benachbarten Räder übertragen (\( t_3 \)). An dieser Stelle

Abb. 5

Transformation des aristotelischen Diagramms zur Bewegung angrenzender Räder, Hervorhebungen vom Verfasser
kommt eine entscheidende, durch eine gesetzte Spur erzwungene Beobachtung ins Spiel. Der rote Pfeil bei $\Gamma(t_4)$ lässt sich auch der angrenzenden Kontaktstelle $\mathcal{B}$ zuordnen. Er bleibt in diesem doppelten Bezug dennoch die Wahrnehmung ein und derselben Spur. Geht man von dieser Identität aus, lässt sich die Bewegung von $\mathcal{B}$ nicht mehr unabhängig von $\Gamma$ wählen.

Aus dieser Beobachtung kann nun in wenigen Schritten das Prinzip der umgekehrten Drehrichtung hergeleitet werden: $\mathcal{A}$ bewegt sich nach der eingeführten Regel (die besagt, dass sich gegenüberliegende Seiten eines Rades in entgegengesetzte Richtungen drehen) umgekehrt zu $\mathcal{B}$, entsprechend bewegt sich $\mathcal{Z}$ umgekehrt zu $\mathcal{E}(t_5)$. Fasst man diese Richtungen zusammen, steht das postulierte Prinzip auf dem Papier. Angrenzende Räder bewegen sich in entgegengesetzte Richtungen ($t_6$). Der Aha-Effekt ergibt sich daraus, dass das Ergebnis nicht als vollkommen willkürliche Vorstellung gezeichnet wurde, sondern durch die Wahrnehmung bereits materialisierter Vorstellungen und die Anwendung elementarer Regeln bedingt ist.

Fassen wir diese Analyse mit Blick auf eine Theorie des Diagrammatischen zusammen. In der Einschreibung der Spur und deren gedanklicher Transformation wird die graphische Fläche zunächst von innen her bestimmt. Es werden Vorstellungen nach bestimmten Regeln in die Tat umgesetzt. In der Wahrnehmung einer gesetzten Spur kann die graphische Fläche dann zum Stellvertreter einer Außenwelt werden, die uns den Vorstellungen entsprechende Erfahrungen aufzwängt, die von außen nach innen führen. So stehen die Pfeile im aristotelischen Diagramm der Drehrichtungen einmal für Bewegungen, die willkürlich ausgeführt sind und einmal für Bewegungen, die in Erfahrung gebracht und sozusagen „erlitten“ sind. Dieser essentielle Gegensatz wird in der diagrammatischen Operation zu einer reflektierbaren Größe: In Beziehung zu $\Gamma$ steht der rote Pfeil für ein willkürlich in Drehung versetztes Rad, d.h. für eine Bewegung, die unabhängig vom materiellen Kontext ist und von den eigenen Wünschen und Vorstellungen abhängt. In Beziehung zu $\mathcal{B}$ hingegen steht der Pfeil für eine Drehung, die vom materiellen Zusammenhang der Räder abhängig ist, so dass die Bewegung eines Rades unter Umständen auch mit katastrophaler Plötzlichkeit falsche Vorstellungen durchkreuzen kann.

Das Geheimnis der diagrammatischen Operation zeichnet sich hier besonders deutlich ab. Es besteht darin, dass sich auf der einen Seite alles als Form verstehen lässt, die man aus einem freien Bewegungsimpuls heraus mit Bezug auf übergeordnete Regeln in die graphische Fläche einschreiben kann. Auf
Zwischen innen und außen. Für eine Pragmatik des Diagrammatischen

...die dort gemäß einer bestimmten Regel gesetzt ist, ohne dass die Vorstellung die dauerhaft festgehaltene Einschreibung auslöschen könnte. Die Leichtigkeit, mit der sich beide Aspekte ineinander verwandeln lassen, hilft Fällen zu kontrollieren, in denen das Verhältnis von Regeln, Vorstellungen und unveränderlichen Bedingungen der Wirklichkeit verwickelter ist.


**mundus – annus – homo**


Wiederum ist es grundlegend, den Akt der Einschreibung von zwei Seiten her zu denken: als etwas, was faktisch auf das Papier gesetzt worden ist, und als etwas, was sich als *Potential der Setzung nach bestimmten Regeln* vorstellen und dabei auch in Beziehung zu anderen Setzungen bringen lässt. Mit Bezug auf Schriftzüge lässt sich das auch einfach als Zusammenhang von Schreiben und Lesen begreifen. Nehmen wir einen konkreten Begriff wie *calidus* als Beispiel. Fasst man *calidus* als Schriftzug auf, steht dieser unverrückbar
Zwischen innen und außen. Für eine Pragmatik des Diagrammatischen


Die konkrete Lektüre bleibt damit offen und anschlussfähig. Gibt es weitere Regeln, die nicht nur für den einzelnen Schriftzug, sondern auch für

Abb. 6

Diagramm zur aristotelischen Elementenlehre aus einer karolingischen Sammelhandschrift München, Bayerische Staatsbibliothek, clm 16128, fol 16r.
seine Beziehung zu anderen Wörtern und Kreissegmenten gelten? Wir können tatsächlich erkennen, dass die zwei Schreibungen von *calidus* in einem blassgelb markierten Kreissegment zusammengefasst sind. Auch die anderen Eigenschaftsbegriffe (*humidus*, *frigidus* und *sicca* [für *siccus]*) sind jeweils zweimal geschrieben und durch ein Kreissegment verbunden, so dass sie in dieser Hinsicht als Einheit erscheinen. Die identischen Adjektive lassen sich jedoch auch getrennt auf verschiedene Kreise beziehen, die um die vier Elemente geschlagen sind. Das erste, weiter links und oben im Kreis geschriebene *calidus* ist zum Beispiel dem türkis-blauen Kreis um *IGNIS* zugeordnet, das benachbarte *calidus* einem kleinen dunkelblauen Kreissegment um *AER*. Dieses Segment ist verkürzt ausgeführt, kann jedoch im Analogieschluss gedanklich weiter gezogen werden.


An dieser Stelle lässt sich noch einmal möglichst präzise die Frage nach der Freiheit von Vorstellungen im Zeichnen des Diagramms stellen. Im Fall der mechanischen Räder wurden zwingende Regeln der Körperwelt angenommen,
die der Vorstellung dennoch Spielraum ließen: die Drehrichtung des ersten Rades ist frei vorstellbar, die Bewegung der verzahnten Räder jedoch nicht mehr. So blieben die Kreise auch leer, ohne Richtungspfeil. Nicht die Zeichnung, sondern die Vorstellung konnte bestimmen, in welche Richtung sich das System im konkreten Fall drehen sollte. Die freie Setzung der ersten Richtung verwandelt sich in den Zwang, resultierende Richtungen abzuleiten.


Gerade weil alles, was in das Diagramm geschrieben ist, keine weitere Bestimmung zulässt, fordert die Form dazu auf, zusätzliche Vorstellungen in das System einzuschreiben. Das Diagramm selbst ist Ergebnis einer solchen Operation, indem nicht nur das Thema der vier Elemente (mundus), sondern auch das Thema der vier Jahreszeiten (annus) und die auf Galen zurückgehende Lehre der vier Säfte und Temperamente (homo) in dieselbe Form geschrieben werden. Dem Feuer (IGNIS) wird zum Beispiel der Sommer (aestas) und die gelbe Galle (colera) zugeordnet. Durch die gemeinsame Projektion wird die Kompatibilität der verschiedenen Lehren veranschaulicht: Die Einteilung des Jahres in vier Jahreszeiten, die Unterscheidung von vier Elementen und die Grundsätze der Humeralpathologie beruhen auf denselben logischen Operationen der Unterscheidung.

So ist die mittelalterliche Kultur der Diagramme, angefangen mit Isidor von Sevilla’s Schrift *De natura rerum*, über Jahrhunderte damit beschäftigt, die Figur nicht nur zu kopieren, sondern mit weiteren Begriffen, zum Teil auch mit figürlichen Symbolen anzureichern. Mit unerschöpflicher Energie werden neue Begriffe gesucht und Allegorien entworfen, die in das System passen. In der historischen Entwicklung des Denkens mag die Figur geholfen haben,
in verschiedenen Themen und Argumenten die iterative Anwendung grundlegender logischer Operationen erkennen zu können. Sie kann aber auch umgekehrt dazu beigetragen haben, die Beweiskraft einer logischen Operation mit der Wahrheit ihrer semantischen Spezifizierung zu verwechseln. Die perfekte Symmetrie des Kreises und die farbliche Ausgestaltung der Figur scheinen die relative Wahrheit der Aussagen beständig in eine absolute Wahrheit transformieren zu wollen. Es gäbe dann tatsächlich nur diese eine zwingende Möglichkeit, die Welt in vier Elemente und vier Grundeigenschaften aufzuteilen. Man sollte jedoch mit kontextunabhängigen Behauptungen vorsichtig sein. Es lassen sich nämlich auch Zusammenhänge denken, in der die Ausgestaltung eine ästhetische Reaktion auf das Bewusstsein gewesen ist, dass die Besetzung der logischen Struktur kontingent und nicht mit allen möglichen Erfahrungen deckungsgleich ist.7

Zwischenfazit


2. Ein wesentliches Spezifikum verschiedener Operationen betrifft die Frage, inwieweit eine Differenz zwischen den Bereichen Vorstellung und Erfahrung
produktiv gemacht wird: Geht es um Erkenntnis im klassischen Sinn, das heißt um Vorstellungen, die durch materielle Bedingungen erzwungen werden? Oder ist eher Planung und Kontrolle das Ziel: Ist die diagrammatische Operation ein Instrument, materielle Unbestimmtheiten durch Vorstellungen besser bestimmen zu können?

**Pulsschreiber**


Ohne die Details dieses Prozesses erhellen zu können, verdeutlicht Mareys Abbildung, wie die graphische Fläche der aufgezeichneten Kurve sich an die Stelle der pulsierenden Haut setzt und dabei viel stärker als die lebendige Haut zu einer Membran zwischen innen und außen werden soll: Die Handwurzel, an der sich der Puls abzeichnet, steht für eine „Außenhaut“ des Patienten, der die Stärke und Frequenz des Pulses nur in einem sehr begrenzten Maß willentlich kontrollieren und den eigenen Wünschen und Vorstellungen unterwerfen kann. Erst das geschwärzte Papier, in welches die Kurve eingeschrieben wird, unterstützt die Verwandlung der Außenhaut in etwas, was dem Zugriff von innen zugänglich werden soll. Dazu bedarf es der Kompetenzen eines Arztes. Die Fläche des Diagramms ist also – paradoxerweise – viel stärker als die Haut des Patienten eine „Innenhaut“, auf der sich abzeichnen soll, was durch die medizinische Intervention vorgestellt und kontrolliert.

Das medizinische Kurvendiagramm ist das Beispiel, das vielleicht am deutlichsten vom Eigenwert der wahrnehmbaren Form wegführt und stattdessen weite pragmatische Handlungsräume öffnet. Ein Kurvendiagramm wird in dem Bewusstsein gezeichnet, dass die materielle Welt und die Regeln, denen sie unterworfen ist, durch die Welt der Gedanken und Vorstellungen entscheidend mitbestimmt werden kann. Nicht nur dadurch, dass innerhalb vorgegebener Regeln und Prinzipien bestimmte Fälle geschaffen werden, die zu bestimmten Resultaten führen. Das ist die Welt der mechanischen Positions- und Funktionsdiagramme. Ein Kurvendiagramm ist mit einem ungleich größeren Spierraum verbunden: In ihm kann über die Gesetze und Prinzipien selbst verhandelt werden. Was soll normiert, welche Zusammenhänge sollen gestiftet werden? Ab welchem Punkt soll man eingreifen? Welcher Fall gilt als normal, welcher als unbedenklich, welcher als therapiewürdig? Die Unterscheidung zwischen dem, was sich frei bestimmen lässt, und dem, was man eben als körperlich gegeben hinnehmen muss, wird zum Gegenstand einer Diskussion, die immer wieder auf Diagramme zurückgreifen muß, um nicht gegenstandslos zu werden.

Abb. 8
Deutsche Börse, Frankfurt a. M.
Verlauf des DAX
am 15. April 2003
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**Fazit**

Diagrammatische Aufzeichnungen folgen Regeln, die die Innenwelt unserer Vorstellungen und Wünschen mit einer Außenwelt körperlicher und materieller Prinzipien verbindet. Im graphischen Akt sind die Faktoren in idealer Weise aufeinander bezogen: Die Spur, die nach bestimmten Regeln als Teil der körperlichen Außenwelt auf das Papier gesetzt und dort nach dem Prinzip räumlicher Nachbarschaften festgehalten wird, und die Wahrnehmung der Spur als etwas, was sich aus der Innenwelt der Vorstellungen und Wünsche heraus nach bestimmten Regeln setzen, transformieren und in Verhältnis zu anderen Spuren bringen lässt.


Zum einen können damit im klassischen Sinn des Begriffs „Erkenntnis“ Welten entworfen werden, in denen die graphische Handlung keinen Einfluss auf die Referenzhandlung haben soll, sondern deren feststehende Prinzipien und Regeln in der diagrammatischen Operation wiederholt und aufgedeckt


In der Moderne erscheint diese Funktion noch potenziert: Diagrammatische Operationen sind zu einem zentralen Instrument der Steuerung und Rückkopplung körperlicher und kultureller Prozesse geworden. Ihr Gegenstand sind zeitliche Prozesse, deren Verlauf durch die Einführung neuer Regeln radikal verändert werden kann. Erfolgt die Herstellung der Diagramme in einer offenen und reflektierten Diskussionssituation, fragt die Gemein-
schaft mit Hilfe der aufgezeichneten Daten, an welchen unveränderlichen Regeln der Wirklichkeit und an welchen selbst gewählten Normen sie die eigenen Handlungen ausrichten will. In einer unreflektierten und zur Gewohnheit gewordenen Praxis wird sich die Gemeinschaft den erzeugten Diagrammen und eingefahrenen Interpretationsroutinen unterwerfen, so als seien sie die eigentliche, unveränderliche Wirklichkeit.

Anmerkungen


7 Vgl. Felix Thürlemann in diesem Band.


**Bildquellen**


5 Verf.


8 http://deutsche-boerse.com
Showing Space, 
or: 
Can there be Sciences of the Non-Discursive?

Bill Hillier, London

Introduction:  
Space and Wittgenstein

The aim of this paper is to explain a theory of space, and how it features, conceptually and practically, in everyday life. The theory, which is known as space syntax, bears on the work of Wittgenstein in three ways. First, from the point of view of language, space seems to the kind of problem that Wittgenstein identified for logic in the *Tractatus*, that what is expressed through language cannot be represented in language (TLP 4.12, 4.121). Practically speaking, this means that although natural language, like life, is built on a scaffolding of space and spatial relations, so much so that ‘language and space’ is now a key theme in cognitive neuroscience (Bloom et al. 1996), the patterns of space in which we live our lives are not representable in linguistic terms. The spatial relations and structures of our lives are in effect non-discursive: we live them but don’t know how to talk about them. The non-discursivity of space is a particular problem in architecture where the primary task is to create a pattern of space—a ‘layout’—adapted for functional purposes, yet there are no linguistic means to describe the differences between one layout and another, forcing architects to proceed by intuition, precedent or metaphor. Yet architects must predict function from space, and so need a consistent language, if not a science of space. This poses the question: can there ever be a science of space when space is non-discursive in this sense? Space syntax then addresses the architectural problem of space, but anticipates that in doing so it will address the problem of space in general.
The second point of contact with Wittgenstein is that graphical representations played a critical role in the creation of the theory, and still play a critical role in its applications. These representations were able to show features of spatial patterns that language was not able to describe. But more unexpectedly, perhaps, from a Wittgensteinian point of view, these representations led directly to seeing how we could quantify structural features of space, and so seek to render the non-discursive discursive. We can make the point in a Wittgensteinian way. In the *Untersuchungen* he says:

> Our language can be regarded as an ancient city: a maze of little streets and squares, of old and new houses, of houses with extensions from various periods [...] surrounded by a multitude of new suburbs [such as the symbolism of chemistry] with straight and regular streets and uniform houses. (PI § 18)

We can say that we sought to add a new suburb to language, based on a science of space, which will allow the spatial scaffolding of life to be described. But this also means that in Wittgensteinian terms we are trying to say the unsayable. The question is: do we succeed and what are the implications?

The third point of contact concerns what Wittgenstein would call the ‘formal unity’ of the ‘language of space’ at which we arrive. Once the structural features of spatial relations are brought to light, we seem to discover that space is subject to something like laws, not in the form of universal behaviours, but of the form ‘if we intervene physically in space in this way rather than that—say by placing an object in the centre of a room rather than a corner, or making the object rectangular rather than square—then the structural consequences for the ambient space are these.’ These ‘laws’ seem to be known intuitively to human beings, in the same sense that when we throw a ball of paper so that its parabola leads it to land in the waste paper basket, we ‘know’ the laws of mathematical physics—what cognitive science has called ‘intuitive physics.’ It seems to be these lawful potentials that human beings exploit in culturally differentiated ‘spatial games.’ We also find that the emergent forms of complexity, such as the spatial structures of cities, that accumulate from human spatial behaviours, manifest astonishing cross-cultural invariants. All this suggests that the human language of space, in spite of its power to generate differentiated cultural expression, is in some sense a universal language. Should we then conclude that space has the formal unity that the later Wittgenstein doubted for natural language?
In this paper then, we aim to clarify space by seeing it through key Wittgensteinian ideas. We do not aim to clarify Wittgenstein! But we end with a Wittgensteinian twist, which may suggest other areas where Wittgenstein’s thought might be explored, namely in the sciences of complexity. Although the emergent structures that arise in large and complex spatial systems can be represented graphically, and so shown clearly, and can even be tested against functional evidence for their verisimilitude to reality, they cannot so far be described within a formal language. They can, it seems, only be shown. As we will argue, this is a general problem in the sciences of complexity, so we seem to be back to square one, and the Tractatus, but with a more generalised view of the problem of showing!

In what follows, we deal with these questions in turn. Let me first try to show that space is a seriously Wittgensteinian problem.

**Space as a Wittgensteinian Problem**

If we are to talk about space and language, we should begin by addressing a fundamental theme in Wittgenstein’s writing, that language prescribed the limits to thought. It is hard to defend this point of view in the early twenty first century in the light of cognitive research, and the field where this can be said most emphatically is space. For example, according to Bowman:

> If any domain has plausible claim to strong language-independent perceptual and cognitive organisation, it is space. Our mental representations of space are constrained not only by our biology but also by their fit to the world out there. Little wonder it has seemed likely to many investigators that the language of space closely mirrors the contours of non-linguistic spatial understanding. Several kinds of empirical evidence support the assumption that children know a great deal about space before they can talk about it, and that they draw on this knowledge in acquiring spatial words. (Bowman, 1996: 387)

Johnson-Laird goes further: ‘Human reasoners use functionally spatial models to think about space, but they also appear to use such models in order to think in general’ (Johnson-Laird, 1996: 460). How language handles space is then critical for both language and space.
The problem of space in human thought and language, then, seems almost to involve a contradiction. Thought is profoundly spatial, yet at the same time language lacks any means of describing the everyday spatial complexity in which we live. How can this be? We can begin by looking more carefully at how language is spatial. A key part of the spatial structuring of many languages, including English, comes from the system of prepositions. In general, prepositions specify different spatial relations with considerable precision, but only between two or three entities. For example, ‘inside’ implies an ‘outside’ and something which distinguishes one from the other, ‘through’ implies a kind of origin and a destination as well as an entity passed through, ‘beyond’ specifies an origin and a place the other side of an intervening place, and so on. Where more entities are specified, as in the English ‘among’, then there is less precision in the spatial relations, and, in the case of ‘among’, the set of entities into which the ‘among’ entity is set is treated as a single entity, a grouping without further spatial form. Prepositions also differ in the kinds of relation they specify. For example, ‘next to’ is a symmetrical relation, in that if \( a \) is next to \( b \), then \( b \) is next to \( a \), while ‘above’ or ‘under’ are asymmetric relations, in that if \( a \) is above \( b \) then \( b \) cannot be above \( a \). ‘Between’ then can be seen to specify both symmetrical relations between the two outside entities, and an asymmetrical relation between them and the inner entity. Prepositions also specify the numbers of objects in particular places in a scheme of relations. For example, you cannot be between or among one entity or inside more than one, unless one is inside the other.

There seems, in effect, to be something like a formal structure underlying the set of spatial prepositions. Each preposition specifies a scheme of spatial relations, with both abstract and concrete properties, and comes as a kind of irreducible bundle, so that it is quite hard to specify what each means without using the word itself. For example, it is quite hard to say exactly what ‘between’ means without at some stage wanting to say ‘between’. We could perhaps try to say that there is an object with another object at one side and another on the opposite side, but this describes a line of three objects without pointing to the central one as being in a special relation to the other two as ‘between’ does. Or imagine a line of houses. Each, except the end two, is ‘between’ a pair of others, but we would not say this if we were looking at the line, which appears to us as a series of ‘next to’ relations. If we were living at number 10, though, we might well see ourselves as being between number 9 and number 11. So in effect betweenness needs to be pointed to, and is hard to indicate in
any other way. This seems a very clear case of Wittgensteinian ‘showing’ and what is shown is the scheme of relations bundled up in the word. The word, we might say, is a form of showing.

It is because prepositions bundle up relations in words that they seem to offer a kind of bridge between the perceptual and the conceptual. We see them, and show them, all at once, and what is shown are irreducible schemes of spatial relations. It is this that makes them suitable vehicles for abstract as well as concrete thought. But more significantly, it is perhaps possible at this stage of our evolution for this kind of bundling to be possible with up to three objects. Perhaps superior intelligences in the future will be able to do this with four, five or many more entities. But for the time being, we are in a situation in which our languages are pervasively spatial, yet lack any kind of terminology to describe even the simplest kind of everyday spatial complexity. Space then seems a very clear case of what is transmitted through language not being expressible in language.

**Defining Spatial Configuration**

So how do we proceed with the problem of spatial non-discursivity? (For a more extended treatment see Hillier & Hanson 1984 and Hillier 1996) Prepositions, as little schemes of spatial relations with both abstract and concrete properties, offer a clue. Can we somehow extend this mix of abstract and concrete to more complex patterns? We suggest this is possible by defining spatial configuration formally as spatial relations which take into account other relations. We must begin by saying exactly what we mean by this. How can relations affect other relations?

In Figure 1 (overleaf) we show top left a two cell plan with an opening between two spaces, $a$ and $b$. The relation of $a$ and $b$ is *symmetrical*, meaning that $a$ is to $b$ as $b$ is to $a$—just as if $a$ is $b$’s neighbour then $b$ is $a$’s neighbour. We then introduce a third space, $c$—in fact the outside—and in the middle case link both $a$ and $b$ to $c$, but in the right case link $a$ but not $b$, to $c$, so we must pass through $a$ to get to $b$ from $c$. The relation between $a$ and $b$ has not changed intrinsically, and remains exactly the same as it was, but if we consider the third space, in the middle case the relation between $a$ and $b$ with respect to $c$ is still symmetrical, but in the right case is has become *asymmetrical*, in that we must pass through $a$ to get to $b$ from $c$, but we do not need to pass through $b$
to get to \( a \) from \( c \). So the presence of a third element has changed the relation between \( a \) and \( b \) with respect to that element. This is what we mean by spatial configuration, in contrast to the simpler concept of spatial relations. Elements acquire values by virtue of their relation to all other elements in the system.

We can show this more clearly through a simple but powerful representation, and one which played a critical role in creating space syntax: the ‘justified’ graph, as in the bottom line in Figure 1. This means that you select a node as a ‘root’, and align all those connected to it one layer above, all those two steps from it two layers above, and so on, with the effect that you can see the configuration. With this representation, we can easily see what turn out to be the two key configurational properties of space. The first addresses the question ‘do you have to pass through intervening nodes to get from one node to another?’ We can call this the depth or, in space syntax parlance, the integration property—the less spaces are deep from each other the more integrated they are, and the more accessible they are as destinations from all other nodes. The second is: are there different routes from one node to another, which we can call the choice property, and how likely is each node to be used on a route between any pair of nodes. Any choice of routes implies rings or cycles in the graphs, since in any graph without rings there will be exactly one route from any node to any other node. These will turn out to be
the critical social properties of space, and because we can see how to detect their presence in simple cases we can learn to measure them in complex cases. How much integration and choice is there in a particular graph? The resulting values will turn out to have social meanings and even social effects.

**Showing Configuration**

We can also show how the justified graph can make accessible more complex configurational properties to intuition, to *show* them, in Wittgenstein’s terms. The top line in Figure 2 shows the plans of notional 8-cell houses. As plans it is difficult to say much about them apart from making a list of local relations. Of course, by living in the houses we would quickly intuit the configurational differences, and functional possibilities and inhibitions. But they would remain non-discursive. In the bottom line we see in the j-graphs from the outside immediately the configuration properties of depth and rings, so we can see how shallow or deep, ringy or tree like each graph is, more or less at a glance.

But we are still in the realm of seeing more clearly what can not be expressed in language. To take the next step, we must learn to measure the presence of these properties. This will lead us to the most fundamental property of graphs from a spatial point of view: graphs differ in the properties of integration and choice when seen from the points of view of different nodes.
within the graph. Consider the two graphs in Figure 3. The two seem quite different in terms of the configurational properties we have described, but in fact the two are the same graph seen from two different points of view, namely spaces 5 (the shallow graph on the left) and 10 (the deep graph on the right). So we can say the graph is integrated from the point of view of space 5, and segregated from the point of view of space 10. This is the fundamental property of graphs that is exploited by buildings and cities, from the scale of the domestic dwelling to that of metropolitan Tokyo: graphs are different from different points of view.

To capture these differences means measuring the depth and choice values of the system when seen from the point of view of each space in the complex. These are essentially the familiar mathematical measures of *closeness* (depth) and *betweenness* (choice) (they were not familiar when we first developed them!), though with certain syntactic normalizations to allow comparisons of systems of different sizes. Once we have this we can give a spatial meaning to the pattern of functions in a building. For example, as in Figure 4, which represents the real case of a house in Normandy in France (Hillier et al. 1987), we commonly find that a ‘living room’ or a ‘kitchen’ is not just a space with certain furnishings and implements, but also a certain configurational position in the house, and a certain way of relating to all other spaces. These differences can be clarified and demonstrated by assigning values to spaces which index how it is related to all the other spaces in the house. In this way, we can find a clear and culturally variable *spatial meaning* to the idea of *function*.
A form-function relation exists because function has been realised spatially through the positioning of the function in the layout as a whole. So ideas are seen to be objectively present in the layout itself, and its pattern of assigned functions, as well as in minds.

These values give us the configurational properties of individual spaces with respect to the whole, and this is sufficient to give a picture of functional patterns. If we may be permitted a little Wittgensteinian immodesty, this formulation solves a key theoretical problem in architecture. Although a leading element of the architect’s trade is to match the spatial form of a building to its functioning, there is no theory to inform how this can be done other that of the most generalised kind. There is no design level theory capable of informing decisions about the relations between spatial form and functioning.

A key reason for this is that most buildings are made up of the same kinds of spaces—room, corridors, courts, and so on—varying in size but not much else, so most functioning happens in a similar range of spaces. It was only by showing that the key properties of spaces were those which linked it to the pattern of space as a whole, that each space acquired properties which were distinctive to its function, as for example in the French house in Figure 4, a *salle commune* must be integrated into the plan to work as an everyday gathering space, while a *grande salle* needs to be segregated from everyday activity to preserve its identity as a special space. Space syntax shows in effect that it is the extrinsic properties of spaces which relate to function in a non-trivial way, because this is the way spaces acquire distinct identities in the plan.
But what we still lack is a picture of any kind of the pattern of the whole. Configurational value gives a picture of the whole from a certain point of view, but no discursive picture of the whole that we see when we look at the layout. At this level we have not translated the non-discursive into the discursive. However, we can take an important step in this direction by using another syntactic device: the translation of numbers into colours. By representing bands of numerical values as colours, and always from red (or ‘hot’) for strong values on any variable through to blue (or ‘cold’) for weak, the picture of the whole can be *shown* in Wittgensteinian terms, but still not of course described in any kind of language. Here then is a strong, simple and clear example of something that is an expression of the spatial relations that are to be found throughout language not being sayable *in* language, but only *shown*—in this case by a graphical trick!

![Image](image_url)

**Fig. 5** Warm and cold colours representing the total depth value.

**More Complex Representations**

But so far we have looked only at the first, simple steps in space syntax. To take the next steps we need to consider how to represent space in order to make configurational calculations. So far we have used rooms as spatial elements. But cities, and indeed many buildings, do not have rooms, or anything that can be easily recognised as well-defined spatial elements. So how, in such cases, can space be represented to allow configurational computations?

To answer this we need a little philosophy! Through our education, we acquire the habit of seeing space in a Cartesian way as ‘extension without
the object’, and so as the background to objects, and in architecture we extend this to seeing space as the background to human activity. But as soon as we try to translate this idea into human space, all is lost. We are condemned not to understand it. The reason is simple. Space is intrinsic to human activity, not a background to it. Movement is fundamentally linear, whether we are leaving a room or crossing a city. Interaction is convex, because all interactors must be co-present. Our experience of space as we move about in buildings or cities is of strange jagged shapes we call isovists, and somehow we use these to put together an intelligible picture of where we are. Once we understand this, we see that we shape space in ways which reflect the different types of human activity and experience, and through this the space we make becomes humanised. This is where we have to begin if we want to understand space analytically.

We can now define space syntax as a set of methodologies for making configurational analyses of space represented in different ways as points, lines, convex spaces and isovists, and at different radii from each home element. Let us show you the power—including the predictive power—of these analyses. Visual integration analysis means taking a layout as a set of points at an arbitrarily fine scale, and calculating how many visual steps are needed to see all points in the layout from each point. In effect it analyses the whole pattern of visual fields in a layout and assigns integration values to the roots of each visual field. We then colour up from red for strong through the blue for weak as usual and so extract a visual integration structure from the layout.

Fig. 6 Shapes of human activity and experience.
For example, Figure 7 shows the visual integration structure for the Tate Britain gallery, a structure which links galleries together and links the whole pattern to the entrance (we call it a shallow core). On the right are traces of visitors entering the gallery and moving about for ten minutes. Each visitor takes an individual path through the layout, but when we look at the aggregate of traces, we see that the pattern of traces and the structure of visual integration resemble each other strongly. The similarity of the two patterns can be checked statistically, and in fact something like 70% of the differences in individual movement patterns can be accounted for by the visual integration structure of the layout. This leaves no doubt that visitors are using the spatial layout of the gallery, consciously or unconsciously, as their main navigational aid. The spatial form and functional pattern of the building resemble each other, not through design intention but as an emergent effect.

Now reflecting on this case and that of the French house we can begin to see that space works in two ways. A spatial layout can reflect and embody a social pattern, as in the case of the French house, where space was laid out and categorised to give reality to a culturally given pattern of activity, and so reinforce and reproduce it. So we can perpetuate things about ourselves and our cultures by building them into space, and so making them seem inevitable and natural. We can call this the conservative use of space, since space is
being use to reflect and so reproduce a given social pattern by the control of copresence. But space can also shape a social pattern, as in the case of the Tate Britain movement study, since by shaping movement, space also creates a pattern of natural co-presence in space, and so potential encounter and potential social relation arising from co-presence. We can call this the generative use of space, since we are using space to create the potentials for new co-presence and potentially for social patterns. We will see in due course that this dual potential of space is one of the keys to understanding space in cities.

The Discovery of Spatial Laws

Once we have the concept of measuring configuration as the relations between all the spatial elements in the system and all others, then whatever representation we use, we can easily discover spatial laws. These laws do not take the form of universal behaviours, but govern the ways in which different types of spatial configuration arise from the placing and shaping of objects in space—which is what architects do.

For example, as Figure 8 shows, if we take a square object and place it within a bounded square space, and move the object from corner to centre edge and then to centre, with each step we decrease the degree of visual integration in the ambient space, as well as changing its pattern.
We find the same with metric integration. The mean length of trips in the ambient space increases as we move the object from corner to centre. If we change the shape of the object from square to rectangular while conserving the area, as in Figure 9, we find again that visual integration decreases and mean trip length increases, and again the pattern changes:

These effects can be explained easily by means of a diagram—Figure 10—and some simple calculations. As we move a partition in a line of cells from centre to edge, the total inter-visibility from each cell to all others increases, though of course the total area remains constant. So both this and inter-accessibility effect arise from the simple fact that to measure either we need to square the numbers of points on either side of the blockage (Hillier 2009). All we need to know is that twice the square of a number, \( n \), will be a smaller number than \((n-1)^2 + (n+1)^2\):

\[
2n^2 < (n-1)^2 + (n+1)^2
\] (1)

We call these all-points-to-all-others-measures configurational metrics. We use them when instead of being interested in, say, the distance from \( a \) to \( b \), we are interested in the distance, metric, visual or topological, from each point or element in the system to all others. So we see that the configurational metrics we use in real human space are not the same as geometry and in fact behave in a quite different, though still lawful, way.

These simple laws have some highly interesting effects. They mean that a large space and a small space are, from the point of view of intervisibility
Showing Space, or: Can there be Sciences of the Non-Discursive?

Within the spaces, ‘larger’ than two similarly sized spaces of equal total area, and that a long line and a short line are ‘longer’ than two lines of similar length and equal total length. They also mean that small blocks placed in the centre of a system are more integrating than small blocks placed on the edge of the system. All these lawful phenomena are found pervasively in cities. The laws are, we believe, intuitively known to human beings in the sense, as we said, of ‘intuitive physics’. We feel the laws of physics in our minds—even in our arms—when we manipulate objects by throwing them or moving them. This could be shown by examining human spatial behaviour and by spatial experimentation (Hillier 2009). But the most powerful evidence that these laws are known to human beings comes from the degree to which evidence for them is found in the largest and most complex spatial objects that human beings make: cities. The fact is that in spite of the cultural differences we find in the forms of cities in different parts of the world, and in spite of the differences in the circumstances in which they are created, there is an underlying universal city made up of an astonishing range of invariants common to all cities.
Cities as Spatial Configurations

To analyse a city spatially in syntactic terms means analysing its street network. But before we do so, simply by measuring and counting we can discover invariants. To illustrate this we can use arbitrarily selected areas of London and Tokyo, both largely ‘organic’ cities, and about as far from each other in distance and socio-cultural background as it is possible for cities to be. By representing both as least line maps (the fewest lines that cover the network and make all connections) we find:

- that at all scales, from local areas to whole cities, cities are made up of a very small number of long lines and a very large number of short lines (Hillier 2002), so much so that in terms of the line length distributions in their least line maps cities have been argued to have scale-free properties (Carvalho & Penn 2004). This is just as true of more geometric cities such as Chicago and Athens, as it is for more ‘organic’ (meaning lacking obvious geometry) such as Tokyo or London,

- that in ‘organic’ cities (as defined above), the longer the line the more likely it is to be end-connected to another by a nearly straight connection (between about 5 and 25 degrees), creating sequences of such lines, which the eye instinctively identifies when looking at the map, and the shorter the line the more likely it is to intersect with others at near right angles, creating local clusters of such lines. In more geometrical cities,
a similar pattern can be found but with more often straight rather than nearly straight long lines,
• that through these metric and geometric regularities, cities’ street networks acquire a dual structure, made up of a dominant foreground network, marked by linear continuity (and so in effect route continuity) and a background network, whose more localised character is formed through shorter lines and less linear continuity.

Applying syntactic measures to least line maps of cities—in this case treating the street segment between junctions as the spatial element and using least angle change, rather than simple metric distance as the measures of distance (since this has been shown to be how people read and move about in cities—see Hillier & Iida 2005), we bring to light further regularities. For example:
• by measuring least angle integration (normalised mathematical ‘closeness’—or more simply the relative accessibility of each street segment from all others) analysis without radius restriction (so the most ‘global’ form of the analysis), a dominant structure is identified approximating the form of what we call a deformed wheel, meaning a ‘hub’ of lines in the syntactic centres, strong ‘spokes’ linking centre to edge and strong ‘rim’ lines. Figure 12, for example, shows the underlying deformed wheel pattern in both metropolitan Tokyo (with multiple rims) and London within the M25.

Fig. 12 Least angle integration (normalised closeness) for metropolitan Tokyo (left) and London within the M25 (right) in each case showing a variant of the ‘deformed wheel’ structure, with multiple rims in the case of Tokyo.
The syntactic measure of least angle choice (mathematical ‘betweenness’, or the potential of each segment for through movement on routes from all segments to all others) then commonly identifies a network spread through the system, though strongest in the more syntactically central locations (see Figure 13). In other words, in spite of the differences in socio-economic and temporal circumstances in which cities grow, they seem to converge on common generic forms which have metric, geometric and configurational properties. However the similarities between cities does not stop there. On close examination, for example:

- all cities seem to exhibit a property we call **pervasive centrality**, meaning that ‘central’ functions such as retail and catering concentrations diffuse throughout the network at all scales, from the city as a whole to the local network of streets. For example, Figure 14 is Mike Batty’s image of the 168 largest centres in London within the M25. By comparing Figure 14 to Figure 13 we find a strong ‘eyeball’ correspondence. However, the image also makes clear that the global properties shown in the map are not sufficient in themselves to identify the location of centres. We typically find for example that along the length of a high global movement potential alignment we find the centre occurring only in certain locations. For example, if we take the Edgware Road between the North Circular Road and Oxford street, there are three high streets with the rest fairly free of shops. In each case, the centre occur where local **grid intensification** (a dense and smaller scale local grid) co-incides.
with the globally strong alignment. The pattern is far more complex than envisaged in theories of *polycentrality*. It is notable also that pervasive centrality seems spatially sustainable because it means that wherever you are you are close to a small centre and not far from a much larger one. (Hillier 2009)

If we reduce the radius of the measures we then find the—much more numerous—smaller scale centres. For example, at radius 750 metres, all of the ‘urban villages’ in a section of north west London are picked out in red.
The regularities that we find in cities with least angle analysis suggest a new definition of the city. Cities of all kinds, however they originate, seem to evolve into a foreground network of linked centres at all scales, from a couple of shops and a café through to whole sub-cities, set into a background network of largely residential space. The foreground network is made up of a relatively small number of longer lines, connected at their ends by open angles, and forming a superordinate structure within which we find the background network, made up of much larger numbers of shorter lines, which tend to intersect each other and be connected at their ends by near right angles, and form local grid like clusters. We suggest this is the proper generic definition of what a city is as a large object.

The Dual City of Economic and Social Forces

So what forces give the city this shape. We believe the answer lies in two key new phenomena which research using space syntax has brought to light. The first we call spatial emergence: the network of space that links the buildings together into a single system acquires emergent structure from the ways in which objects are placed and shaped within it. As we have seen, this process is law-governed, and without an understanding of these laws the spatial form of cities cannot really be deciphered. The second phenomenon is spatial agency: the emergent spatial structure in itself has lawful effects on the functional patterns of the city by, in the first instance, shaping movement flows, and, through this, emergent land use patterns, since these in their nature either seek or avoid movement flows. Through its influence on movement, the urban grid turns a collection of building into a living city. Movement is literally the lifeblood of the city. It is these two linked processes of spatial emergence and spatial agency that set in train the self-organising processes through which cities acquire their more or less universal spatial form.

What then drives these processes? In fact, the universal functional structure associated with the dual network suggests the answer. Within the envelope created by cognitive constraints—the need for the city to be intelligible in order to be usable at all (see Hillier 2009)—we can now see how economic and social forces put their different imprints on the city. The foreground structure, the network of linked centres, has emerged to maximise grid-induced movement, driven by micro-economic activity. Micro-economic activity takes
a universal spatial form and this type of foreground pattern is a near-universal in self-organised cities. The residential background network is configured to restrain and structure movement in the image of a particular culture, and so tends to be culturally idiosyncratic, often expressed through a different geometry which makes the city as a whole look spatially different. The first is an instance of the generative use of space, since it aims to generate co-presence and make new things happen, and the second conservative since it aims to use space to reinforce existing features of society. In effect, the dual structure has arisen through different effects of the same laws governing the emergence of grid structure and its functional effects. In the foreground space is more random, in the background more rule-governed, so with more conceptual intervention.

We can illustrate this most clearly in a city with more than one culture (now unfortunately separated): Nicosia (Figure 16). Top right is the Turkish quarter, bottom left the Greek quarter. Their line geometry is different. In the Turkish quarter, lines are shorter, their angles of incidence have a different range, and there is much less tendency for lines to pass through each other. Syntactically, the Turkish area is much less integrated than the Greek area. We can also show that it is less intelligible, and has less synergy between the local and global aspects of space. Yet in spite of these strong cultural differences in the tissue of space, we still find Nicosia as a whole is held together by a clear deformed
wheel structure. This shows how micro-economic activity spatialises itself in a universal way to maximise movement and co-presence, while residence tends to reflect the spatial dimension of a particular culture, and the expression is in the first instance geometrical. Since residence is most of what cities are, this ‘cultural geometry’ tends to dominate our spatial impressions of cities.

**Two Wittgensteinian Remarks**

So we seem to have a theory of the city which links form to function, micro-structure to macrostructure, and differentiates between socio-cultural and micro-economic factors in creating the spatial form of the city. Have we then succeeded in our aim of creating a science of the non-discursive for space, and so emancipated ourselves from Wittgenstein’s strictures? There are two key issues. Does space have a formal unity (since there cannot be a science of space if it does not)? And have we described structure and function in spatial phenomena (since without this we cannot make predictions from theory)? Two Wittgensteinian remarks seem in order.

The first concerns the relation between the microeconomic and cultural aspects of urban form, as found in the foreground and background networks. The former seems to reflect the universals of human micro-economic behavior, the latter the relativity of human cultural behavior. Should we then see the ‘language of space’ as being composed of spatial games, or does it have ‘formal unity’ (to use Wittgenstein’s own expression in the *Untersuchungen*)?

In our view, the evidence indicates strongly that there is a single language of space and that it has formal unity because it is based on the underlying laws we have described. We would go farther and suggest that it is because the language of space is a formally unified language that differentiated cultural expression is possible. For example, the spatial and functional differences between the foreground and background grids arise because the laws governing the emergence of spatial patterns through the placing and shaping of buildings, and those linking patterns of space to patterns of movement and co-presence, are being used in different parts of the network to create different functional outcomes. Both are in this sense the expression of the same laws, but used in one case to maximize movement and co-presence and in the other to restrict and structure it.

The same applies to the difference between background grids that we find in different cities, and even in the same city (as in the case of Nicosia). The
same spatial means are used to give different degrees and patterns of relative segregation. To put it at its simplest, the spatial language which permits the creation of patterns of integration also permits the creation of patterns of segregation. And because the language is unified in fact, we can use the same methodology to give parametric characterisations of different spatial cultures (Hillier 2002). Different cultures, in effect, are using the same language to say different things, rather than using different languages. We must conclude then that space as a language does have the formal unity that the later Wittgenstein denied for natural language.

The second Wittgensteinian remark concerns the near-invariant structures for cities which space syntax has brought to light. In what sense are these scientific entities? Here we do after all encounter a severe Wittgensteinian problem. Although the structures that we see by ‘colouring up’ maps undoubtedly exist, in that they are in reality patterns of mathematical values whose correspondence with reality can be tested by observing and correlating them with function, there is no scientific way to describe the pattern itself. What we can do mathematically, of course, is to take the set of values and examine their distribution statistically. In this way we can discover, for example, that the distribution of the length of lines of sight and access in all cities is scale-free, meaning that at whatever scale we examine space, from a small area to the whole city, we will always find a fractal pattern with few long lines and many short lines. But analyses of this kind are statistical in nature and so operate in an abstract space, and make no mention of the actual patterns of connections of different kinds of line which give the city its structure. We can only show these patterns and wave our hand at them, and hope our audience will agree with the—usually metaphorical, such as ‘deformed wheel’—way we describe them. Remarkably, we are in effect in the same kind of mental position we were in with the word ‘between’. We can point to it and show it, but we cannot describe it within the formal language we have developed for space.

This is in fact a fundamental problem in the ‘sciences of complexity’. Everywhere in nature we find complex processes which generate simple emergent structures which then ‘forget’ the complexity of their creation and operate as autonomous relatively systems at the emergent level. As Cohen and Stewart (Cohen & Stewart 1993) argue: ‘We must … explain why, on every level of existence, we can deal with the world as though it were simple.’ In addressing complexity, they argue, science is asking the less interesting question. ‘The interesting question is precisely the opposite … where does the simplicity
come from?’ These simple (in comparison to the processes that create them) emergent structures can be generated and identified, and their interactions studied, but their structures cannot yet be described in a rigorous scientific way.

The spatial structure of cities is a singularly clear example of this. The city structure evolves through a step by step bottom up process which we can more or less describe. But because the pattern of movement flows the structure generates reflects the global patterns of interconnectedness of spaces, not their local or intrinsic properties, we are compelled to acknowledge that the structure of the city works top down to set in train the functional processes which turn collections of buildings into living cities. Like so many emergent phenomena in nature, then, the structure of the city emerges bottom up, but works top-down. We can if we wish describe this structure by listing all the elements and connections, but this only re-describes the problem. It does not characterise the structure in such a way as to show what it is about this structure that works. So the structure that emerges and creates the living city we can only point to and say ‘look’. We are back, it seems, to the Tractatus!
Literature


‘The Mind’s Eye’ and Planarity

We live in a three-dimensional world; and yet, within this world we are surrounded by two-dimensional planes. We encounter them as images, book pages, displays, maps, movie screens, and computer screens. The fundamental evolutionary logic of technical devices tends towards a ‘flattening out’; the end result of technological innovation is often the plane. Two-dimensional planes are ubiquitous; we are so familiar with them that we are hardly aware of the remarkable form of spatiality they constitute. Surfaces confront us as the outer skin of voluminous bodies; a ‘depth’ therefore always corresponds to a surface. A plane, however, is something extended without the dimension of depth. Indeed, we treat surfaces as if they were planes. We do this especially when the function of a surface consists in rendering images or inscriptions visible. Their importance in carrying out this latter action cannot be overestimated: could the invention of the inscribed surface, we are tempted to ask, perhaps have meant for the mobility and creativity of the mind what the invention of the wheel meant for the mobility and productivity of the human body?

What are the consequences for thought of introducing this artificial form of two-dimensional spatiality into the process of cognition? What does it mean for the acquisition and justification of knowledge?

Ever since the ‘iconic turn’1 challenged the claim to absolutism of the ‘linguistic turn’, it has been widely understood that images initiate not only aesthetic
but also cognitive experience.\(^2\) This symposium also attends to the debate on epistemic intuition and visual thought. However, our focus in this paper lies less on visuality and iconicity per se, and more on the idea that both are necessarily linked to spatiality.\(^3\) We use spatial relations in order to depict epistemic, non-spatial states of affairs and to carry out palpable cognitive operations within those states. This offers a key to understanding the productivity of our thinking in terms of the ‘extended mind’.\(^4\) Thus, we must examine iconicity both structurally, that is, as it is deployed through planar spatiality, and functionally, which is to say, in regard to its perceptive-tactile operativity. The ‘mind’s eye’ does not look behind appearances, it does not penetrate surfaces down to their hidden structures, but rather acts in cooperation with the writing and drawing hand upon the plane.

The Cartographic Impulse

Within the spectrum of knowledge-generating forms of visualisation, ranging from the X-ray to computer simulations, one subset, comprising notations, lists, tables, diagrams, graphs and maps, belongs in a category we may term ‘operative iconicity’.\(^5\) We call this subset ‘the diagrammatical’; we call its members ‘inscriptions’. Its lowest common denominator is the inscribed plane that emerges from the interaction of point, line and plane. Out of this graphism arises what we will call the ‘epistemology of the line’.\(^6\) As we will see, this epistemology has important consequences for the subject at hand: the epistemic activity of the diagrammatical does not only characterise scientific knowledge, but also philosophy.\(^7\) What remains so far absent from the literature on epistemology is a reconstruction of the explicit and implicit diagrammatical dimensions of philosophy, which are not restricted, as is often assumed, to Charles Sanders Peirce.\(^8\) The following considerations are meant as a contribution to filling this absence. Their guiding hypothesis is that traces of a ‘cartographic impulse’ can be found even (or especially) within the tradition of philosophic reflection.

What, in turn, do we mean by ‘cartographic impulse’? To clarify this question, let us consider the peculiar representational conditions of maps.\(^9\) Through mapping, a three-dimensional territory that is largely difficult to view as a whole is translated into a readily comprehensible, two-dimensional plane. A real space of our lifeworld is transformed into the virtual space of
a topographical map. To accomplish this, a number of conceptual steps must be taken: first, the mapmaker must examine his subject from a highly external point of view, one that makes an overview possible in the first place. Then, a method of projection as well as a scale must be chosen. The purpose of the map is to make an unfamiliar terrain accessible to a user as a space of movement and action. This is, however, only possible through indexicality: by means of indexicality, a real person, a user, can transform him- or herself into a virtual point on the map. Only when this latter condition is fulfilled does the map become not only a representational object, but also an instrument for orienting oneself for action.

We thus encounter a decisive difference between two modalities of space in the use of maps: the difference between a virtual configurative space and a real action space. The map itself is exemplary of a configurative space in which places are arranged by their topographical order and determined by their relations to other places. The synchronic, synoptic nature of a configurative space presumes that the user’s position is outside of the configuration. But a map enables its users to act in the real space of the lifeworld. The action space comes into being by means of these activities, performed by the user, who has now also become a participant within the space. It is brought forth by the movements of actors and for its duration remains limited to the completion of these actions. Orienting oneself with maps using virtual, two-dimensional configurations makes real, three-dimensional spaces of movement accessible. The symbolic configuration space that a map provides is meant to be transformed into a real space of activity. This also means that something is a map only when it is in use, only as the means of transforming arrangements into movements. Otherwise, the map remains merely an image, a structural picture.

Thus, when we speak of a ‘cartographic impulse’ in philosophical and epistemic respects, we mean graphic arrangements that can be transformed into a space of intellectual activity. Cognition is thus conceivable as spatially-oriented movement. Hence Kant’s provocative question: What does it mean to orient oneself in thinking?

Epistemology of the Line

How, then, do diagrammatical arrangements manage not only to represent space, but also to produce movements of thought within it? In order to answer
this question, we must clarify what ‘epistemology of the line’\textsuperscript{12} means. Let us recall that diagrammatical inscriptions, including notations, tables, graphs, diagrams, and maps, are based on the interaction of point, line and plane. In the following, we will concentrate on the line, although these considerations are also applicable to the phenomenon and concept of the point.

Considerable epistemic potential is already nested within the simple act of drawing a line. This potential reveals itself in two binary oppositions: it is at once sensual and non-sensual; it is both a dependent trace and a free design. These seeming paradoxes merit more detailed description:

(i) **Perceptible/intelligible:** The stroke on the page is perceptible; it is virtually two-dimensional; the subtle individual characteristics of the line’s course carry æsthetic weight. Yet within a schema of notation, diagram, or map, the stroke is valued as a one-dimensional line, representing a state that is therefore not perceptible, but rather only intelligible or ideal. **Idealisation and flattening out** are closely related. In the empirical stroke, we see a non-empirical line; in a phenomenon, we see a concept. The activity of the ‘mind’s eye’\textsuperscript{13} depends upon this ‘seeing-in’. It is connected with the tactile handling of the continuous line: perceptivity and tactility are combined.

(ii) **Trace and Outline:** The stroke is the result of a gesture; the succession of a temporal action is carried over into the simultaneity of a spatial structure. As a trace of a gesture, the line has the potential to be determined and to become the image of something. At the same time, the stroke is always a free form with which a ‘Not-Yet’ can be conceptualised, plans can be made, or something unreal or even impossible can be drawn up. **Heteronomy and autonomy** are combined: transmission and creativity are intertwined in the line’s productivity.

It is in embodying these functions that the line acquires its epistemic significance. In the tension between the hand that does and the eye that sees, the stroke constitutes the elementary action of operative iconicity. The plane of inscription creates a space for the movement of thought in which theoretical entities are made visible and thus manageable. The perceptual nature of this act may be described as suddenly being able to see a non-empirical state of affairs within empirical arrangements. With regard to tactility, it means that operations of configuring and reconfiguring graphical markings simultaneously carry out
ideal/intellectual operations. The interstitial world of planar inscriptions mediates between intuition and thought; it intellectualises intuition and sensualises thinking. In brief: we think on paper.

**Plato’s Simile of the Divided Line**

Let us put our theoretical considerations to a practical test by attempting to reconstruct the diagrammatical structure of some instances of philosophical thought. We will demonstrate that the cartographic impulse and the space produced diagrammatically for the movement of thinking are both operative phenomena within philosophy; we will show how they are put into place within the structure of thought. We shall begin with Plato and then proceed to Wittgenstein.

In the *Republic* (*Politeia*, 509d–511e), Plato develops what is known as the ‘Simile of the Divided Line’, in which Socrates orders the ontological structure of the world according to a relationship between original and image, further organizing this into sub-categories by degrees of knowability. To reproduce this structure, one must draw a line and divide it into two unequal sections, such that the smaller section depicts the visible and the larger section the intelligible. These two sections should then each be re-divided in the same proportion as the original division. A four-part division of realms of being is thus created, which at the same time embodies a series of levels of cognitive knowledge with a progressively increasing degree of theoretical clarity.

Within the region of the visible, the lowermost realm is comprised of images, shadows and reflections, which correspond to the epistemic state *eikasia*, that is, conjecture. The next section of the visible encompasses the originals of these copies, the objects, plants and animals. The cognitive activity corresponding to these is *pistis*, faith or belief. Together, these two levels form the domain of ‘doxa’, that is, opinion. In the third subsection, which opens up the realm of the intelligible and thus of the ‘episteme’, reside general concepts and mathematical objects. The form of knowledge here is *dianoia*, that is, reasoning. The fourth section, in turn, is concerned with ideas as true being understood through *noesis*, the act of pure reason, which for Plato constitutes the highest form of understanding.

We must now take a closer look at the third level, where Plato locates mathematical objects, for him the proto-form of all scientific objects. As Plato
characterizes this form of cognizance, mathematicians use visible objects as images representing invisible ideas: while mathematical speech and proofs necessarily refer to perceptible figures such as particular circles or numbers, they deal not with these concrete figures, but rather with the general concepts ‘circle’ or ‘number’, which are themselves not visible, but rather purely intelligible. The form of cognizance of dianoia treats the visible as the perceptible imaging of something that is purely intelligible. It is thus the distinctive feature of mathematical knowledge to depend indispensably on the sensory representation of its theoretical objects and at the same time always to remain conscious of the difference between the intuitive and the purely intelligible. This prevents images from becoming illusions.

In all modern editions, Plato’s Simile of the Divided Line appears only in verbal description. But perhaps the oldest extant copy of the Republic, contained in a manuscript held in Paris, does in fact contain a diagrammatic representation of Socrates’ four divisions of knowledge.

Three aspects of Plato’s use of images are instructive from a diagrammatical perspective.

(1) **Iconicity as ontological principle:** In contrast to the hostility towards images often attributed to Plato, and to which philosophy’s larger suspicion of images was casually able to attach itself, it must be noted that iconicity is in fact the inner principle of Platonic ontology and epistemology. For Plato, everything that is real is defined by its capacity to be depicted by images. Even the highest level of being—the Forms—are introduced as originals, and thus as templates, for pictorial copies. Degrees of reality are held up against the measuring stick of the original-copy relationship. Correspondingly, Plato first introduced to philosophy the term theoria, which originally meant ‘viewing of a festive performance’.

(2) **Differentiation between the visible and the intelligible; bridging of this differentiation:** Plato differentiates categorically between the perceptible and the intelligible, and thereby introduces a distinction that was for 2000 years to form the lifeblood of philosophy. The Simile of the Divided Line inaugurates this differentiation. At the same time, however, it identifies an area of epistemic activity—dianoia, characteristic of mathematics and the sciences—in which this difference is intentionally bridged, in that sensory objects are recognized as depicting the non-sensory. Decisive here is the fact that the sensory objects deployed in thinking are neither a final product nor an end-stage, but rather are passed through en route to
that which is not perceptible, but rather only intelligible. The bridging function of this third level, conceived of as an ‘interstitial world’, is the enabling factor behind movements of thought.

(3) Spatiality of thinking: Plato views cognizance as an activity characterized by an implicit spatiality. Thinking is directional; this direction is defined by the cartographically arranged space of the Simile of the Divided Line and can be characterized as an ascent, that is, a rise through ascending levels. Thus is the Allegory of the Cave in the next book of the Republic a continuation of the Simile of the Divided Line by other means: it visualizes not abstract lines but rather the concrete situation of a cave, and knowledge is here imagined as an ascent out of the cave and into daylight. This inherent spatiality corresponds to the methodical manner in which Plato, in the act of applying his own approach, deploys configurations of lines to visualize his own philosophy. In this regard, we can infer from the spatial-visual arrangement and extension of line segments their ontological and epistemic meanings. For Plato himself, the diagrammatic scene becomes the medium of philosophical insight. The diagram functions as an instrument for making evident a philosophical world-image.

Possible Connections

It is no coincidence that Plato’s visualisation of a philosophical world image is paralleled slightly later by the drawing of a geographical world image by the Greek mathematician, astronomer, and geographer Ptolemy. Ptolemy left a Guide to Geography (‘Geographiké’) which is deeply instructive in its diagrammatics. It contains, for example, a map that depicts the entire known world from an external observational standpoint—an achievement made possible only by the innovative conical projection method Ptolemy himself developed. He also introduced lines of latitude and longitude to form a homogenising system of geographical coordinates. The majority of his Atlas was created from one table, which indicated the respective degrees of longitude and latitude for 8000 localities. The world was thus depicted as a planar distribution of places arranged in a numerically determinable relation to one another. As there was no reliable process for reproducing maps in antiquity, Ptolemy developed a ‘do-it-yourself’ method: he designed a rubric for travellers
to make their own maps. Based on his written table and innovative projection method, every reader was able, at least in theory, to draw a map corresponding to his desired itinerary. Ptolemy’s work traverses various forms of diagrammatical representation: it is variously embodied in geometrical drawings, written-out tabulations of locations and pictorial maps. At the same time, his Guide to Geography does not simply embody an image of the world, but rather serves as an operation manual for producing world images.

The relationship between philosophy and geography has been little analysed. In passing we can briefly mention that placed next to the ancient parallel between Ptolemy and Plato, the Early Modern duo of Mercator and Descartes is no less instructive. It is unfortunately beyond the scope of this paper to explore the many correspondences between their work.

Let us summarise a few relevant points already well-known to students of Wittgenstein’s work. (i) Having studied engineering, Wittgenstein was conversant with technical drawing, and thus with the projection of the three-dimensional onto the two-dimensional. Wittgenstein’s training in drafting can be traced back to his schooldays. (ii) There is a vast number of sketches, schemata, drawings, diagrams, and figures in his ‘Nachlass’. (iii) Concepts of the visual constitute his basic conceptual repertoire. He is widely considered to have been a ‘visual thinker’ who assigned the role of providing evidence to the pictorial; he always treated philosophical problems graphically. (iv) His reflections have for many scholars formed the basis of a ‘logic of the visual’.

In brief: the extraordinary (indeed, eminent) role played by iconicity in Wittgenstein’s thought has been explored in multiple ways. So what contribution can the identification of a cartographic impulse in his thinking add to all of this?

We assume that this impulse, understood in an epistemic sense, consists in transforming a graphic configurative space into a space for the actions of thinking. In fact, the relation between arrangements and intelligible activity

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**Wittgenstein**

We shall now jump across the centuries to Wittgenstein. Is there a cartographic impulse articulated in Wittgenstein’s thought as well? And can its presence shed an instructive light on Wittgenstein’s way of thinking?

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In brief: the extraordinary (indeed, eminent) role played by iconicity in Wittgenstein’s thought has been explored in multiple ways. So what contribution can the identification of a cartographic impulse in his thinking add to all of this?

We assume that this impulse, understood in an epistemic sense, consists in transforming a graphic configurative space into a space for the actions of thinking. In fact, the relation between arrangements and intelligible activity
in Wittgenstein’s philosophical work plays a role that we can roughly express like this: thinking takes place in operating with and looking at configurations. We shall explain the connection between ‘seeing a configuration’ and ‘thinking’ by means of two examples. The first refers to the relationship between seeing and thinking in the so-called change of aspect. The second refers to the relationship between different periods of Wittgenstein’s thinking.

(1) Change of Aspect: By famously invoking the duck-rabbit optical illusion, Wittgenstein is not attempting anything as ambitious as explicating a theory of perception. Instead, he wishes to show how complex our use of the word ‘see’ is: for that which occurs during aspect seeing is “half visual experience, half thought.” There are many versions of this duck-rabbit figure; Wittgenstein uses a simple line drawing derived from Jastrow. The drawing is not altered during the changing of aspect. But what is crucial here is that as the observer turns the figure over, he or she is connected to a reconfiguration of its spatial orientation. As a duck-schema—following the direction of the beak—the picture is oriented to the left: the point that marks the duck’s eye looks out to the left margin. As a rabbit-schema, the beak becomes the ears and the alignment is precisely the opposite: the point of the rabbit’s eye points to the image’s right margin. The change in aspect draws upon the fact that the inscribed surface contains in each case the alignment’s opposite orientation. For Wittgenstein, the role of thinking is embodied during the change of aspect by the moment of its transfiguration. This turning over is that which we cannot quite see; rather, we slip into the invisible domain of thought. Thinking is analogous to the act of spatially re-orienting the two-dimensional space of optical illusion. Could we perhaps say that philosophical thinking is analogous to the act of re-orienting oneself?

We thus see that Wittgenstein’s schema—functioning as a visual alignment inserted into the flow of his text—opens up a space of intellectual operation in which the reader can perform a distinct cognitive act: we see the aspect, but we perform the change of aspect without actually seeing the change. For this reason, the flip-flop-picture is more than an explanation of ‘seeing-as’. In addition, it evokes an epistemic ‘seeing-in’. The reader should experience in the drawing the insight that seeing and thinking are connected and thus understand the complexity of the grammar of ‘seeing’. We see in
the optical illusion an ambiguous drawing, which should make evident the impossibility of being able to see the change of aspect itself. As paradoxical as this appears to be, Wittgenstein demonstrates with his duck-rabbit figure what cannot be rendered visible—and this is precisely what is characteristic of the epistemic handling of diagrammatic inscriptions that we have specified as a ‘seeing of the conceptual in graphical configurations.’ Incidentally, in his Simile of the Divided Line, Plato has already named this ‘making visible of the invisible’: it is the epistemic device ‘dianoia’, which is put into place when, for example, the mathematician sees an inextensible point represented within an empirical one.

(2) The Relationship of the Early and Later Wittgenstein. The Wittgenstein of the Tractatus behaves like a logical cartographer of the world. With the aid of the picture theory of the proposition and nourished by an internal inclination toward a structure in which thought, proposition, and world intersect, he gives us the world as an intuited—albeit limited—whole. The spatial positioning is in this case the vertical; it embodies that one correct perspective in which the world and our model of the world become congruent.

In contrast, the Wittgenstein of the Philosophical Investigations behaves like an ethnographer of our forms of life; he only reaches insights when he exchanges his standpoint as an observer for a participatory perspective. The spatial positioning is in this case the horizontal, in which the world is encountered as a multitude of heterogeneous language games and life forms, which amongst themselves cannot be hierarchically ordered. They can only be represented as a synoptic plurality—‘sketches of a landscape’ that come into the world on ‘these long and meandering journeys’. In the Tractatus, model and world coincide; in the Philosophical Investigations, the ‘sketches of landscapes’ cannot be made congruent amongst themselves. Thus it only remains to order them in the form of an ‘album’. The world becomes a continual change of aspect between various two-dimensionally ordered world images.

This distinction between Wittgenstein’s early vertical perspective and his later participatory, horizontal perspective is illuminating. Nevertheless, it is apparent that Wittgenstein, in describing representations that depend upon the participatory perspective within an action space, always returns to the idea of ‘sketches of landscapes’ that must be arranged as an ‘album’. It is
thus our assumption that Wittgenstein never broke away from the diagrammatical synopticity that was the nucleus of his interest in the pictorial. His debt to the spatiality of the planar, which we can understand as the phenomenology of everything pictorial, manifests itself as a diagrammatical trace in Wittgenstein’s pronounced philosophical renunciation of ‘depth’.

We wish to clarify Wittgenstein’s renunciation of the dimension of depth using two examples: first, his concept of the ‘perspicuous representation’ (‘übersichtliche Darstellung’) and secondly, his approach to formalism.

(i) Wittgenstein favours the idea of ‘perspicuous representation’ as well as that of morphological procedure. Descriptions take the place of explanations because phenomena are synoptically aligned and therefore their relationship can only be visualised by the gradual appearance among them of a figure, form or pattern. In other words, to describe is to make visible by way of alignment. Hence Wittgenstein’s injunction: ‘don’t think, but look!’ Clearly, there are different kinds of groupings and—returning to Goethe—Wittgenstein assumes that one possibility for alignment consists in finding a standard of comparison or paradigm in relation to which all remaining phenomena can be ordered according to their similarity or dissimilarity. The scale of the ideal against which all other phenomena are measured is thus not independently inferred, but rather stems directly from the circle of appearances. Which morphological relationship is produced depends upon which phenomenon is chosen as a standard of comparison. Clearly, on the horizon of this morphological process, there is no longer any gradation between essence and appearance, between ideals and realisations, between surfaces and deep structures. Wittgenstein cites Goethe approvingly: ‘Don’t look for anything behind the phenomena; they themselves are the theory’.

(ii) A recurring impulse in Wittgenstein is the renunciation of hierarchisation. It is present in his rejection of Bertrand Russell’s theory of types, insofar as this theory falls back upon the linguistic hierarchy of languages. It also appears in his critical discussion of Gottlob Frege’s concept of ‘meaning’: for Wittgenstein, the meaning of a sign does not exist as an entity beyond or behind the sign, but rather lies exclusively in its use. Above all, the paradigmatic orientation toward planarity manifests itself in its relation to mathematics, which he interprets in terms of sign-games which are nonetheless embedded, applicable, and useful in everyday life; they mani-
fest themselves in his dismissal of the descriptive character of mathematical language, which he notably interprets as normative.\textsuperscript{42} All computation and proof is based on procedures of sign-transformation, which are made visible as planar configurations of figurative character.\textsuperscript{43} Proofs are reproducible pictures whose notable feature is in turn their ‘perspicuity’.\textsuperscript{44}

The rejection of the dimension of depth and hierarchisation represents Wittgenstein’s proximity to formalism;\textsuperscript{45} and this proximity does not only relate to mathematics, but also reveals a main feature of his entire philosophy. Wittgenstein is a thinker of flat ontology and planar epistemology; this is perhaps the most radical form of realizing the ‘cartographic impulse’ within philosophy.

\textbf{Summary}

\textbf{(i)} Diagrammatic inscriptions in the form of notations, tables, graphs, diagrams, and maps belong to the domain of visual language. They are as significant for the working of the ‘extended mind’ as auditory language. Epistemic connections are ‘translated’ into spatial relations and constituted at the same time. ‘Mind’ comes into being in the interaction of eye, hand and brain.

\textbf{(ii)} Point, line and plane constitute the elementary repertoire of graphematics. They produce a two-dimensional configurative space that can be implemented as a space for the movements of thought. Cognition is oriented by thinking on paper. Diagrammatic inscriptions serve not only to represent and communicate epistemic states of affairs, but also to produce and explain them.

\textbf{(iii)} The epistemology of the line is based upon the double life of the line: the empirical stroke is perceptible, the one-dimensional line is merely conceivable. Based on this dual character of the sensual/intelligible, the lines of two-dimensional planes become the ‘place’ in which the difference between intuition and thought are both produced and bridged.

\textbf{(iv)} The metamorphosis of configurative spaces into movement spaces is called a ‘cartographic impulse’. The conversion of graphematic structural
spaces into spaces for the activity of thought is a central aspect of our reasoning acts. While the role of notational and graphical inscriptions in the sciences has been repeatedly explored both historically and systematically, a diagrammatological reconstruction of philosophy—with the exception of Peirce—is still needed. Plato, Aristotle, Nicholas of Cusa, Descartes, Leibniz, Lambert, Kant, Peirce, Wittgenstein and Deleuze, among others, will be crucial for this reconstruction.

(v) With his Simile of the Divided Line (Politeia, 509d–511e), Plato demonstrates the epistemic signature of his ontology by means of a proportioned line. Cognition is specified in terms of spatial ascent. Although Plato’s philosophy locates the essential beyond appearance, his Simile of the Divided Line imagines the perceptible and the intelligible by means of the homogeneous line on one plane, allowing the gap between them to be bridged by ‘dianoia’—scientific understanding that uses the visible as an image of the intelligible. The cartographic impulse takes Plato ‘beyond Plato’.

(vi) Wittgenstein is an anti-Platonist: for him there is no difference between essence and appearance. Wittgenstein’s ontology is ‘flat’; his representation is pervaded by characteristics of visual-projective thought, which he had first encountered in his engineering studies. For him, ‘cognition’ is the way in which phenomena are ordered and depicted via projection and arranged in perspicuous representations. Nevertheless, he concedes in his remarks on the optical illusion of the duck-rabbit that cognition is associated with that which remains invisible—in this particular case, the moment of the change in aspect itself. To articulate it paradoxically: within the diagrammatic scene, Wittgenstein makes visible not what is invisible, but rather an invisibility.
Notes

10. ‘Real space is the space we find ourselves sharing with other people and things; virtual space is space represented on a surface, space we “seem to see”.’ Summers 2003, 43.
14. Information by Dieter Harlfinger, Director of the Aristotle Archive, Freie Universität Berlin. Reference to the manuscript: Cod. Gr. 1807, f22r.
17. See also: Menon 82b–84c und 86e–87a, Theaitet 147c–148d, Politikos 266b.
26 To the ‘seeing in’: Wollheim 1982, 205–226; Seel 2000, 284.
27 Stenius 1969; Stenius 1975.
29 Krämer 2001, 111–121.
32 To this ‘diagramatical character’ of Wittgenstein’s picture theory: Mersch 2006; Schneider 2005.
33 For the ‘synopticity’: Plaud 2010a, 256–257.
45 Mühlhölzer 2008.
Literature


anzeigen. Doch das Ziel dieses Vortrages ist nicht eine vorrangige Klärung exegetischer Probleme in den Texten Wittgensteins, sondern eine medienanalytische Klärung der Frage, ob wir nichtverbale Medien als Instrumente der Wortsprache verwenden.


Umgekehrt gilt: Nichtverbale Medien verlieren ihre mediale Funktion in einem verbalen Medium. Mit Worten zu sagen, was nur Bilder unter Bildern auf die Weise eines Bildes mitteilen, wäre der Versuch, Bilder durch Texte zu substituieren. Bilder sind keine Instrumente der Wortsprache; ihre verbale Nichtfunktionalität überträgt sich auf Wort-Bild-Verbindungen. Das ist die These, die zu begründen sein wird. Die These kann darauf verweisen, dass ein Satz auch als visuelles Muster in einer Bildsprache Verwendung finden kann. Als Ornament unter anderen visuellen Mustern verliert ein Satz seine Funktion als Satz unter Sätzen. Der Funktionsverlust eines Satzes ist in diesem Fall aber kein Indikator für einen Gebrauchsfehler der Wortsprache, denn ein Fehler ist nur dort möglich, wo Texte auch Texte verantworten können.


Ein Beispiel: Wir können die Zufallsabfolge der Kugelpositionen in einem Roulettespiel beschreiben und diese Beschreibung könnte mit Fotoprotokollen dokumentiert werden. Die Verbindung des Satzes „Die Kugel liegt auf der


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In der Verbindung von Satzzeichen und Fotografien finden wir diese stabilen Bedeutungen, weil Texte und Fotoelemente eine mediale Verbindung eingegangen sind, die nicht in ihren medialen Bestandteilen lag, nicht aus der Herkunft der beteiligten Medienelemente abzuleiten war. Zufallsereignisse wie beispielsweise Roulette-Ergebnisse oder Lottozahlen benötigen für ihre verbale Beschreibung diese Medienschnittstellen. Wir stellen diese Verbindungen zwischen unterschiedlichen Medien her und wir gebrauchen solche Verbindungen,

Alles wird in Medien ausgetragen


Beide Ansätze zeigen dennoch ein gemeinsames Thema: Bedeutungsstabilität in Medienübergängen, die weder allein in der Analyse des Wortsprachengebrauches noch in der Analyse des Gebrauchs einer Bildsprache (Fotos unter Fotografien) zu finden ist, sondern ausschließlich in der Verbindung unterschiedlicher Medien und unterschiedlicher Medienelemente.

Dennoch können wir auf geordnete Weise über etwas sprechen, das als visuelles Element dem Gebrauch der Wortsprache nicht zu entnehmen ist. Ein Medium hat die Möglichkeit zu funktionieren oder nicht zu funktionieren nur in Verbindung mit anderen Medien. Es muss also eine Form der Synchronisation geben, um von einem Medium behaupten zu können, es sei mit einem anderen verbunden. Ein Medium ist mit einem anderen synchronisiert, wenn es zu keinen Missverständnissen in der Medienkommunikation kommt. Die Praxis zeigt, dass dies der Regelfall unserer Verständigung ist, wenn wir unterschiedliche Medien zugleich verwenden.

Medienverbindungen, Medienschnittstellen bzw. gemischt-mediale Darstellungen werden von uns im Praxisgebrauch aller Medien auf immer neue Weise hergestellt. Etwas herzustellen setzt aber keine Konvention voraus, sonst könnte nur hergestellt werden, was bereits bekannt ist.

Der nichtfunktionale Wortgebrauch

Wir finden Wort-Bild-Verbindungen und damit auch mediale Schnittstellen in vielen alltäglichen Situationen, in denen wir mit Worten ein Szenarium beschreiben, das durch visuelle Inhalte zu ergänzen ist. Ein Beispiel für eine solche Medien-Schnittstelle in unserer Alltagskommunikation sind Begrüßungsrituale:

Werden wir einen begrüßen, den wir vielleicht zum ersten Mal an diesem Tag auf der Straße treffen? Werden wir diese Person auch grüßen,
wenn wir ihr bereits mehrfach an diesem Tag begegnet sind? Wird die geografische Breite, die Wetterlage und die Windrichtung bzw. die Neigungsrichtung des Regenschirms in diesem Begrüßungsritual eine Rolle spielen oder überhaupt die allgemeine körperliche und psychische Verfassung der beteiligten Personen? Welchen Einfluss haben Begleitpersonen des Begrüßten und des Begrüßenden in einer solchen Begrüßungssituation? Wird beispielsweise eine Frau ihren Mann auf der Straße begrüßen, wenn er mit seiner Freundin unterwegs ist – oder umgekehrt?


Wenn Ornamente, Fotos oder andere visuelle Elemente nicht wie Sätze funktionieren, Sätze aber ihrerseits als visuelle Muster betrachtet werden können, dann muss es Sätze geben, die nicht wie Sätze, sondern als visuelle Mustert funktionieren. Sätze, die nur so aussehen, als ob sie wie Sätze unter Sätzen funktionieren, verweisen in diesem Fall aber nicht auf sprachlichen oder grammatischen Unsinn, sondern auf Medienverschränkungen, die diesen Sätzen ihre Gebrauchsform entziehen bzw. diese verändern.

Wird ein Satz als visuelles Medium verwendet, verliert er seine Funktion als verbales Medium, muss aber seine Funktion als visuelles Medium in diesem Falle nicht verlieren, denn Sätze sind immer grafische Muster, auch wenn diese Eigenschaft ihre Gebrauchsfunktion innerhalb der Wortsprache nicht maßgeblich bestimmt. Es muss also Sätze und visuelle Elemente in einem Sprachspiel geben, die in der Wortsprache nichtfunktional sind, d. h. in einem Sprachspiel nicht verwendet werden können, damit es Sätze und visuelle Elemente geben kann, die funktional sind bzw. verwendet werden können. Funktionalität und Nichtfunktionalität bedingen sich in der Wortsprache wechselseitig.
Diese Abgrenzung der Beschreibung der Gebrauchsarten eines Satzes beantwortet aber noch nicht die Frage, woran wir nichtfunktionale Medien- 
elemente erkennen können.

„Sehen als …“, „Lesen als …“

Gäbe es eine Theorie der unhintergehbaren Funktionalität der Wortsprache, dann hätte man sich mit ihr jeder Möglichkeit beraubt, den Gebrauch eines Satzes im Unterschied zu seinem Nichtgebrauch beschreiben zu können. Eine transzendentalphilosophische Interpretation Wittgensteinscher Sprachspiele wäre nicht in der Lage, Gebrauchsübergänge zwischen Medien zu beschreiben, weil sich ein Medium nicht in ein anderes Medium verwandeln könnte. Die Grenze eines Mediums – in diesem Falle der verbalen Sprache – wäre die Grenze der Sprache überhaupt. Eine transzendentalphilosophische Interpretation der Sprachimmanenz könnte also nicht erklären, warum ein Medium anders funktioniert als ein anderes und warum das, was in einem Medium geschieht, ein anderes Medium nichts angeht.

Innerhalb der Wortsprache scheint die funktionale Differenz zwischen der Sprache und ihrem Beschreibungsgegenstand zwar zu entfallen, denn beschrieben ist, was der Wortgebrauch zu einem Beschriebenen macht. Ein Irrtum aber liegt in der Auffassung, ein Satz verliere jede Funktion, wenn er nicht mehr als Satz unter Sätzen funktioniere. Hier wird die gegenteilige These vertreten: Ein Satz der Wortsprache kann unterschiedliche Funktionen in unterschiedlichen Medien annehmen und andere Funktionen in anderen Medien verlieren. Der wechselnden Medialität, der Medialitätsdynamik der Zeichen, wurde bisher vermutlich zu wenig Aufmerksamkeit geschenkt. Betrachten wir die folgende hybride Medienkonstruktion:

Abb. 2 „Der ist .“

Wir könnten hier von einer gemischt-medialen Mitteilung sprechen, in der wir lesen und sehen können, wovon die Rede ist. Die Gebrauchsnähe unterschiedlicher Medienelemente stellt auch in diesem Fall eine Verbindung zwischen Medienelementen hier, wenn auch zwischen Elementen unterschied-
licher Medien, zwischen Texten und geometrischen Mustern. Die Frage ist, ob sich diese gemischt-mediale Konstruktion wie ein Satz der Normalsprache analysieren lässt.

„Der … ist … .“ steht offenkundig nicht für einen analysierbaren Satz der deutschen Sprache.


Anmerkungen


2 Im Sinne einer Arbeitsdefinition können wir ein Medium jede gebrauchs- spezifische Mitteilungsform nennen, deren Verwendungsform nur mit den Mitteln dieses Mediums und innerhalb dieses Mediums beschrieben werden kann.

I hope that, before I cease to be useful in this world, I may be able to define better than I now can what the distinctive essence of theoretic thought is. I can at present say this much with some confidence. It is the directing of the attention to a sort of object not explicitly referred to in the enunciation of the problem at hand …

(Peirce ‘Specimens of Mathematical Mazes’, 1908, NEM III, p. 622)

A central aspect of Peirce’s doctrine of diagrammatical reasoning is the idea of using the diagram as a tool for making deductions by performing rule-bound experiments on the diagram. This paper discusses Peirce’s distinction between two classes of diagram proofs, ‘corollarial’ and ‘theoretical’, respectively—a distinction he himself saw as his first major discovery. Theoretical reasoning concerns diagram experimentation involving the introduction of new material—in particular, I shall investigate the issue of the structure of theoretical diagram experiments, propose three types of such experiments and connect them to the role played by hypostatic abstractions in those experiments.

The increasing interest in Peirce’s philosophy of logic as well as his philosophy of science highlights the importance of his notion of deductive reasoning as based on diagrams. As argued by several authors in Moore 2010 (Tiercelin and Cooke), this can be taken as providing an original solution of the dilemma which has haunted much philosophy of mathematics since Benacerraf’s famous 1973 ‘Mathematical Truth’ article against Platonism (in Benacerraf and Putnam 1983). Benacerraf’s paper argued against Platonism and the existence of abstract objects in mathematics by setting up the following dilemma:
1) Mathematics claims the existence of abstract objects outside of time and space; 2) Acquisition of knowledge takes place by means of a causal process connecting an object with a knowing subject. But as abstract objects are causally inert, we must either accept Platonism and reject causal epistemology—or we must embrace causal epistemology and refuse Platonism. Due to the prominence of causal reference theories at the time, Benacerraf’s choice seemed obvious: abstract objects and Platonism must be discarded in the face of the seeming evidence of causal epistemology. Literally taken, Benacerraf’s argument would, in fact, eliminate not only abstract objects but a series of other aspects of the world, such as many properties (color, pitch, shape …) which may also be suspected for being causally inert in the billiard-ball causation theory of the second horn of the dilemma.

Causal reference theories hardly hold the attraction which they did in the 1970s, and the role of diagram experiments in an alternative, Peircean way of cutting the cake is the following. To Peirce, deduction and mathematical reasoning are one and the same. Mathematics is defined by two things, methodologically and substantially, respectively. The former comes from the definition of mathematics that he inherited from his father, the mathematician Benjamin Peirce: mathematics is the science that draws necessary conclusions. Peirce’s own addition to this doctrine pertains to the subject matter of those necessities: the object of mathematics is hypotheses concerning the forms of relations. All mathematical knowledge thus has a hypothetical structure: if such and such entities and structures are supposed to exist, then this and that follows. We might call this weaker variant of commitment to abstract objects ‘hypothetical Platonism’. This admission liberates you, of course, from the presupposition of a strange, space-time-less realm of real existence—but it commits you, on the other hand, to further existence modes than that of particular individuals, which is why diehard nominalists will hardly feel attracted by Peirce’s alternative. Peirce’s doctrine operates with no less than two further existence modes than that of individuals, namely that of possibility—‘May-Bes’—and that of real possibility—‘Would-Bes’. Mathematics being hypothetical through-and-through then forms a subset of the latter. The crucial role of diagrams, now, is that the notion of reasoning by diagram experiments furnishes an epistemological alternative to Benacerraffian causal reference. The idea is that diagrams form the epistemological means of accessing hypothetical abstract objects. They do that in two steps, as it were. One step is taking a diagram token, a drawing on paper, blackboard, computer screen,
or in the imagination, and subjecting it to ‘prescission’, the imaginary stripping it of accidental qualities so that only the relevant, controllable, general, schematic relations are left—permitting the observer to grasp, through the token, its type. This process of prescission, of course, is not arbitrary nor subjective and is governed by symbols and rules, explicitly or implicitly. Once the type is grasped, it may, by the intermediary of its physical token, be subjected to experimental manipulation, in imagination or on a physical diagram replica, or both. Certain types of transformation are allowed, others not so, corresponding to truth-preserving logical reasoning steps. So diagram experimentation constitutes the if-then hypothetical structure of mathematics and thus gives mathematical knowledge its conditional, modal character.

The observation of diagram tokens/types, of course, is prefigured in the perception of ordinary objects as tokens of types—just like the prescission process stripping the token of its accidental qualities in order to access its type is a more formalized version of similar processes when we address natural kinds by stripping away accidental properties in order to constitute categories like red, chairs, running—or even the category of an individual persisting in time despite its changing appearances. General structures and shapes of reality are present already in the perceptual stream, and it is no wonder we, as biological beings, have become adapted to focus upon such features in perceptual structures. This very ability, however, may now be recycled apart from its basis in real objects to be put to use to purified imaginary objects like those of mathematics.

This argument pertains to pure, mathematical diagram reasoning; now what about the vast amount of applied diagrams representing empirical states-of-affairs? Peirce’s system of the sciences offers an explanation of the efficacy of such diagrams—namely that they inherit, explicitly or implicitly, the mathematical structure of pure diagrams and add further constraints to those diagrams stemming from the special science of the domain to which they pertain. Thus, all deductive reasoning, everyday or scientific, is taken to involve a mathematical-diagrammatical scaffolding, and necessary inferences in all sciences as well as in everyday reasoning employ mathematics, implicitly or explicitly. In Stjernfelt (2007), I have attempted a reconstruction of Peirce’s overall doctrine of diagrams and diagrammatical reasoning, arguing that this cluster of ideas forms the center of a Peircean epistemology as well as it constitutes an important contribution to contemporary realist semiotics in general.
In this paper, I shall take a closer look at the notion of diagram experiment based on Peirce’s famous distinction between two such classes of experiments, giving rise to Corollarial and Theorematical reasoning, respectively. On the base of this distinction, a series of important issues are addressed. To what degree does this distinction capture different formal classes of problem difficulty? How may we distinguish between different types of Theorematic reasoning? And what is the relation between diagram experiments and hypostatic abstraction?

In the years after 1900, Peirce returns over and over again to the Corollarial/Theorematical-distinction, famously celebrating it as his own first “real discovery” (in his Carnegie application 1902). The overall idea is that corollarial deduction has a conclusion which fleshes out a proposition which lay already implicitly in the premisses—thus conforming to the Kantian idea of logical conclusions offering nothing which was not already defined in the premisses. By contrast, theorematic (or theorematogenic, or theoretic, or theoric) reasoning forms a more demanding and creative type of reasoning where some new elements must be experimentally added to the premisses before reaching the conclusion.

Take a simple example: asking the question of the size of the perimeter of a square with the side \(s\), the conclusion may be reached based on the very definition of a square as a quadrangle with four equal sides—or by a very simple diagram experiment of counting sides, using the following diagram:

![Fig.1: Square with the side s](image)

The result of \(4s\) is easily reached by both of these means. By comparison, the famous Euclidean proof of the angle sum of the triangle being equal to two right angles may serve as an example of theorematic reasoning:

![Fig. 2: Angle sum of a triangle](image)
This proof requires the addition of auxiliary lines to the triangle—here CE and CD, parallel to AB and prolonging BC, respectively—to establish the proof based on the fact that the three angles meeting at C have the same sizes as those of the triangle. BCA participates in both of the two sums, ACE is equivalent to BAC, while ECD is equivalent to ABC. The sum of the three angles meeting at C—BCA, ACE, and ECD—is obviously two right angles. But this is impossible to derive from mere definitions of ‘angle’ and ‘triangle’ just like it is impossible to prove from the triangle diagram without any additions.

The terminology of corollarial/theorematic comes from Euclid whose editors named simple inferences corollaries—while propositions to be proved were theorems. Peirce judges that some of Euclid’s theorems are, in fact, mere corollaries—the overall distinction is taken to rely upon the necessity of experimenting by adding new elements to the diagram, elements which disappear in the final, general statement of the proof. The theorem that the angle sum of a triangle equals two right angles does not, for example, in any way refer to the subsidiary lines necessary to reach the proof.

The basic issue behind this distinction is, of course, the duplicity of mathematics, being apodictic and inexhaustible at one and the same time. How is it possible that mathematicians find results by necessity while at the same time new, unexpected discoveries abound among these results, just like in the empirical sciences? This issue troubled Peirce for a long time. Already when constructing his first formal language for logic, in his 1885 masterpiece ‘On the Algebra of Logic’, he reasoned:

> It has long been a puzzle how it could be that, on the one hand, mathematics is purely deductive in its nature, and draws its conclusions apodictically, while on the other hand, it presents as rich and apparently unending a series of surprising discoveries as any observational science. Various have been the attempts to solve the paradox by breaking down one or other of these assertions, but without success. The truth, however, appears to be that all deductive reasoning, even simple syllogism, involves an element of observation; namely, deduction consists in constructing an icon or diagram the relations of whose parts shall present a complete analogy with those of the parts of the object of reasoning, of experimenting upon this image in the imagination, and of observing the result so as to discover unnoticed and hidden relations among the parts. (CP 3.363)
Here, the inexhaustibility of mathematics is explained by means of Peirce’s first, germ-like diagram reasoning doctrine—as a generalization, interestingly, of his linear algebra of logic, far from the ordinary conception of diagrams. The ‘unnoticed and hidden’ relations obtainable by diagram observation, of course, are what are later taken to require theorematic deduction, in addition to mere inference from definitions.

Even if the problem addressed by the distinction is thus an early concern in Peirce, it seems only in the years after 1900 that he explicitly coins the corollarial/theorematic distinction and sets out to elaborate it. Only in 1901, we seem to witness the nascent terminology of the distinction appearing:

1901 Oct 12

If my present view, held for four or five years, is right that Abduction Deduction Induction are Premarian, Secundarian, and Tertian, then there ought to be two types of Deduction & three of Induction […] Now I don’t recognize any such two types of Deduction. […] We can distinguish Deductions into those which are corollarific and those which are theorematogeneous. The former merely require the careful consideration of the conclusion, the latter involve outside considerations,—subsidiary lines, etc. But this seems a methodeutic not a critical distinction. (Logic Notebook Ms. 339, p. 362; earlier on the page, Peirce attempts to distinguish proposition deductions and term deductions).

Later, Peirce will include the corollarial/theorematic distinction in his critical table of inference types—but this early quote points to the fact that the latter part of the distinction sits uneasily on the critical/methodeutic divide (today, we would rather speak of logic versus heuristics or theory of science). Theorematic reasoning requires an inventiveness or even ingenuity which makes it alien to a narrow concept of logic—even if its results, on the other hand, remain purely deductive.

This apparently simple distinction covers a whole bunch of interesting issues: that of the much more outspoken experimental character of theorematical reasoning as compared to corollarial reasoning, that of finding suitable new elements to add, that of instantiating those elements in particulars (only a particular set of lines in the angle sum example will lead to the proof), that of the character of those elements, that of the relation of the diagram experiment to verbal instructions and definitions, that of the strategy of
finding the proper elements to add. Probably for this reason, Peirce’s description of theorematical reasoning differs to some extent from time to time.

**Theorematic diagram experiments in Peirce**

Let us run through Peirce’s different definitions.

1) The basic idea is the indirect conception that theorematical reasoning, unlike corollarial reasoning, is not reducible to inferences from concept definitions: ‘An accurate definition of Corollarial Demonstration would require a long explanation; but it will suffice to say that it limits itself to considerations already introduced or else involved in the Explication of its conclusion; while Theorematic Demonstration resorts to a more complicated process of thought.’ (‘A Neglected Argument for the Reality of God’, 1908, CP 6.471, EPII, p. 442)

This brief definition of theorematic reasoning, of course, is merely negative and contrastive vis-à-vis Kant’s description of logic as tautological, and most of Peirce’s descriptions of the pair of concepts take their point of departure in the inability of certain theorems to be proved by corollarial reasoning:

Deductions are of two kinds, which I call *corollarial* and *theorematic*. The corollarial are those reasonings by which all corollaries and the majority of what is called theorems are deduced; the theorematic are those by which the major theorems are deduced. If you take the thesis of a corollary, i.e., the proposition to be proved, and carefully analyze its meaning, by substituting for each term its definition, you will find that its truth follows. (‘On the Logic of Drawing History from Ancient Documents’, 1901, CP 7.204, EPII, p. 96—after which the quote continues with a more positive definition of theorematic reasoning (cf. below)).

Even if corollarial reasoning counts as the ideal and should be preferred whenever possible because of its simplicity, a certain class of ‘major theorems’ require more than careful description in terms of concept analysis. This necessity stems from the general impossibility of defining things, in all cases, so that all their properties will be corollaries from their definition. Peirce addresses this when claiming that the best translation of Greek ‘episteme’ is ‘comprehension’ which is ‘… the ability to define a thing in such a manner that all its properties shall be corollaries from its definition. Now it may be
that we shall ultimately be able to do that, say for light or electricity. On the other hand, it may equally turn out that it forever remains as impossible as it certainly is to define number in such a way that Fermat’s or Wilson’s theorems should be simple corollaries from the definition. ’ (‘On Science and Natural Classes’, 1902, EPII, p. 129). Even if much in arithmetics is corollarial (such as Kant’s famous 7+5=12 which Peirce refuses to admit the status of synthetic a priori for the same reason), complicated theorems of arithmetics are not. So the impossibility of defining things, in all cases, so that all their essential properties flow from the definition, obviously forms the first argument for the necessity of theorematic reasoning.

2) A basic way of describing theorematic reasoning more positively, now, is as involving the addition of new elements to the premisses (abstractions or not, foreign ideas or existential instantiations of general objects the existence of which is granted by the universe of discourse). Peirce seems to have received this idea about the introduction of a new element from no less than George Boole’s widow in 1898:

The widow of the great Boole has lately written a little book in which she points out that, in solving a mathematical problem, we usually introduce some part or element into the construction which, when it has served our purpose, is removed. Of that nature is a scale of quantity, together with the apparatus by which it is transported unchanged from one part of the diagram to another, for the purpose of comparing those two parts. Something of this general description seems to be indispensable in mathematics. (‘The Logic of Mathematics in Relation to Education’, 1898, CP 3.561)

—and his overall development of the corollarial/theorematic distinction now covers the following decade. The addition of such objects is taken to be the subject of an additional lemma to the premisses, supported by a postulate. Continuing the above quote from ‘On the Logic …’ (1901), Peirce writes:

But when it comes to proving a major theorem, you will very often find you have need of a lemma, which is a demonstrable proposition about something outside the subject of inquiry; and even if a lemma does not have to be demonstrated, it is necessary to introduce the definition of something which the thesis of the theorem does not contemplate. In the most remarkable cases, this is some abstraction; that is to say, a subject whose existence consists in some fact about
other things. Such, for example, are operations considered as in themselves subject to operation; *lines*, which are nothing but descriptions of the motion of a particle, considered as being themselves movable; collections; numbers; and the like. (‘On the Logic of Drawing History from Ancient Documents’, 1901, CP 7.204, EPII, p. 96).

In Peirce’s debatable analysis, lines are abstractions from the trajectory of particles—so the subsidiary lines in the angle sum proof are taken to be examples of the introduction of abstractions. Be that as it may, the quote given here overlooks the important issue of the selection of those lines. The postulate in Euclid that given a line and a point, a line through the point may be drawn which is parallel to the line given, obviously lies behind the lemma of introducing the two particular auxiliary lines in the proof. But not any lines added to the original triangle would lead us to the proof. So the selection of particular objects to add becomes an important issue. Hintikka, in his famous development of Peirce’s notion of theorematic reasoning, takes this ‘existential instantiation’ in the shape of ‘witness individuals’ to constitute the core of theorematical reasoning, adding further quantified variables to those referred to in the premisses. Sun-Joo Shin (2010) emphasizes the importance of this individualizing step in reasoning: much has been spoken, since the British empiricists, of the access to the triangle in general, but the inverse movement, that of selecting the right individuals to add in a proof, has received much less attention. Hintikka insists that the addition of individuals to the premisses constitutes the very core of Peirce’s idea: ‘What makes deduction theorematic according to Peirce is that in it we must envisage other individuals than those needed to instantiate the premise of an argument.’ (1980, 110)—also other than those needed to express its conclusion, we may add. This is what constitutes the basis of Peirce’s ‘brilliant insight […] that this geometrical distinction can be generalized to all deductive reasoning.’ (1980, 109). Thus, in Hintikka’s reconstruction, ‘… a valid deductive step is theorematic, if it increases the number of layers of quantifiers in the proposition in question.’ (1980, 110). To Hintikka, this solves the ancient Aristotelian riddle of logical incontinence—how can it be that one may fail to grasp the sum total of logical consequences of the amount of knowledge in one’s possession. This is because many of those consequences require the theorematic addition of further individuals for their proof, and Hintikka surmises that the difficulty of a problem is roughly proportional to the amount of new individuals needed for its solution (Hintikka 1980, 113; Stjernfelt
2007, 107–8). This particularity of auxiliary individuals, much discussed after Hintikka’s reinterpretation of theorematical reasoning, is surprisingly rarely addressed in Peirce; however, this late quote connects the basis of the additional elements in a general postulate with the particularity of those elements:

Of my two divisions of Deductions, one is into Corollarial and Theorematic Deduction. The former requires nothing more than a logical analysis of the premisses to furnish the conclusion. The latter involves as one of its premisses a postulate, or proposition asserting the possibility of any object which lies in certain definite general relation to any existing objects of a certain kind. E.g. Between any two points on a line it is possible to place a third. Now to derive from this postulate the particular consequence that will lead to the conclusion requires not merely sagacity or Aristotle’s eustokha […] but also imaginative genius in all its complexity of resources. (Ms. 764, reel 16, 1282–83, late, seemingly 1910–11)

Here, the requirement of imaginative genius—implicitly compared to the laborious teasing out of corollarial definition consequences—is highlighted as required for finding the appropriate particular elements to add. Shin (1997; 2010) also insists upon the importance of selecting the right individuals, among many possible, to conduct the proof.5

Other times, it is rather the general or abstract (which is not the same) character of the added elements which is emphasized: ‘To the Diagram of the truth of the Premisses something else has to be added, which is usually a mere May-be, and then the conclusion appears.’ (letter to James 25. dec 1909, EPII, 502). A May-be, in Peirce’s late metaphysics, is a possibility which is, of course, general. Especially when talking about the added elements in this general way, Peirce insists they are foreign to the theorem which the proof intends to establish:

What I call the theorematic reasoning in mathematics consists in so introducing a foreign idea, using it, and finally deducing a conclusion from which it is eliminated. Every such proof rests, however, upon judgments in which the foreign idea is first introduced, and which are simply self-evident. (Carnegie Application (L75), 1902, NEM IV, p. 42).6

The question is: are the additional elements particular instantiations selected on the basis of general possibilities granted in the relevant universe of
discourse (like the subsidiary lines of the angle sum proof granted by Euclid’s postulates), or does the addition concern a new, general principle or idea? Judson Webb, in an important paper on Hintikka’s philosophy of logic, also points to the fact that, in discussing different proofs of Desargues’ theorem, Peirce involves different types of theorematic reasoning: ‘There are just two distinct kinds of things we can introduce into a proof that do not appear in such a theorem: auxiliary lines and the idea of length. The former are only new objects of the same kind occurring in the theorem, while the latter is a new concept that is “foreign” to it.’ (Webb 2006, 249). Peirce, however, did not seem to pay explicit attention to this important distinction to which we shall return later.

He did, however, introduce another distinction between subtypes of theorematic reasoning. In the famous description of the two kinds of deduction in the Carnegie application, the description in terms of new elements gives rise to a subdivision of theorematic reasoning based on the abstract or non-abstract character of that reasoning:

My first real discovery about mathematical procedure was that there are two kinds of necessary reasoning, which I call the corollarial and the theorematic, because the corollaries affixed to the propositions of Euclid are usually arguments of one kind, while the more important theorems are of the other. The peculiarity of theorematic reasoning is that it considers something not implied at all in the conceptions so far gained, which neither the definition of the object of research nor anything yet known about could of themselves suggest, although they give room for it. Euclid, for example, will add lines to his diagram which are not at all required or suggested by any previous proposition, and which the conclusion that he reaches by this means says nothing about. I show that no considerable advance can be made in thought of any kind without theorematic reasoning. When we come to consider the heuretic part of mathematical procedure, the question how such suggestions are obtained will be the central point of the discussion.

Passing over smaller discoveries, the principal result of my closer studies of it has been the very great part which an operation plays in it which throughout modern times has been taken for nothing better than a proper butt of ridicule. It is the operation of abstraction, in the proper sense of the term, which, for example, converts the proposition “Opium puts people to sleep” into “Opium has a dormitive virtue”. This turns out to be so essential to the
greater strides of mathematical demonstration that it is proper to divide all theorematic reasoning into the non-abstractional and the abstractional. I am able to prove that the most practically important results of mathematics could not in any way be attained without this operation of abstraction. It is therefore necessary for logic to distinguish sharply between good abstraction and bad abstraction. (Carnegie Application (L75), Draft C, 90–102, NEM IV, p. 49).

This distinction between abstractional and non-abstractional theorematic reasoning has been taken up by Stephen Levy and Michael Hoffmann (1997; forthcoming) in their efforts to outline taxonomies of theorematic reasoning. But is it the case that this idea might, simultaneously, constitute a basis for the distinction between theorematic reasoning by means of existential instantiation on the one hand and the introduction of new, foreign ideas on the other? Peirce does not further develop his distinction between abstractional and non-abstractional theorematic reasoning, so it is difficult to decide. Suffice it to say that it is not evident these two distinctions are identical or even co-extensive; the introduction of certain abstract objects may be permitted in the formalism used and in that sense not being new or foreign (just like the introduction of lines in a geometric proof or a variable in an equation)—the foreign idea seems to comprise a special class of abstractions only.

3) An interesting feature of the descriptions in terms of added elements quoted here is that they do not refer to deductions in terms of diagram experiments. Diagram experiment, however, is taken to constitute the center of deduction in general, and of theorematic deduction in particular. In a parallel draft for the Carnegie application, Peirce thus characterizes theorematic reasoning as follows:

Theorematic deduction is deduction in which it is necessary to experiment in the imagination upon the image of the premiss in order from the result of such experiment to make corollarial deductions to the truth of the conclusion. The subdivisions of theorematic deduction are of very high theoretical importance. (Carnegie Application (L75), 1902, NEM IV, p. 38).

The year after, in the masterful Syllabus accompanying his Lowell lectures, Peirce connects the experimental character of theorematic reasoning to the ingenuity required as well as to observation; it ‘… is one which, having represented the conditions of the conclusion in a diagram, performs an
Peirce’s Notion of Diagram Experiment

ingenious experiment upon the diagram, and by the observation of the diagram so modified, ascertains the truth of the conclusion.’ (Syllabus, 1903, CP 2.267, EPII, p. 298). In one of the drafts of the Lowell lectures, Peirce connects these two descriptions, now taking the addition of new material to be a subtype of experiment:

I draw a distinction between Corollarial consequences and Theorematic consequences. A corollarial consequence is one the truth of which will become evident simply upon attentive observation of a diagram constructed so as to represent the conditions stated in the conclusion. A theorematic consequence is one which only becomes evident after some experiment has been performed upon the diagram, such as the addition to it of parts not necessarily referred to in the statement of the conclusion. (Lowell Lectures, Ms. 456, (p. 49; ISP 28) transcription by Helmut Pape).

Here, it is not made explicit which other types of experiment there might be besides the addition of new elements. In an early account for diagram experimentation, however, Peirce provides such an example:

Deduction is that mode of reasoning which examines the state of things asserted in the premisses, forms a diagram of that state of things, perceives in the parts of that diagram relations not explicitly mentioned in the premises, satisfies itself by mental experiments upon the diagram that these relations would always subsist, or at least would do so in a certain proportion of cases, and concludes their necessary, or probable, truth. For example, let the premiss be that there are four marked points upon a line which has neither extremity nor furcation. Then, by means of a diagram,

we may conclude that there are two pairs of points such that in passing along the line in any way from one to the other point of either pair, one point of the second pair will be passed an odd number of times and the other point an even (or zero) number of times. This is deduction. (Untitled manuscript, c. 1896, 1.66)7

In this example, the diagram experiment is undertaken by following a trajectory along the closed curve, until realizing that each full turn will add 2 to the number of passages of each point pair—so with respect to odd/even, the result will stay the same as the very first half trajectory, passing one point
1 time, the other point 0 times. This experiment hardly introduces any new ideas at all, but it does involve instantiation, this time of a trajectory moving in the diagram. So the new elements added may also be actions performed on the diagram. In the ‘Minute Logic’ of 1902, Peirce hints at those other experiment possibilities:

Just now, I wish to point out that after the schema has been constructed according to the precept virtually contained in the thesis, the assertion of the theorem is not evidently true, even for the individual schema; nor will any amount of hard thinking of the philosophers’ corollarial kind ever render it evident. Thinking in general terms is not enough. It is necessary that something should be DONE. In geometry, subsidiary lines are drawn. In algebra permissible transformations are made. Thereupon, the faculty of observation is called into play. Some relation between the parts of the schema is remarked. But would this relation subsist in every possible case? Mere corollarial reasoning will sometimes assure us of this. But, generally speaking, it may be necessary to draw distinct schemata to represent alternative possibilities. Theorematic reasoning invariably depends upon experimentation with individual schemata. (‘Minute Logic’, CP 4.233, c. 1902)

Here, the mere introduction of new elements or ideas as additional general terms is not deemed sufficient—the experiment is supposed to perform an action manipulating the diagram—drawing the auxiliary lines—or, in the algebraical example, undertaking transformation granted by the relevant symbol manipulation rules. In the Euclidean example, transformations including the movement of geometrical objects on the plane permitted (rotations, mirrorings, translations, etc.) obviously form a class of experiments different from those of introducing new elements, just like, in arithmetics, the transformation possibilities given by calculation rules (and more generally, in algebra, symbol manipulation rules), provide such experiment possibilities.

An important issue here—both related to the “addition of new elements or foreign ideas” and to the “experiment” aspects—is the relation between theorematic reasoning and abduction. A finished piece of theorematic reasoning, of course, is deductive—the conclusion follows with necessity from the premisses. But in the course of conducting the experiment, an abductive phase appears when investigating which experimental procedure, among many, to follow; which new elements or foreign ideas to introduce. This may require
repeated, trial-and-error abductive guessing, until the final structure of the proof is found—maybe after years or centuries. Exactly the fact that neither premisses nor theorem needs to contain any mentioning of the experiment or the introduction of new elements makes the abductive character of experimentation clear. Of course, once the right step has been found, abductive searching may cease and the deductive character of the final proof stands out.

4) A further description of the corollarial/theorematic distinction makes it correspond to reasoning with words or schemata, respectively. The quote just given from the ‘Minute Logic’ continues with the conclusion that

We shall find that, in the last analysis, the same thing is true of the corollarial reasoning, too; even the Aristotelian “demonstration why.” Only in this case, the very words serve as schemata. Accordingly, we may say that corollarial, or “philosophical” reasoning is reasoning with words; while theorematic, or mathematical reasoning proper, is reasoning with specially constructed schemata. (‘Minute Logic’, CP 4.233, c. 1902).

This complicated claim identifies corollarial reasoning with philosophical reasoning in words (implicitly placing a severe limitation on the powers of such reasoning), as compared to the constructive power of theorematic reasoning using specially constructed schemata and being able to make ‘demonstration that’. Immediately, however, words are also taken to constitute such schemata, even if maybe simpler and less directly accessible than ‘specially constructed’ schemata. The ubiquity of such schemata also outside of science (maps, graphs and tables in newspapers, media, commodities, etc.) points to the fact that the distinction between words and constructed schemata does not, as it might be immediately assumed, coincide with that of everyday reasoning and science. Rather, the idea that conceptual reasoning forms a simple version of schematic reasoning points to the idea of the distinction between corollarial and theorematic as being a gradient continuum rather than two mutually exclusive classes—also supported by the fact that theorematic reasoning examples differ enormously in complexity and the amount of new elements required. We shall return to this below.

5) A final characterization of theorematic reasoning is that of requiring a new point of view of the problem. We find a simple version of this in Ms. 773 (Reel 16, MF 1434–35): ‘I spoke of Deduction as the compulsive kind of reasonings. Almost all the theoretic inferences are positively creative. That is,
they create, not existing things, but *entia rationis* which are quite as real. This blackboard is black. Theoric deduction concludes that the board possesses the quality of blackness and that *blackness* is a simple object, called an *ens rationis* because that theoric thought created it.’ Here, the hypostatic abstraction from ‘black’ to ‘blackness’ is taken as an example of theoric deduction.

Here is a terminological problem. In many cases, ‘theoric’ is used interchangeably with ‘theorematic’; in other contexts, Peirce seems to intend a slightly different meaning by the concept ‘theoric’. One of his paradigm examples is that of Desargues’ theorem (two triangles which are centrally in perspective are also axially in perspective, usually referred to by Peirce as ‘the ten point theorem’)8—a 17. century geometry proof recently rediscovered in Peirce’s time by von Staudt in the context of projective geometry. Here, Peirce uses the notion of ‘theoric’ to refer to the ‘new point of view’ which may introduce a third dimension to the diagrammatical representation of the 2-d theorem, thereby making it much more immediately graspable than much more cumbersome proofs using lengths of lines:

The two triangles lying in a central perspective as seen from the point 0 have the intersections of their sides coinciding on the same line (axial perspective). This figure (Hilbert and Cohn-Vossen, quoted from Hoffmann, forthcoming p. 18) shows how a three-dimensional interpretation of the originally 2-d planar diagram makes it easy to grasp that the two planes of the triangles meet at the line $g$. Peirce returns over and over again to this proof, taking it as a central example of ‘theoric’ or ‘theorematic’ reasoning. An alternative proof remains restricted to two dimensions but rests upon another theorematic addition, namely that of the length of lines which is also not mentioned in the original theorem.

Michael Hoffmann has made a strong case that this adoption of a new
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point of view should be called ‘theoric’, differing from theorematic reasoning because it simply constitutes a gestalt shift in the conception of the problem rather than the necessary experimental introduction of new elements in the deduction process (Hoffmann, forthcoming). Hoffmann’s interpretation is based on the use of the term ‘theoric’ in Ms. 318 and Ms. 754, both of them from 1907. From the large Ms. 318 on pragmatism, Hoffmann quotes the following description of ‘theoric’ reasoning which consists ‘… in the transformation of the problem,—or its statement,—due to viewing it from another point of view’ (ibid., CSP 68 = ISP 225). In the brief Ms. 754 (notes for a ‘talk to the Phil. club’ April 12, 1907), Peirce writes:

I formerly, quite dubiously, divided Deductions into the Corollarial & the Theorematic. Explain these. Deduction will better be called Demonstration. But further study leads me to lop off a corollarial part from the Theorematic Deductions, which follows that part that originates a new point of view. This part of the theorematic procedure, I will call theoric reasoning. It is very plainly allied to retroduction, from which, it only differs as far as I now see in being indisputable. (Peirce, quoted in: Hoffmann, forthcoming, p. 27, n13)⁹

The core of theorematic reasoning, following this quote, is taken to be the theoric introduction of a new viewpoint—the rest seems to be mere corollarial reasoning. I am not convinced, though, that Peirce, by the introduction of the term ‘theoric’ in 1907 intends a new concept, completely different from that of ‘theorematic’. In the Ms. 754 quote just given—which forms a hapax, the only place, to my knowledge, where Peirce uses both of the notions ‘theoric’ and ‘theorematic’—the former is introduced as a central part of the latter. Shortly afterwards, in the April 1908 issue of The Monist, Peirce publishes the ‘Amazing Mazes’ in whose ‘First curiosity’ he defines ‘theoric’ in complete parallel to the usual definitions of ‘theorematic’ contrasting ‘corollarial’:

I shall term the step of so introducing into a demonstration a new idea not explicitly or directly contained in the premisses of the reasoning or in the condition of the proposition which gets proved by the aid of this introduction, a theoric step. (CP 4.613).

So, I just take ‘theoric’ to be another example of Peirce’s proliferating neologisms where the same concept gives rise to the coining of many, dif-
fferent terminological expressions for that concept. Hoffmann, on the other hand, remains right in pointing to the fact that Peirce’s analysis of the recurrent example of Desargues’ theorem does not coincide with his other examples and descriptions of theorematic reasoning—I would say it adds a further aspect to the description of varieties of theorematic reasoning. Adding a third dimension to the diagram of Desargues’ theorem is adding a new element in another way than adding a particular line to an Euclidean diagram, because it induces a ‘transformation’ in the whole way of viewing the problem. When returning to Desargues’ theorem the next year, in a letter to William James in 1909 (L224, NEM III, p. 471), Peirce now characterizes the Desargues proof as ‘theorematic’ and the introduction of a third dimension as yet another example of ‘additions to the diagram.’ The ‘theoric’ examples thus rather point to the fact that the range of possible additions and experiments in theorematical reasoning is fairly large, involving elements of highly different dimensionality, generality, and abstractness.

To sum up Peirce’s different descriptions of theorematic reasoning, we can say they exceed the mere explication from the combination of definitions by introducing something further, be it new elements (particular or general), be it experiments by diagram manipulation, be it the substitution of schemata for words, or be it the gestalt shift of seeing the whole problem from another point of view.¹⁰

**Theoretical reasoning, relative to psychology?—or to logic systems chosen?**

But why could we not see the differences between corollarial reasoning and the different types of theorematic reasoning as a difference in reasoning psychology only? The former reasonings are generally taken to be easy while the latter require ingenuity—could we not reduce the difference between them to a difference between psychological resources needed to solve the problems? When only we are taught which lines to select in the angle sum proof or how to introduce the third dimension in Desargues’ proof, these proofs become just as easy to conduct as corollarial proofs. The corollarial/theorematical distinction would thus be reduced to one of psychology of learning, of the peculiarity of human reasoning capabilities to which some problems appear easy and other appear more difficult? Peirce, always alien
to psychologism in logic, does not consider this possibility and maintains the idea that it is the very structure of the problem and the formal resources for its proof itself which gives rise to the distinction.\textsuperscript{11} Here, we take Peirce’s stance in assuming that the difference in problem complexity is no purely psychological phenomenon.

A related idea rests on the fact that proofs of the same theorem may take many different forms—cf. the Desargues example—and so a logical parallel to such psychological ideas will be the following question: After a successful theorematic proof, could we not simply add the theorematic additions to the original set of premisses, the original statement of the problem—then the ensuing proof would become corollarial only and easy to perform? From time to time, Peirce toyed with the idea that proofs once having been theorematic might be transformed into the simpler form of corollarial reasoning by the change of logical system: ‘Perhaps when any branch of mathematics is worked up into its most perfect form all its theorems will be converted into corollaries.’ (‘Sketch of Dichotomic Mathematics’, c. 1903?, NEM III, p. 289). That corollarial proofs must be preferred to theorematic proofs for the same theorems, if available, follows from the obvious ideal that simpler proofs must be preferred to more complicated proofs of the same theorem—but this ideal does not grant that all of the latter may, in fact, be translated into the former. And even if some theoretical proofs may be translated into corollarial proofs, Peirce generally finds such an idea—not so far from a positive solution to Hilbert’s \textit{Entscheidungsproblem}—impossible, as we already saw in the 1902 quote where he deemed it impossible ‘... to define number in such a way that Fermat’s or Wilson’s theorems should be simple corollaries from the definition.’ (‘On Science and Natural Classes’, 1902, EPII, p. 129).

At one occasion, in the ‘Amazing Mazes’, Peirce clearly distinguished between theorematic reasoning as such and the repetition of an already established theorematic proof, as well as between proofs necessarily requiring theorematic tools and theorematic proofs reducible to corollaries. (As in the ‘Amazing Mazes’ in general, Peirce here uses ‘thoric’ for ‘theorematic’). A theorematic proof which may—if possible—be transformed into a simpler corollarial proof caused by the introduction of a better formal representation system, is called a ‘theorem-corollary’—somewhat a misnomer. The repetition of a theorematic proof, once it has become familiar, ‘a matter of course’, and thus as easy as corollarial reasoning, he terms ‘theoremation’—this must,
of course, be distinguished from the former by still possessing the theore-
matic structure. Finally, the theorematic introduction of the new element in
order to establish the proof is, by contrast, named a “major theorem”:

Now to propositions which can only be proved by the aid of theoric steps (or
which, at any rate, could hardly otherwise be proved), I propose to restrict the
application of the hitherto vague word “theorem,” calling all others, which are
deducible from their premisses by the general principles of logic, by the name
of corollaries. A theorem, in this sense, once it is proved, almost invariably
clears the way to the corollarial or easy theorematic proof of other proposi-
tions whose demonstrations had before been beyond the powers of the math-
ematicians. That is the first secondary advantage of a theoric step. The other
such advantage is that when a theoric step has once been invented, it may be
imitated, and its analogues applied in proving other propositions. This consid-
eration suggests the propriety of distinguishing between varieties of theorems,
although the distinctions cannot be sharply drawn. Moreover, a theorem may
pass over into the class of corollaries, in consequence of an improvement in
the system of logic. In that case, its new title may be appended to its old one,
and it may be called a theorem-corollary. There are several such, pointed out by
De Morgan, among the theorems of Euclid, to whom they were theorems and
are reckoned as such, though to a modern exact logician they are only corollar-
ies. If a proposition requires, indeed, for its demonstration, a theoric step, but
only one of a familiar kind, that has become quite a matter of course, it may be
called a theoremation. If the needed theoric step is a novel one, the proposition
which employs it most fully may be termed a major theorem; for even if it does
not, as yet, appear particularly important, it is likely eventually to prove so. If
the theoric invention is susceptible of wide. (‘Amazing Mazes’, 1908, CP 4.613)

The terminology of these distinctions seems not particularly well-chosen, one
referring to the process (‘theoremation’) two to the result (‘theorem-corollary’,
‘major theorem’), and the syncretistic notion ‘theorem-corollary’ doesn’t seem
to be a good means to indicate that the proposition in question is a corollary
of one set of axioms, but not of another. The overall conceptual argument,
however, clearly establishes the distinction between theorematic reasoning
as such on the one hand, the issue of its dependency upon axiom and rule
systems on other hand—and, finally, the psychological issue of its becoming
familiar with repetition. As Hintikka (1983, 112) argues, the fact that some
theorematical proofs become corollarial under other rule systems does not at all obliterate the corollarial-theorematical distinction, rather it makes clear that the distinction is relative to the logic system used and will remain, albeit differently, in any such system.

**Types of theorematical diagram experiments**

As we have seen, Peirce developed the distinction of corollarial and theorematical diagram deductions during the last 15 years of his life, and both explicitly and implicitly, he proposed different subtypes of theorematical deductions. He explicitly proposed a distinction between theorematic reasoning with or without abstractions, and more implicitly, distinctions may be inferred from his examples: manipulating with the diagram versus adding new material; the new elements added being objects, foreign ideas or new points of view. Apparently, he realized that all this laid out a whole field for further investigation:

I wish a historical study were made of all the remarkable theoretic steps and noticeable classes of theoretic steps. I do not mean a mere narrative, but a critical examination of just what and of what mode the logical efficacy of the different steps has been. Then, upon this work as a foundation, should be erected a logical classification of theoretic steps; and this should be crowned with a new methodeutic of necessary reasoning. (‘Amazing Mazes’, 1908, CP 4.615)

The ultimate goal for such a research, as so much in Peirce, is heuristic (‘methodeutic’): it should be undertaken in order to find better methods for deduction within the confines of the research process as such. The plurality of theorematic subtypes involved, already more or less vaguely glimpsed, may be no wonder, given the basic negative definition of somehow transgressing the merely definition-based corollarial reasoning. In how many ways is it possible to transgress corollarial reasoning? Given Peirce’s overall continuism, we might surmise that these different subtypes of theorematic reasoning rather form a continuum from the simplest corollarial examples in the one end to the most complicated theorematical specimens in the other end. Hintikka proposed one arithmetic measuring stick for such a gradual scale—the amount of additional individuals needed in the proof. But this only goes for one subtype of
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theorematic reasoning, that of the introduction of further quantified particulars.

Among the many species of theorematical reasoning to investigate, we shall propose three logical levels of theorematical diagram experiment. Let us go back to the simple Euclidean example with the angle sum proof. Here, the introduction of auxiliary lines gives a basic example of the introduction of new particular objects. They are not in any way extraordinary—their very possibility is granted by basic Euclidean axioms and postulates. The only extraordinary thing about them is, as Shin argues, the selection of the right lines among the infinity of many possible.

A higher level of diagram experiment addresses the change of selected details of the very formalism making the former experiment possible. The famous geometrical example, of course, is the change of the parallel axiom\textsuperscript{12} which made possible the angle sum proof. This axiom was originally changed in order to try to find an ad absurdum proof: if a changed parallel axiom lead to inconsistencies in geometry, this would prove the parallel axiom was a theorem of the theory, and the rather cumbersome postulate could change status and become a theorem of geometry rather than part of the premisses. Famously, these attempts failed and lead, instead, to new systems of non-Euclidean geometries by Bolyai, Lobachevsky, Riemann, etc. in the mid-19th century. The parallel axiom could be changed, now, in two basic directions: instead of one possible parallel, given a line and a point, no parallel lines could be drawn through the point, or an infinity of parallel lines could be drawn—resulting in elliptic and hyperbolic geometries, respectively. But the very change of the parallel axiom is obviously an experiment with a wholly different status than the addition of auxiliary lines in the angle sum proof. Here, the very definition of which objects are taken to be possible in the formalism is changed—and a theorem such as the angle sum theorem will consequently be revised—in the former case, the angle sum will be more than 180 degrees, in the latter, less. Generally, experiments varying axioms, postulates, object definitions, transformation rules etc. of a theory must be ascribed a status different from the mere introduction of an object allowed by the existing rule system.

A still higher level, now, may be grasped from the same example. After the realization that three different types of geometries may result from the change of the parallel axiom, an experiment on an even higher level was possible: to vary and synthesize all such geometries and organize them on one continuum so that Euclidean geometry now forms a point with zero curvature of space
on a line with different elliptic geometries having different positive curvatures, hyperbolic geometries having different negative curvatures (Bolyai, Riemann). By doing so, those pioneers undertook a step characterized by Peirce before he discovered the corollarial-theorematic distinction:

Mathematical reasoning consists in thinking how things already remarked may be conceived as making a part of a hitherto unremarked system, especially by means of the introduction of the hypothesis of continuity where no continuity had hitherto been thought of. (‘Review of Spinoza’s *Ethic*’ 1894, in: Peirce, 1975–1987, II, pp. 84–85)

This third step realizes how Euclidean geometry and the infinite number of elliptic and hyperbolic geometries form part of ‘a hitherto unremarked system’ given by variation of curvature—exactly by taking them to be connected by the continuous variation of curvature.

Of course, still higher syntheses are possible—in geometry, the generalizations of the Erlangen program, defining different geometries by which invariances their transformation procedures allow for (thus finding a higher-order unremarked system of which both (non-)Euclidean geometries, projective geometry, and topology form a part)—or the generalization by Hilbert, taking the axiomatic structure of geometries as fixed while the interpretation of which model of objects they refer to could be subject to variation—or the generalization of category theory allowing for the co-articulation of geometry with different branches of mathematics, etc.

Such syntheses, however, seem to repeat the two latter types of theorematic experiments on higher levels. Thus, the three theorematic levels distinguished here—the introduction of a new object, and the two types of introducing a foreign idea, the experiment with one or more of the basic object or rule definitions, and the establishment of a system of different versions of those definitions, seem to to give us a hypothesis of three different types of theorematic diagram experiment.

**The three levels in applied diagrams**

Let us argue by example in discussing diagram experiments of these three kinds in applied diagrams, taking the geographical example of topographical
maps. Here, the tracing of a route on the map from one location to another must constitute an example of corollarial reasoning. It does introduce new elements—the real or imaginary drawing of a line on the map, respecting, in addition to the mathematical aspects of the diagram, additional features of physico-geographical ontology: the trajectory should follow roads, not cross lakes, swamps, buildings, mountains etc. Geography, of course, is no fully axiomatized science, and the regional ontology of geography makes the additional geographical diagram constraints more vague than the exact mathematical aspects of the same diagram. A practical example of corollarial map reasoning may be the Danish police detective Jørn ‘Old Man’ Holm’s computer program, immediately plotting huge amounts of cell phone information related to suspects on a map:

Calls from the same cell phone are marked by the same colour. This diagram representation does not add anything new to previously existing information—except for the synthesizing a lot of single informations on one map, information which otherwise would have to be gathered from long lists of single pieces of longitude-latitude information of cell phone masts, cell phone
numbers and call-up times. The synthesis of such information on one and the same diagram makes it possible to grasp in one glance gestalt information about cell phone trajectories on the map which would otherwise require complicated, time-demanding and not immediately convincing argumentation in court. Diagrammatic argumentation, by contrast, proves highly efficient in court where Holm has been called as an expert witness in many severe cases about drug smuggling, trafficking etc. Obviously, it becomes harder for a defendant to stay with his explanation that he spent the whole day in front of his tv set when a diagram proves that his cell-phone travelled from one end of the country and back the same day. Such information synthesis on a diagram constitutes an example of corollarial reasoning—unproblematically adding to the mathematical diagram aspects of points and lines those of the regional ontologies of geography and human communication.

Now, we may argue that the introduction of a new object in the diagram, e.g. in the shape of a ruler, marks a first small step in theorematical reasoning. It permits us to compare distances across the map—and even if having become an everyday utensil in our time and automatized in GPS and elsewhere, the ruler must have been a major breakthrough when the first distance calculation on a map was actually performed.

Still higher species of diagram experiment with maps may be gathered from science. A recent such example stems from Jared Diamond’s celebrated book *Guns, Germs, and Steel*, tracing the roots of domesticated agriculture on Earth since the beginning of the neolithic period. A basic argument in the book comes from Diamond’s diagram experiment with a world map (Diamond 2005, 177):
Diamond’s basic observation is that among the three major continental complexes, Eurasia, Africa, and the Americas, there is a seminal difference—the former is roughly oriented East-West, while the latter are both oriented North-South. This almost trivial diagram experiment receives its non-triviality (which qualifies it as a piece of theorematic reasoning) from the underlying combination of biogeography with human culture in the regional ontology of the diagram. The domestication of plants and animals is a watershed event in human culture giving rise to the agricultural revolution and the development of large-scale, layered societies. Domestication presupposes the presence of easily domesticated species and the stable human settlement over many generations in the environment favoring the survival of these species. But local domestincations only get the ability to dominate the development of human civilization if they are able to spread from there to other areas and cultures. But biogeographically, species are tied to local climate,—and local climate roughly depends on the latitude, forming isotherms across a temperature gradient falling from Equator towards the Poles. So the piecing together of these pieces of geographical ontology into a system depends upon a diagram experiment: once you have domesticated a species, where may it spread? Most favourably it spreads in the overall East-West direction, along isotherms, keeping climate conditions approximately constant—as opposed to traveling in the North-South direction where climate changes drastically with latitude. By this piece of a priori diagram reasoning—based on the combination of biogeographical ontology and the ontology of human culture development—Eurasia stands out as a privileged site for the original domestication of agricultural species (as opposed to Africa which might immediately be taken as a better candidate, original cradle of the human species as it is). Empirical findings subsequently corroborate this piece of theorematic reasoning: the fertile crescent of present-day Israel, Palestine, Syria, and Iraq seems to form the origin of many of the most important domestic species of the whole world, while the Far East comes in second. These areas were able to communicate domestincations along the East-West axis and export them to Europe and the Far East. Of course, theorematicity must be a vaguer concept in empirical examples like this, where the ontologies of biogeography and of culture are not exhaustively described, but still an argument may be made which runs as follows. The complex of three basic propositions 1) domestication of a species is a local event, 2) requiring stable human settlement in the natural niche of the species 3) and the spread of such species must favor isotherms,
combined with the diagram experiment of searching the world map where the most favorable isotherms occur, constitutes a piece of theorematic reasoning. It introduces a new object on the map—the possible spreading trajectories of domesticated animal and plant species—and thus hypothesizes a general regularity on the globe. This experiment on the map involves the combination of concepts from different regional ontologies, of geography, biogeography, meteorology, cultural history—in some sense, it synthesizes different world maps charting findings in these different disciplines as a prerequisite of the experiment. Thus, it provides a new argument for which cultures were able to survive. But it does not introduce a foreign idea.

A further geographical example may be the more famous diagram experiment by the German geographer and explorer Alfred Wegener leading to the plate-tectonics of current geology. Famously, Wegener was toying with a map and noticing that the West coast of Africa strangely fit like a puzzle piece into the East coast of South America:

![Fig. 6](image-url)

The coastline fit of South America and Africa, supplemented with geological similarities, from Wegener 1929, p. 73 (the illustration adapted by Wegener from Alexander du Toit).
This lead to Wegener’s groundbreaking 1912 idea (‘Die Entstehung der Kontinente’) that these continents had once been one—a controversial argument initially ridiculed, but much later corroborated by the findings of geological and biological similarities along the two coasts and finally accepted after the discovery of the mid-Atlantic mountain range as the decisive indication that the ocean does in fact ‘grow’ in the middle. This diagram experiment belongs to a second level as compared to the Jared Diamond example. Here, not only new objects or connections are introduced—here a completely new idea is introduced, namely that of continents moving over time. Taken on the level of pure diagrams, of course, nothing is strange—all Wegener did was to take a geometrical object and make a classical rigid Euclidean movement in order

![Reconstructions of the world map according to the continental drift theory](image-url)

**Fig. 7**

Reconstructions of the world map according to the continental drift theory, from Wegener 1929, p. 19
to let it face another object. This is permitted by geometry, but, of course, not by the regional ontology of pre-Wegener geography. So Wegener’s diagram experiment changed an axiom of geography, as it were—the assumption of long-term stability of large-scale features of the Earth surface—and so introduced not only a new object, but a foreign idea, that of continents moving on a geological timescale.

An example of a third level diagram experiment in geography might be taken from the same piece of history of science: the reinterpretation of the whole of the surface of the Earth in terms of moving continental plates, inverting their present movements and extrapolating them into the past in order to trace the origins of the continents. Mountain ranges were now seen as the results of continent collisions and volcanic areas as the result of chasms between plates going in each their direction. This permitted the coordinated diagram experiment reconstructing the original ur-continent of Pangaea. Wegener already presented the idea of the ur-continent in his 1915 book, it was baptized Pangaea at at 1928 conference, and was presented like this in the 1929 version of his book *Die Entstehung der Kontinente und Ozeane* shortly before his death in 1930 (see Fig. 7).

Here, the particular change of an axiom lead to the systematic reinterpretation of a whole conceptual structure of geographical and geological ontology, effectively integrating the two into one discipline by seeing the same forces in work all over the surface of the Earth—in some ways comparable to the systematization of geometries after degrees of curvature.

**Theorematic reasoning and Hypostatic Abstraction**

We may sum up our hypothesis of three basic levels of Theorematic reasoning as follows:

1) Addition of new individuals to the premises
2) Higher-level experiment with variation of axiom or transformation rule
3) Establishment of system of different axioms or rules

Now, what is the relations of them to Hypostatic Abstraction—the procedure Peirce described as making a second-level substantive out of a first-level predicate, thereby creating a new object of thought? As we have seen in this
paper, Peirce sometimes distinguishes non-abstract from abstract theorematic reasonings; while in an early quote he almost identifies abstraction with theorematic reasoning. Immediately, the talk about individual instantiation in the first theorematic reasoning type seems to preclude that abstraction should play any role here. Peirce’s debatable analysis of lines as abstractions from the trajectories of moving particles would make the subsidiary lines in the angle sum proof abstract objects added in the proof. In any case, the importance of this step lies in the selection of the individual lines needed for the proof which is not a matter of abstraction. Likewise, such lines do not add an idea which could be said to be foreign to the theorem to be proved. Maybe the first-level addition of new individuals could comprise both abstract and non-abstract cases.

Different, however, seems the case of the second level of theorematic reasoning, implying that something in the rule system is taken as object of experiment, leading to a ‘foreign idea’. If the parallel axiom is what defines the hypostatic abstraction of ‘parallelness’ or ‘being parallel’, then the variation of that axiom introduces competing definitions of that abstraction—the ‘foreign ideas’ of that level.

The third level, then, would be that of making a whole system out of hypostatic abstractions—this system constituting itself, then, a complex hypostatic abstraction on a higher level, involving such new hypostatic terms as ‘curvature of space’. This level seems characterized by ‘the introduction of the hypothesis of continuity where no continuity had hitherto been thought of’, as Peirce had it—establishing continua of hypostatic abstractions from the second level.

No doubt, the relation between theorematic reasoning and abstraction allows for many sophistications which is beyond our scope to investigate here. This must be left for further reasoning.

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Notes

1. Taking Comte’s principle (a science is below another science from which it takes its principles, and above another science whose principles it borrows from it) as basis for his classifications of the sciences, Peirce places mathematics on top as the science from which all other sciences borrow principles.

2. These equivalences between alternate angles, of course, are granted by Euclid’s Proposition 29: *If two straight lines are parallel, then a straight line that meets them makes the alternate angles equal.*

3. Shin’s investigation of syntheticity in Kant and Peirce concludes as follows (1997, 37): ‘Even though Peirce himself did not engage in a full evaluation of Kant’s analytic/synthetic distinction, we can now acquire a quite comprehensive picture of this matter. Peirce’s theory of mathematics locates the origin of Kant’s syntheticity in two different sources: One is the historical fact that Kant was writing before the discovery of quantification theory, and the other is Kant’s appreciation of different kinds of reasoning. The former source is responsible for Kant’s claim about the statement “7 + 5 = 12”, but his claim about the statement “A triangle’s angles sum to 180 degrees” is related to the latter. The development of logic cleared away the first source of syntheticity, and we know that this origin of Kant’s syntheticity is not sustainable any more.’ Consequently, the other, more sound aspect of Kant’s syntheticity relies in his appreciation of two different modes of reasoning, logical and mathematical,—which were reconstructed by Peirce as corollarial and theorematical reasoning, respectively. See also Stjernfelt 2007, ch. 8.

4. As abstractions come in many levels, and abstract/concrete is not coextensive with general/particular, the issue whether the subsidiary lines should be taken as abstractions or particulars or both needs not bother us.

5. The selection of the right elements to add is abductive. In the angle sum case, the addition of parallel lines is probably prompted by the previous knowledge of Proposition 29 dealing with the relation between parallel lines and the size of alternate angles—because the theorem to be proved is about angle sizes. So even if the selection itself is not deductive but merely abductive, the abduction is motivated by a certain likeness between the theorem and possibilities offered by previous theorems proved.

6. A parallel quote, emphasizing the theorematic step as the addition of a new idea, is the following: ‘I shall term the step of so introducing into a demonstration a new idea not explicitly or directly contained in the premisses of the reasoning or in the condition of the proposition which gets proved by the aid of this introduction, a
Peirce’s Notion of Diagram Experiment

The shortest presentation is probably: ‘For mathematical reasoning consists in constructing a diagram according to a general precept, in observing certain relations between parts of that diagram not explicitly required by the precept, showing that these relations will hold for all such diagrams, and in formulating this conclusion in general terms. All valid necessary reasoning is in fact thus diagrammatic.’ (‘Lessons from the History of Science’, 1896, CP 1.54) The object of mathematics will be pure diagrams of any kind, while ordinary reasoning as well as the empirical sciences will use diagrams applied in being constrained by existing relations—empirical data and regional ontology—as well.

A detailed attempt at developing the distinction between corollarial and theorematical reasoning in ‘The Logic of History’ (1901, NEM IV) takes the proof of \((x + y) + z = x + (y + z)\) as example of the former and the proof that ‘every multitude is less than a multitude’ \(\approx\) there is no largest set) as example of the latter. The overall argument, however, is not very clear. Especially the latter proof which seems to be a sort of diagonal argument implying a power set construction is not very clearly presented, and even if Peirce concludes it ‘requires the invention of an idea not at all forced upon us by the terms of the thesis’, he does not make explicit what that new idea should be, apart from not being derivable from the definition of the concept ‘fewer’ (a clearer example of Peirce’s version of Cantor’s power set theorem can be found a few years earlier in ‘The Logic of Relatives’ (1897, CP 3.548). Similarly, at the end of ‘Logic of History’, Peirce has a brief and clear summary of the Power Set Theorem: ‘I proved that there is no maximum multitude by considering the collection of all possible collections of the numbers of a collection. Now a collection is an abstraction …’ (1901, NEM IV, p. 11), but still there is no indication of what the ‘new idea’ introduced should be. Certainly not the abstraction of ‘collection’ which is presupposed by the multitudes of the premises—rather the power set notion of the set of all possible subsets of a given set. Peirce seems to have realized the early discussion of corollarial/theorematical in ‘The Logic of History’ was less than satisfying; according to the Robin catalogue on the Ms. (691), Peirce added the following note to the Ms.: ‘These pages are to be used in the chapter of the Logic treating Deductive Reasoning. But the theory needs completion.’

Here, I quote Ms. 754 from Hoffmann (forthcoming) as the ISP page 8 is missing from the Microfilm edition where it seems to belong between pages 5 and 6.

Maybe the very concept of theorematical reasoning is necessarily open—given the inexhaustibility of mathematics, it may not be granted we should be able to chart
all possible subtypes of such reasoning beforehand?

11 A related issue is the degree of conscious access to reasoning processes: ‘If, however, as the English suppose, the feeling of rationality is the product of a sort of subconscious reasoning—by which I mean an operation which would be a reasoning if it were fully conscious and deliberate—the accompanying feeling of evidence may well be due to a dim recollection of the experimentation with diagrams.’ (CP 2.172) The experience of evidence resulting from rational reasoning may, in some cases, depend upon subconscious reasoning. A recurring argument in Peirce, however, points to the fact that such reasoning—and, even more, that of computers—lacks self-control as the hallmark of real reasoning. As to mechanization of reasoning, Peirce often discusses the corollarial/theorematical distinction with reference to computers (‘logic machines’). His overall idea is that the former will generally be mechanizable, while the latter lie beyond mechanization because their introduction of new elements by experiment requires creativity and ingenuity. These ideas might be seen as a vague anticipation of later discoveries of decision limitations in the philosophy of mathematics and computation (Gödel’s incompleteness theorem, or Turing’s related halting problem), but they are not simply equivalent. These limitations have another character than Peirce’s distinction, because they limit the range even of purely mechanical decision procedures which Peirce would, in all probability, categorize as corollarial.

12 Strictly speaking, the parallel postulate. It has become common usage to call it an axiom.

**Literature**


Peirce’s Notion of Diagram Experiment

Peirce’s Notion of Diagram Experiment

— (no year) ‘Logic, Considered as Semiotic’ [LCS], constructed from manuscript L 75 by Joseph Ransdell (1902) (http://www.cspeirce.com/menu/library/bycsp/l75/ver1/l75v1-01.htm).
— Manuscripts at the Houghton Library referred to by Ms. numbers in the Microfilm edition 1966 *The Charles S. Peirce Papers, Microfilm Edition, Thirty Reels with Two Supplementary Reels Later Added*. Cambridge: Harvard University Library Photographic Service. Manuscript numbers also refer to the Robin catalogue of the Mss. (Robin 1967). As to manuscript page numbers, ‘CSP’ refers to Peirce’s pagination (which is not unanimous since several parallel drafts may belong to the same Ms.), while ‘ISP’ refers to the pagination of the Mss. by the Institute for Studies in Pragmaticism, also used by the Peirce Edition Project in Indianapolis. When ISP numbers are not available, numbers refer to the sequence of the microfilm reel, e.g. ‘Reel 16, 1434–35’ meaning the 1434th and 1435th page of reel 16.
— 1997 ‘Kant’s Syntheticity Revised by Peirce’, *Synthese* 113, 1–41.


Gegenstand und Fragestellung


Das Gemälde wurde früher fälschlicherweise Lucas van Leyden zugeschrieben.\textsuperscript{2} Im Louvre lautet die Beschriftung heute „Leyden oder Antwerpen, um 1525–30“, wobei die Entstehungszeit wohl etwas früher anzusetzen ist. Stilistisch gehört das Gemälde meiner Ansicht nach zur Kerngruppe jener Werke, die Max Jakob Friedländer unter dem Namen „Jan de Cock“ zusammengefasst hat.\textsuperscript{3}

Das Werk hatte einen berühmten Verehrer, den französischen Schriftsteller und Theatertheoretiker Antonin Artaud, der es bei einem seiner Besuche im Louvre entdeckte und 1931 unter dem Titel „La mise en scène et la mé-
Artaud fasste die Tafel als Ideallmodell für das von ihm konzipierte Theater auf, ein Theater, das auch ohne Worte auskommen kann: „Dieses Gemälde ist das, was das Theater sein sollte“, lautet die Quintessenz seines Textes.


Der simulierte Sachverhalt ist ebenso ungewöhnlich wie komplex: Wunderbare kosmische Ereignissen sind mit einer außerordentlichen, ja skandalösen menschlichen Handlung kombiniert. Dennoch stellt sich ein überzeugender effet de réel ein. „So ist es gewesen!“ oder genauer: „So könnte es gewesen sein, damals als …“ Das Gemälde evoziert eine Vorstellung, die der Leser des biblischen Textes nur vage als so genanntes ‚inneres Bild‘ zu realisieren braucht. Es sind die Konventionen des Figurenbildes, die den Maler gezwungen haben, das im Text nur allgemein Formulierte, wie den Begriff ‚Stadt‘, als ein ganz bestimmtes architektonisches Gefüge, als eine mögliche Stadt zu imaginieren. Das neue Bildkonzept der Renaissance verlangte die Individualisierung des Gezeigten.

Eine weitere Konvention zwang den Maler dazu, den Ausblick grundsätzlich einer Art Momentaufnahme gleichzusetzen, für seine Darstellung einen Augenblick aus dem Verlauf der biblischen Erzählung auszuwählen. Der Begriff ‚Momentaufnahme‘ ist anachronistisch, doch war es die nachträgliche Erfindung des mechanischen Mediums der Fotografie, die das albertianische
Abb. 1  Anonym („Jan de Cock‘), *Lot und seine Töchter*, um 1520. Paris, Louvre
Konzept des perspektivisch konstruierten Fensterausblickes auf ideale Weise realisiert hat. Der Maler unseres Bildes hat sich, wie wir sehen werden, an die Norm der punktuellen Zeitauffassung nicht ganz gehalten, was übrigens in der vorfotografischen Zeit durchaus üblich und allgemein akzeptiert war. Dennoch musste er besondere Strategien entwickeln, um mit einem unbewegten Fensterausblick eine Geschichte erzählen zu können.

allgemein gültigen Gesetzen. Der Gegensatz zwischen den beiden ‚Bildern‘ (Abb. 1 und Abb. 2) könnte kaum größer sein.

Es ist verständlich, wenn die Bildwissenschaft zu Beginn ihrer Entwicklung versucht, mit klaren typologischen Setzungen einzelne Manifestationen aus dem großen Universum der vom Menschen zu Kommunikationszwecken hergestellten visuellen Artefakte, wie das ‚Figurenbild‘ und das ‚Diagramm‘, möglichst deutlich voneinander abzuheben. Ich möchte im Folgenden jedoch den gegenteiligen Weg einschlagen und die Frage stellen, was ein Figurenbild mit einem Diagramm gemein haben könnte. Doch bevor ich diese Frage zu beantworten versuche, möchte ich mich dem Pariser Gemälde, das mir als Beispiel dient, mit einer ersten Beschreibung und Elementen für eine Analyse nähern.6

**Doppelte Gliederung**


Die Bildfläche ist jedoch gleichzeitig nach einem orthogonalen Schema gegliedert (Schema b). Die Horizontlinie des Meeres und die Vertikale des schlanken, jungen Baumes – er durchquert beinahe die ganze Bildfläche – gliedern diese zusätzlich in vier unterschiedlich große rechteckige Zonen,

Abb. 3

**Schema a:**
Raum-zeitliche Differenzierung des dargestellten Sachverhaltes.
die ich im folgenden ‚Quadranten‘ nenne. Jeder der vier Quadranten ist durch eine besondere Thematik charakterisiert. Die figurative, raumsimulierende Logik des Gemäldes als einem kohärenten ‚Fensterausblick‘ wird durch eine thematische Logik überblendet, die auf einer Aufteilung der Bildfläche nach den Kategorien der **Vertikalität** (oben vs. unten) und **Horizontalität** (links vs. rechts) beruht.\(^7\)

Wiederaufnahmen

Die drei Figuren an der Spitze des Zuges, Lot und seine beiden Töchter, sind ein zweites Mal im linken unteren Quadranten der Bildfläche dargestellt. Lot sitzt, die ältere Tochter eng umschlungen, zu Füßen des Baumes und bietet dieser Wein in einer Schale an; die jüngere, aufreizend gekleidete Tochter steht daneben und ist daran, weiteren Wein aus einer der Reiseflaschen in einen Krug umzufüllen. In einem Paralleldiskurs der Dinge – Flaschen, Wein und Krug – wird die sexuelle Vereinigung, die mit ihrer Hilfe zustande kommt, bereits angedeutet.

Doch auch die Mutter ist im Bild wieder aufgenommen. Sie erscheint ein zweites Mal, erneut leblos, im Felsen des linken oberen Quadranten in der Form eines riesigen, mit einem Schleier bedeckten Frauenkopfes. Die Tatsache, dass dieser Kopf, den der Betrachter im Profil wahrnimmt, zur untergehenden Stadt hin ausgerichtet ist, spricht dafür, dass es sich hier tatsächlich um eine zweite Darstellung der zur Salzsäule verwandelten Mutter handelt.

Es bleibt der Esel. Auch er ist ein zweites Mal dargestellt, aber sozusagen in einem späteren Zustand. Der Esel erscheint im rechten unteren Quadranten nochmals, als Skelett, zu Füßen eines verfaulten, abgestorbenen Baumstrunks.

Man kann feststellen, dass die fünf Figuren des Schattenrisses, die auf der Bildfläche ein zweites Mal im größeren Format wieder aufgenommen sind, dem orthogonalen Schema entsprechend verteilt sind, wie es durch die Horizontlinie und den aufragenden Baum gebildet wird: Lot und seine beiden Töchter besetzen den Quadranten unten/links, Lots Frau den Quadranten oben/links, der Esel den Quadranten unten/rechts. Im Quadranten oben/rechts ist die Stadt Sodom dargestellt, wie sie vom himm-
lichen Feuer zerstört brennend im Meer versinkt. Auf dem Marktplatz, der wie eine schiefe Ebene in die Diagonale gekippt ist, irren die Menschen hilfesuchend umher, während über ihnen die Spitze des gotischen Stadtturms vom Beben erschüttert abbricht (Abb. 5). Die Detialaufnahme dieser gespenstischen Szene mit ihren raffiniert gesetzten Lichteffekten, Schlagschatten und Wasserspiegelungen gibt einen Eindruck von der überragenden malerischen Qualität des Gemäldes und der Beobachtungsgabe seines Autors, die sich gleichzeitig auf optische Kenntnisse stützt.

**Verschleifungen**


Abb. 6

**Schema c:**

<table>
<thead>
<tr>
<th>Erstarrung</th>
<th>Zerstörung</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zeugung</td>
<td>Zerfall</td>
</tr>
</tbody>
</table>
Dennoch erscheint die Aufteilung der Bildfläche entsprechend dem orthogonalen Netz für die Wahrnehmung des Werkes relevant. Sie wird unterstrichen durch die Tatsache, dass jeder Quadrant – als eine mehr oder weniger klar begrenzte rechteckige Zone – eine thematische Einheit besitzt, die jeweils zwanglos mit einem abstrakten Begriff bezeichnet werden kann (vgl. Schema c):


Der Quadrant links oben, in dem die äußere Form von Lots Frau in Stein konserviert ist, kann dem Thema Erstarrung zugeordnet werden.

Eine letzte thematische Einheit manifestiert der Quadrant unten rechts, den man aufgrund des Skeletts und des faulenden Baumstrunks mit dem Begriff des Zerfalls belegen kann. Im Gegensatz zu dem diagonal entgegensetzenden Quadranten der 'Erstarrung' links oben zersetzt sich hier die Form, indem die Materie in einen neuen Aggregatzustand übergeht. Die Auflösung der Form kommt in diesem Bereich einer ikonoklastischen Wendung des Bildes gegen sich selbst gleich: Die Farb- und Helligkeitskontraste werden reduziert, sodass die einzelnen Formen nur noch undeutlich wahrgenommen werden können, und die Darstellung zu einer unartikulierten dunklen Fläche hin tendiert.

Obwohl die einzelnen Quadranten aufgrund der in ihnen jeweils dargestellten Ereignisse und Objekte einen starken semantischen Eigenwert besitzen, ist die inhaltliche Kohärenz des Werkes als ganzem offensichtlich. Alle vier Teile, die wir mit Zerstörung, Erstarrung, Zeugung und Zersetzung charakterisiert haben, handeln von Leben und Tod. Es drängt sich geradezu auf, die

Diagrammatik

Mit der systematischen Verteilung der Figuren auf der Bildfläche, die den existentiellen Grundbegriffen um den Hauptgegensatz von ‚Leben‘ und ‚Tod‘ zugewiesen werden können, verrät das Gemälde einen dezidiert diagrammatischen Zugriff. Dieser besteht darin, elementare semantische Oppositionen topologischen Kategorien zuzuordnen, um so die Artikulation des Sinnes für den Betrachter sinnlich nachvollziehbar zu machen.\(^8\) Gleichzeitig aber bleibt das Gemälde ein traditionelles Figurenbild. Anders als im Diagramm sind keine Wörter auf der Bildfläche verteilt, sondern einzelne Szenen, Akteure und Dinge, die in ihrer spezifischen Gestaltung die fundamentalen Konzepte ‚Zerstörung‘, ‚Zugung‘, ‚Erstarrung‘ und ‚Zersetzung‘ veranschaulichen.

Alle handelnden Figuren sind, wie wir gesehen haben, jeweils zweimal dargestellt: ein erstes Mal zusammen im kleinen Schattentheater der Fluchtszene (unten rechts) und ein zweites Mal – in vergrößerter Wiederaufnahme – auf die Quadranten der Bildfläche verteilt. Die dergestalt verteilten Figuren stellen Episoden dar, in denen die in der kleinen Szene initiierte Erzählung weitergesponnen wird; sie sind aber gleichzeitig die systematische Explikation des Sinnes, der die Erzählung als ganze trägt. So wird die malerische Schilderung der Geschichte von Lot und seinen Töchtern zu einer Reflexion über Leben und Tod und über das Schicksal des Menschen in der Welt. Durch die diagrammatische Unterfütterung ist das Figurenbild mehr als eine bloße Illustration der biblischen Episode, es kann als eine eigenständige Deutung des Textes verstanden werden.


Auch das Gemälde des Louvre regt den Betrachter dazu an, solche Operationen im Sinne einer imaginären Weiterarbeit am dargestellten situativen Bestand vorzunehmen.\(^{10}\)


**Verlauf und Fortsetzung der Geschichte**


Das bereits erwähnte Felsentor ist Teil eines komplexen Zirkulationssystems, eines Weges, der alle vier Quadranten des Gemäldes untereinander
Figurenbild und Diagramm

verbindet (Schema e). Es handelt sich vorerst um den Weg, der von Lot und seiner Familie abgeschnitten wird, und zwar in dem Maße, wie die Geschichte voranschreitet. Es ist aber auch ein Weg, der für den Betrachter eingerichtet ist, um ihm die Erzählung als geordnete Sequenz von Episoden darzubieten. Da jede Episode einem Quadranten und damit einem thematischen Konzept zugeordnet ist, erscheint die Geschichte gleichzeitig als sukzessive Transformation innerhalb der Termini des logischen Quadrates. 12


Die Geschichte endet aber nicht hier, auch wenn die Hauptfiguren hier zum letzten Mal dargestellt sind. Der Maler hat das inzestuöse Paar, Lot und seine ältere Tochter, zu Füssen eines schlanken Baumes platziert, der die Bildfläche entlang der Vertikalen teilt.
Dieser Baum verweist – über die sprachlich fixierte Metapher des „Stamm-
baums“ – zweifellos auf das künftige Geschlecht, das aus der Vereinigung des Va-
ters mit seiner Tochter hervorgehen wird. Doch der Maler hat den jungen Baum
mit einem abgestorbenen, faulenden Baumstrunk im vierten Quadranten
parallelisiert. Der Baum erscheint so gleichsam zweimal, als junger Spross und als
abgestorbener Rest, der bald ganz zerfallen und wieder zu Erde werden wird.

Die Analogisierung geht weiter (Schema f): So wie dem lebendigen Stamm
(B) das inzestuöse Paar (P) beigeordnet ist, ist dem Baumstrunk (B′) das Skelett
(S) beigeordnet. Damit zeichnet sich die Konfiguration einer Raute ab. Die Fig-
urenkonstellation ist ein kleines Diagramm: Dem postulierten Schema kann,
da beide Figurenpaare – B/B′ und P/S – durch die Opposition von Leben
und Tod charakterisiert sind, der logische Status einer Verhältnisgleichung
zugeschrieben werden: So wie der Baum zerfällt, also B zu B′ wird, wird auch
P zu S werden. Ausgedeutet bedeutet dies: Auch die beiden Individuen un-
ter dem Baum werden sterben und als Skelette enden.14

Damit korrigiert die Pariser Tafel den optimistischen Ausgang der bibli-
schen Erzählung. In der Epoche der Renaissance bringt das Gemälde neu die
Dimension des individuellen Wohlergehens in die Geschichte von Lot ein und
gleicht es mit dem Schicksal des Geschlechts ab: Auch wenn Lots Geschlecht
dank der rechtzeitigen Flucht der Familie aus dem sündigen Sodom und des
späteren Inzests des Vaters mit seinen beiden Töchtern überleben wird, als
Individuum wird auch Lot und werden die Mitglieder seiner Familie dem
Tod unterworfen bleiben. Sie werden einzeln das gleiche Schicksal erleiden
wie die Menschen, die bei der Zerstörung von Sodom und Gomorrah umge-
kommen sind. Nach einem langen Umweg, der Flucht aus der Stadt und dem mühsamen Weg über gefährliche Brücken und hohe Gebirge, enden auch die Überlebenden schließlich unten rechts im Quadranten der ‚Zersetzung‘, wo sich ihre Körper auflösen, um zu Staub zu werden.15

Ein des Lateinischen mächtiger Maler


Auf die Spur dieses Textes hat mich das logische Quadrat geführt, mit dem die kompositorische Struktur des Werkes verwandt ist. Das logische Quadrat (vgl. Abb. 2) ist als gezeichnetes Diagramm zum ersten Mal in der kleinen, traditionell Apuleius zugeschriebenen Schrift Peri hermeneias belegt.16 Der lateinisch verfasste Text ist ein Kommentar zu einem im Mittelalter und in der frühen Neuzeit viel gelesenen und ausgiebig kommentierten naturphilosophischen Traktat des Aristoteles, der traditionell unter dem lateinischen Titel De generatione et corruptione gehandelt wurde. Generatio und corruptio, ‚Zeugung‘ und ‚Zerfall‘, lauten aber auch die beiden Begriffe, mit denen ich intuitiv die beiden unteren Quadranten bezeichnet hatte.


Bildgestütztes Denken

Ein erster Hinweis darauf, dass der Maler eine der beiden Basler Ausgaben von Reischs Margarita philosophica benutzt hat, ist die Randillustration zum

Ein weiterer Hinweis darauf, dass der Maler die *Margarita philosophica* in einer der erwähnten Basler Ausgaben konsultiert hat, ist der Holzschnitt zum Kapitel 9.17, das unter dem Titel *De terrae motu* dem Phänomen des Erdbebens gewidmet ist. Er zeigt die vom Erdbeben erschütterte Stadt, genauso wie das Pariser Gemälde, in die Diagonale gekippt und mit einer Turm spitze, die gerade abbricht (Abb. 5 und Abb. 11).

Der Verweis auf die aristotelische Naturphilosophie in der Vermittlung durch die *Margarita philosophica* darf freilich in seiner Bedeutung nicht überschätzt werden. Der Text ist zuerst einmal weder die ‚Quelle‘ des Bildes noch dessen ‚Erklärung‘. Die Entdeckung zeigt jedoch, dass sich der Maler mit der


Das Pariser Gemälde mit der Geschichte von Lot und seinen Töchtern ist kein Diagramm im engeren Sinne, aber es besitzt eine prägnante komposi-
torische Struktur, sodass die dargestellte Szene, der simulierte Weltanschauung, wie von einem Diagramm unterfüttert erscheint. Der Maler hat die einzelnen Szenen und Gegenstände so auf der Bildfläche verteilt, dass sie bei einer konzeptionellen Lektüre Begriffe repräsentieren, die sich entlang der topologischen Kategorien links/rechts und oben/unten zu inhaltlichen Gegensatzpaaren ordnen.


Anmerkungen


5 Artaud, *Œuvres* (wie Anm. 4), 44: „Je dis en tout cas que cette peinture est ce que le théâtre devrait être, s’il savait parler le langage qui lui appartient.“

6 Siehe jedoch Frederik Stjernfelt, *Diagrammatology: an investigation on the borderlines of phenomenology, ontology, and semiotics* (Göttingen: Springer, 2007), 278: „... all pictures, also in the ordinary art-history-meaning of the word, are also diagrams – primarily maps in the general meaning of the term suggested.“ Überhaupt trifft sich die nachfolgende Untersuchung in vielen entscheidenden Punkten mit den Thesen und methodologischen Grundannahmen zum Verhältnis von (Kunst-)bild und Diagramm, wie Stjernfelt sie ausgebild von Charles Sanders Peirce’ Diagrammtheorie formuliert hat. Stjernfelts Kapitel 13, 275–288, ist einer Untersuchung eines figürlichen und eines abstrakten Gemäldes als Diagramme gewidmet.

7 Bätschmann (wie Anm. 1), 159, spricht von „Doppelwertigkeit von Flächen- und Raumteilung“, doch berücksichtigt er in seiner Analyse nur die diagonale Teilung der Bildfläche.

Nach Bätschmann (wie Anm. 1), 179, hat der Komet eine doppelte Valenz: „Im Bild wird die Frage nach der Wahrheit der Rettung entwickelt [...] durch den Kometen, der für die Katastrophe Zeichen des vergangenen, für Lot des künftigen Unheils ist.“

Vgl. Stjernfelt (wie Anm. 6), 279: „Thus analysis of art [...] involves a crucial abductive component.“

Vgl. Bätschmann (wie Anm. 1), 168 f.: „Die Aufstellung der Zelte wie die Verteilung der Weinkrüge wandeln die Disposition der Figuren ab. Die beiden eng beieinander stehenden Weinkrüge wiederholen das Paar und partizipieren an der zärtlichen Zuneigung und zugleich am Ausschluß der zweiten Tochter, ihres Weinkruges und des ihr zugeordneten alleinstehenden Zeltes.“

Auch Frederik Stjernfelt betont diesen Aspekt. Siehe Stjernfelt (wie Anm. 6), 279: „I may construct a space, in which I can imagine my body moving around; this very wandering route inside the landscape has the characteristics of a diagram manipulation.“


Bereits Bätschmann (wie Anm. 1), 170, hat auf diesen prospektiven Aspekt mit Bezug auf die Metaphern, die die sexuelle Vereinigung andeuten, hingewiesen: „Die Metaphorik, die im Fall der Darstellung der Szene des Inzests darauf sich entwickelt, gibt der bildlichen Darstellung die Möglichkeit, in der Erzählung über das unmittelbar Gezeigte hinaus fortzuführen und zugleich auch den Fortgang der Geschichte zu enthüllen.“


Bätschmann (wie Anm. 1), 173, sieht seinerseits im „aufsteigenden Baum“ ein „aktives Gegenbild zum Fall des Feuers“.


Siehe Wolf Peter Klein, *Die Geschichte der meteorologischen Kommunikation in Deutschland: eine historische Fallstudie zur Entwicklung der Wissenschaftssprachen* (Hildesheim: Georg Olms, 1999), 74.
That Ludwig Wittgenstein was interested in maps and map-making comes as no surprise. After all, he compares the form of a philosophical question to our common experience of disorientation—‘I don’t know my way about.’ (PI § 123)—and likens his *Philosophical Investigations* (PI) to an album containing sketches of a landscape which has been explored in a criss-cross manner. In this paper I present metaphors of perfect maps provided by Jorge Luis Borges, Lewis Carroll and Josiah Royce, and set these against remarks by Wittgenstein and Charles Sanders Peirce.

Even this—slightly expanded—version of the talk I gave at the 33rd International Wittgenstein Symposium is, however, far from a survey of literary maps and their inspirational potential for philosophy. I would simply like to offer a series of glimpses at literary maps that might enrich a larger picture.

The larger picture consists in the view that the young Wittgenstein subscribed to a picture-theory of truth, a correspondence theory that understands correspondence between the structure of truth-bearers and states of affairs as congruence. While this is uncontroversial, I would here like to add illustrations that make it plausible that Wittgenstein had no reason to abandon his picture-theory, rather, that his thinking about maps—if understood as an expression of this theoretical position—, particularly in the writings from 1930 to the gestation of the *Brown* and *Blue Books*, may have evolved from this early Tractarian notion.

If one looks at the most pertinent metaphor for the picture-theory, the mirroring or picturing of formal relations in the way markings on a map mirror the structure of that portion of the world of which it is a map, it is helpful to consider extreme examples of maps. Unsurveyable maps as thought...
experiments by writers and philosophers show us why surveyability is such a key quality of a map.

While part one of this paper revolves around an essentialistic picture theory that supposes that there is but one ideal language mapping the sayable, and one ideal of exactness, part two of the paper explores the idea that various maps with various practical purposes make the existence of the one all-encompassing language obsolete.

Seeing connections

In his collection of fake historical fragments entitled Museum [1946] the Argentinean writer Jorge Luis Borges provides us with a description of ‘perfect’ map-making. His short text, titled ‘On Scientific Rigor (Del rigor en la ciencia)’ is an imaginary example of scientific self-destruction. Apparently taken from a 17th century history book, the story tells of a nameless Empire in which Schools of Cartography are held captive by their picture of exactitude:

… In the Empire in question, the Cartographer’s Art reached such a degree of Perfection that the map of a single Province took up an entire City, and the map of the Empire covered an entire Province. After a while these Outsized Maps were no longer sufficient, and the Schools of Cartography created a Map of the Empire that was the size of the Empire, matching it point by point. Later Generations, which were less Devoted to the Study of Cartography, found this Map Irrelevant, and with it more than a little Irreverence left it exposed to the Inclemencies of the Sun and Winter. In the Western desert there are still Ruins of the Map, inhabited by Animals and Beggars. No other relics of the Geographic Discipline can be found anywhere else in the Land.²

The core idea of this story may have sprung from an earlier work, one by Lewis Carroll. The novel in which we find it, Lewis Carroll’s Sylvie and Bruno Concluded [1893], was well-known to Borges³ and admired by such diverse writers as James Joyce and Ludwig Wittgenstein⁴. As in the version of Borges, we are presented with a map too big for its own good:

“What a useful thing a pocket-map is!” I remarked.

“That’s another thing we’ve learned from your Nation,” said Mein Herr,
“map-making. But we’ve carried it much further than you. What do you consider the largest map that would be really useful?”

“About six inches to the mile.”

“Oh, only six inches!” exclaimed Mein Herr. “We very soon got to six yards to the mile. Then we tried a hundred yards to the mile. And then came the grandest idea of all! We actually made a map of the country, on the scale of a mile to the mile!”

“Have you used it much?” I enquired.

“It has never been spread out, yet,” said Mein Herr: “the farmers objected: they said it would cover the whole country, and shut out the sunlight! So we now use the country itself, as its own map, and I assure you it does nearly as well. […]”

Using a country as its own map is comparable to Jonathan Swift’s Lagadonian language. Wittgenstein knew Gulliver’s Travels [1726] well, in fact, he even read an abridged version of it with his pupils at the primary school in Trattenbach. In chapter five Samuel Gulliver visits the Grand Academy of Lagado on the island of Balsebarbi, where he learns about the scientific endeavours to create a perfect language:

We next went to the school of languages, where three professors sat in consultation upon improving that of their own country.

The first project was to shorten discourse, by cutting polysyllables into one, and leaving out verbs and participles; because in reality all things imaginable are but nouns.

The other project was a scheme for entirely abolishing all words whatsoever; and this was urged as a great advantage in point of health as well as brevity. For it is plain that every word we speak is, in some degree, a diminution of our lungs by corrosion, and consequently contributes to the shortening of our lives. An expedient was therefore offered, and since words are only names for things, it would be more convenient for all men to carry about them such things as were necessary to express a particular business they are to discourse on. […] [M]any of the most learned and wise adhere to the new scheme of expressing themselves by things; which has only this inconvenience attending it, that if a man’s business be very great, and of various kinds, he must be obliged, in proportion, to carry a greater bundle of things upon his back, unless he can afford one or two strong servants to attend him. I have often beheld two of these sages almost sinking under the weight of their packs, like peddlers among us;
who, when they met in the street, would lay down their loads, open their sacks, and hold conversation for an hour together; then put up their implements, help each other to resume their burdens, and take their leave.7

In PI § 6 Wittgenstein reminds us that ostensive teaching of words may establish ‘an associative connection between word and thing’, which means, amongst other things, that ‘a picture of the object comes before the child’s mind when it hears the word’ (PI § 6). This is quite desirable, for example when we read poetry or novels, but it also has its disadvantages: We tend to take our pictorial associations for granted and forget that what words mean is not simply given. Using words across a variety of contexts, we tend to forget the language-game which caused us to associate a certain picture in the first place, ‘the language in which it is at home’ (PI § 116).

The more obvious problem illustrated by the Lagadonian language, however, is the fact that Lagadonian does not offer a solution to misunderstandings, to erroneous interpretations. While we can speak in English about an English sentence, Lagadonians only have rebus puzzles. For how would a Lagadonian in his ‘perfect’ language communicate that the red square he is showing to someone is only meant to convey the colour red, but not its rectangular shape? By pointing to it?

Just as maps do not simply show us isolated markings but provide markings in relation to each other, the picture-theory is not so much concerned with singular words and the objects they pick out, but with structural complexes: sentences. To see structures means that one has selected certain relations above others. And this is why unsurveyable maps like the ones by Borges and Carroll fail: They show too much. They are the endpoints of cartography, where abundance of detail has won over clarity of communication.

Before I move on, let me summarise. Swift’s Lagadonian language shares one important feature with Borges’ and Carroll’s maps: it is highly impractical. While the giant maps block out the sun and at best serve as shelter for the poor, they have stopped being maps, since the purpose of a map is to give instructions we can follow, that we may transfer its picture into our actions:

Die Verwendung einer Landkarte besteht darin, daß wir uns in irgendeiner Weise nach ihr richten; daß wir ihr Bild in unsere Handlungen übertragen. (Wittgenstein, MS 114, p. 51)
Faced with these gigantic maps, the problem one encounters is the very reason maps were invented in the first place. For maps are drawn to provide us with orientation in a country ‘deficient in surveyability. A surveyable representation produces precisely that understanding which consists in “seeing connections”’ (PI § 122) and dissolves the feeling of not knowing one’s way about:

Es ist, wie wenn ich ein winziges Gesichtsfeld und ein schlechtes Gedächtnis hätte, und nun, durch hin und her blicken, mich auf einer großen Landkarte auszukennen lernen sollte. Man würde in so einem Falle fortwährend Zusammenhänge vergessen, verkennen, sie langwierig suchen, wo sie nicht sind. (Wittgenstein, MS 117, p. 220)

Seeing differences

Our third map is by Josiah Royce, who invented it for a supplementary essay of his opus magnum *The World and the Individual* [1899]. To Borges this ‘philosophical’ map is clearly on a par with the best of literary inventions. Bertrand Russell discusses it in chapter 8 (‘Infinite Cardinal Numbers’) of his *Introduction to Mathematical Philosophy* [1919].—I quote Russell:

A “reflexive” class is one which is similar to a proper part of itself. (A “proper part” is a part short of the whole.)

A “reflexive” cardinal number is the cardinal number of a reflexive class.

We have now to consider this property of reflexiveness.

One of the most striking instances of a “reflection” is Royce’s illustration of the map: he imagines it decided to make a map of England upon a part of the surface of England. A map, if it is accurate, has a perfect one-one correspondence with its original; thus our map, which is part, is in one-one relation with the whole, and must contain the same number of points as the whole, which must therefore be a reflexive number. Royce is interested in the fact that the map, if it is correct, must contain a map of the map, which must in turn contain a map of the map of the map, and so on *ad infinitum*.10

One interesting aspect of Royce’s map is the feeling of dizziness that grabs hold of the reader, as he tries to reconstruct the map-within-the-map in his mind. A disorientation of another kind.
Ever since Carl Friedrich Gauss wrote his treatise ‘Allgemeine Auflösung der Aufgabe: Die Theile einer gegebenen Fläche auf einer andern gegebenen Fläche so abzubilden, dass die Abbildung dem Abgebildeten in den kleinsten Theilen ähnlich wird’ [1825], the terms prototype (Urbild) and projected pictorial form (Abbild) have been at home in the world of map-making. One important aspect of geodesic projection is the fact that prototype and depiction are never identical, they only come to be very much alike. In the case of a strong likeness—preserving both angles and shapes of infinitesimally small figures—one speaks of a conformal projection. A ‘conformal’ map simply conforms to the principle of angle-preservation.11

Few, if any, philosophers know more about maps than the geodesist and mathematician Charles Sanders Peirce. It is in his review of The World and the Individual that Peirce writes about Royce’s perfect map and finds in it a confirmation of his own ideas concerning the self. Even though Royce states Georg Cantor’s serial one-to-one mapping of odd-numbers onto integers as his source of inspiration, Peirce immediately thinks of Gaussian conformal projection:

[Royce] resorts to Gauss’s conception of Abbild, which has played a great role in mathematics. That is to say, he likens the idea representing the entire life to a map of a country lying upon the territory of that country. Imagine a map of England, absolutely perfect in its minutest details, to lie upon the soil of England, without covering the entire country it maps. Upon this map would be shown the very ground where the map lies, and the map itself, in all its minutest details. In this map of the map, the map will be shown again; and so on endlessly. […] It is to be noticed that, each successive map lying well inside the one which it immediately represents […] the endless series of maps will converge to a single point, which represents itself throughout each and every map of the series. In the case of the idea, that point would be the self-consciousness of the idea. An idea, being a state of mind with a conscious purpose, must evidently be self-conscious.12

Peirce considers the map-within-the-map an apt metaphor for a self-representative system. He even goes one step further than Royce: Peirce insists that self-reference—in the map-metaphor that single point, where all maps of differing sizes converge—is essential to the continuum that gives us the feeling of remaining the same person over time:
the man’s Self encloses intermediate selves—the domestic Self, the business
Self, the better Self, the evil spirit that sometimes usurps his sovereignty. […]
Every reality, then, is a Self, and the selves are intimately connected, as if they
formed a continuum. Each one is, so to say, a delineation; with mathematical
truth we may say, incongruous though the metaphor is, that each is a quasi-map
of the entire field of all the selves […]\textsuperscript{13}

Speculations like these are not Russell’s cup of tea. Regarding Royce’s
infinite maps-within-maps he simply says: ‘This point is interesting, but need
not occupy us at this moment. In fact, we shall do well to pass from pictur-
esque illustrations to such as are more completely definite, and for this purpose
cannot do better than consider the number-series itself.’\textsuperscript{14}

Wittgenstein, who loved to dwell on picturesque illustrations, may have
thought otherwise. He was well aware of the fact that in a contextual sense
every useful map is a map-within-a-map. For what use would a map of
Oxfordshire be to someone lost in Lower Austria? Just as the meaning of
words relies on their context, a map only makes sense where (and for what
purpose) we need it.

Even though the series of maps in Royce’s thought experiment converge
to a single point, each successive map depicts one specific aspect of the
country, has its particular use. The information given on political maps,
climate maps, road maps, underground maps, topographic maps and so on
may converge at particular points, but as each map tells a different story,
none of the maps will give all the information. The specific requirements for
these maps inform the picture language (\textit{Bildsprache}) the map-maker chooses.
From the perspective of its user one could say that the one single perfect
map does not exist, because each map is judged according to the require-
ments it meets.\textsuperscript{15}

Using a map means following its rules, thus we may copy a map of trails
by walking according to the information it gives (cf. MS 153b, 8v). This has
important implications if one contemplates how a model of language may
resemble a map. Language as a projection of reality, mirroring how the map
shows relations of the landscape it depicts (cf. WA2: 184 1). But instead
of solving linguistic problems of meaning, this metaphor only makes them
more apparent. To really understand the map, to be able to read it and
connect it to the landscape, requires that one does not overlook the
differences amongst its markings:
Seeing various lines on a map, without knowing what they stand for, may result in taking their linearity as the most important feature certainly one way of being held captive by a picture.

In 1930 Wittgenstein points out that certain features of commands and expectations can be made clear by reference to maps. Following an order (Befehl), we follow certain rules and the map becomes the picture we interpret: ‘Die Landkarte ist das Bild[,] das interpretiert wird.’ (WA2: 295 3) Here the map may still be a metaphor for language—but it does not simply show its relation, it requires an active interpretation. To understand the map is not the same as looking at it like an uninvolved spectator. We have to put ourselves—see our position—in relation to the markings on the map.16

But then, in close vicinity, Wittgenstein gives another example: Distances depicted on a map tend to ground the expectation for our arrival at a certain point in time: ‘[…] die Landkarte ist das Bild unserer Erwartung[,] indem sie zeigt[,] daß wir in einer Stunde dort und dort hin kommen.’ (23. 7. 1930, WA2: 295 3) Here the map is the cause of our expectations, its relations make us expect something—like a command may make us act in a certain way. One fact remains the same, however: In order to serve as an image of our expectations, we must be in a position to read the markings on the map, to interpret the distances and make sense of it all.

In the lecture notes taken in 1933 by his students Alice Ambrose and Margaret Macdonald known as The Yellow Book, Ludwig Wittgenstein compares language to a country and map-making becomes the task of the philosopher. The method he suggests is akin to getting to know a country by repeated walks. The work of the philosopher of language is a survey culminating in a synoptic view:

One difficulty with philosophy is that we lack a synoptic view. We encounter the kind of difficulty we should have with the geography of a country for which we
had no map, or else a map of isolated bits. The country we are talking about is language, and the geography its grammar. We can walk about the country quite well, but when forced to make a map, we go wrong. A map will show different roads through the same country, any one of which we can take, though not two, just as in philosophy we must take up problems one by one though in fact each problem leads to a multitude of others. We must wait until we come round to the starting point before we can proceed to another section, that is, before we can either treat of the problem we first attacked or proceed to another. In philosophy matters are not simple enough for us to say “Let’s get a rough idea”, for we do not know the country except by knowing the connections between the roads. So I suggest repetition as a means of surveying the connections. (YB 2001, 43)

While Wittgenstein is at that time still unhappy about knowing only ‘isolated bits’ and a synoptic view figures as the ideal he strives for, it seems that providing sketches of a landscape is what he resigned himself to in the end.17

**Conclusion**

The above was meant to show that apparently useless maps may be useful after all. If only as inspirational material for philosophers. For Wittgenstein might just as well have heeded Descartes’ advice that the best way out of a thicket is to continue in the direction once chosen.18 Had Wittgenstein walked in a straight line rather than repeatedly taking detours, we would be one work of philosophy poorer, for it is his criss-cross manner of mapping thought that makes the landscape of his *Philosophical Investigations* so intriguing.
Notes

1. Ludwig Wittgenstein, *Philosophical Investigations*, the German text, with an English translation by G. E. M. Anscombe, P. M. S. Hacker and Joachim Schulte, revised fourth edition by P. M. S. Hacker and Joachim Schulte (New York: Wiley, 2009).— All references are made to the respective paragraphs using the siglum IP. Other reference keys to Wittgenstein’s writings are indicated in the bibliography.


15 A related point is made by Hana Gründler in her perceptive paper “‘Eine Menge von Landschaftsskizzen.” Zur Bedeutung des Zeichnerischen in Ludwig Wittgensteins Spätphilosophie’ in volume one of *Image and Imaging in Philosophy, Science and the Arts*, Proceedings of the 33rd International Ludwig Wittgenstein Symposium, edited by Richard Heinrich, Elisabeth Nemeth, Wolfram Pichler and David Wagner (Heusenstamm bei Frankfurt: ontos Verlag, 2011), 1–22.—Gründler points out that it is less easy to discern the borders of an object in line drawing, once singular clear contours have been replaced by the multiplicity of lines that constitute a sketch. The apparent loss of clarity comes, however, hand in hand with a more natural depiction of the object—one gains the impression of volume. Artists and philosophers both generate perspectives on their object of interest without claiming that any of their respective views is the only viable one.

16 Cf. this example from February 1931 (MS 110): ‘Ich erkläre jemanden einen Plan und wie er zu gehen hat und sage, auf eine Stelle des Planes zeigend: “Hier stehen wir; du gehst ….” Nun sieht er die Karte anders. Verstehen ist nicht: ein Bild sehen, sondern, ein Bild in einer bestimmten Position.’ (WA3: 197 10f.)

17 Hana Gründler suggests that Wittgenstein intentionally chose the form of sketching his thoughts rather than presenting them in a more worked-out and orderly fashion, because he imagined his ideal reader to be someone who prefers thought-provoking impulses to philosophical treatises. Cf. Gründler ‘Landschaftsskizzen’ (as in note 15), 11.


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