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Chapter · January 2011

DOI: 10.1007/978-94-007-0143-4_6

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Principles and Practices of Neurath's Picture Language

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Otto Neurath (1882–1945) might never have been the pet philosopher of the logical empiricists' influential movement. For instance, he appears never to have assumed any distinctively genial and agreeable position in the mainstreams of the movement.[1] His clash with Rudolf Carnap is especially poignant.[2] Concerning the publication of the Encyclopedia series that was to promote the Unity of Science movement, Neurath feared that Carnap was not "only irritated by [his] formulations", but that between them "there are much more deeper [sic] differences".[3] In his 1944 letter to Charles Morris, Neurath identifies these differences in his attempt, already there in the *Antispengler*,[4] to present empiristically his Protokollsätze, which are "statements about statements". His attempts to convince Carnap or the mathematician Hans Hahn on the value and worthiness of his ideas were nevertheless frustrated, Neurath recalls, because "in the Wittgenstein period the statements of statements seemed to be taboo". Neurath recollects the Wiener Kreis readings of Wittgenstein, in which he frequently remarked how metaphysical some statements were, only to be advised by Hahn that Neurath should make a comment only when he "is satisfied by saying 'NM' ['No Metaphysics']".

The subsequent emergence of Tarski semantics was "praised" by Neurath, as it indeed was by Carnap and Karl Menger. Neurath applauded its meta-level way of arguing but did not accept the "comparison of thing and statement". Because by the mid-1930s Carnap had accepted Tarski's point of view pretty much wholesale, which Neurath thought then implied a commitment to obsolete

Aristotelian metaphysics, "certain differences" between him and Carnap were unavoidable.

I suggest that the "certain differences" leading to a conflict between Neurath and Carnap can be explained, at least partly, in terms of the van Heijernoort–Hintikka dichotomy of language as calculus vs. language as the universal media.[5] Neurath promoted meta-theoretical systematisations early on, while for Carnap, the adoption of that point of view required a long incubation period.[6] I shall argue, furthermore, that Neurath's calculistic position shows up in his attempts to establish a standard for a pictorial language of communication, the Isotype system.[7]

The Neurath–Carnap controversy is instructive also in the sense that Tarski's curious and somewhat fluctuating occupation of the middle ground between the universalists and the calculists can now be better identified: he accepted meta-level languages in order to be able to discuss the fundamental properties of object languages while at the same time being committed to what according to Neurath is bound to be "unfashionable" metaphysics.[8]

This clash between two absolute presuppositions seems to have played a part in Carnap's reluctance to give a final go ahead to the publication of Neurath's monograph *Foundations of the Social Sciences* in the *International Encyclopedia of Unified Science* series (Neurath 1944). Carnap, who was the editor of the series together with Neurath and Charles Morris, found the final proofs that he received to be "in a rather unsatisfactory state" both from the "linguistic-stylistic" and the "representation of the whole" points of view.[9] He moreover held the central tenets of the *Foundations* to have been "formulated in a very hasty and careless way".[10] Terminology had been left unexplained, including the key term of 'Terminological Empiricism'. "Not even I have been able to find out what is meant by it," Carnap avers, and continues: "Some sentences are incomprehensible to me, and how many more will be so for the average reader. … The monograph seems to me to be below the level which so far we have succeeded in maintaining the Encyclopedia, and the weakest thing N[eurath] has

ever written." Carnap presumes that "Neurath the Volcanic[’s] … violent emotional reactions" and "obstinacy and unwillingness to accept suggestions for improvements from anybody" might have restrained Morris from communicating to Neurath his possibly likeminded reactions. Neurath had sent the final version of the manuscript to Morris for printing in the Encyclopedia on 11 September 1943.

The more mundane explanations, including that Neurath’s manuscript was indeed written in a hurry for fear of the publisher’s discontinuation of the entire series, do explain some of Carnap’s unsavoury reactions. The lack of that painstaking rigour emblematic to any material that was hoped to receive Carnap’s undisputed approval certainly had a part to play.[11] Yet Carnap nowhere states that he would fundamentally disagree with Neurath’s philosophical point of view. Nothing directly suggests that the opposing philosophical presuppositions were decisive in Carnap’s disapproving assessment of Neurath’s work.

Neurath’s *Foundations* appeared in the Encyclopedia without Carnap’s editorial consent. Neurath was disappointed in both "Carnap’s making a declaration" which "many people will regard as an insult" as well as in Morris’s "not induc[ing] him to drop his decision, which in no case supports the movement".[12] However, Neurath reveals here how he, in turn, "very often could hardly agree with papers [Carnap] accepted without protest". This is an apt recognition of the philosophical differences the two men had. That Neurath and Carnap had very different editorial approaches is just grist to the mill: Neurath explains having assumed no editorial responsibility for the content of the material published in the series, while Carnap was much more sensitive to such matters. Interestingly enough, it is here that Neurath attempts to identify the deep differences between him and Carnap over the directions into which the research on protocol statements was heading, in terms of Carnap’s reluctance to accept the meta-systematic role of language in science.[13]

* * *

In any event, Neurath had a vision. The value of his most lasting contribution has been redeemed only very recently. That vision was an establishment of a standard for a pictorial method of communication, known as the Isotype (International System Of Typographic Picture Education). In Neurath's own words in his 1936 book *International Picture Language*, Isotype was a picture language for "an education in clear thought – by reason of its limits".[14]

Originally a Viennese invention, Isotype was calculated to be the educational medium targeting *hoi polloi* on economic and social issues facing the interwar nation. There were as many as 25 people working on it in Vienna (Twyman 1975). During the war, Neurath re-established Isotype as a British institute. Many charts were produced in books of science as well as in some books of fiction. Most of them were published in the late 1940s soon after Otto's death, with the aid of his wife Marie Neurath. Marie Neurath continued working on Isotype, and published close to a hundred articles, books and pamphlets illustrated by the Isotype system between the late 1940s and early 1970s.[15]

Most of the research on Isotype has focussed on the issues from the point of view of design sciences, such as graphic design, picture design and typography (Hartmann et al. 2006, Lupton 1986, Neurath & Kinross 2008). In addition, Neurath worked on and promoted a development of an international language of urban planning and design (Vossoughian 2008). The connections between the socio-economic data that supplied the Isotype charts and Neurath's overall political views have also been discussed to a considerable extent. Nevertheless, the purpose of the Isotype system was to establish and promote some much more general and deeper perspectives in the philosophy of language and the philosophy of education than these practice-oriented endeavours would have us believe. Isotype has some wider and lasting significance that has not sufficiently been acknowledged before.

I choose to highlight here six items illustrating Neurath's vision, adjoined with brief comments:[16]

1. "To make a picture is a more responsible work than to make a statement, because pictures make a greater effect and have a longer existence" (p. 15).

   We can interpret this statement in the following way. Designing, drawing or drafting a picture is an assertion in a similar sense as putting forth a statement in a written or spoken language is. Asserting something is to assume responsibility for what is being asserted. Assertions are made by someone, and they are about something: they may be true or false. Likewise, pictures and other visual representations are assertions and can well have truth-values. What is more, however, is that pictures possess special *iconic* qualities that linguistic assertions by and large lack, which shows up in the "greater effect" of the former by virtue of them being closely related to our actual cognitive structures and processes of thinking and reasoning. Such close relations with cognition are exemplified by the information contained in the Isotypes that according to Neurath has "a longer existence" in the human or societal memory than what can happen with linguistic assertions.

2. "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 very different ways. The units of the picture language have different senses when they are in different positions" (p. 18).

   Neurath accentuates the important fact that his picture language is not a translation of some well-formed fragments of spoken or written languages. On the other hand, pictorial assertions may be verbalised in many different, non-equivalent ways. Unlike with most words and in most natural languages, the meanings of

the iconic image-like constituents of a picture can change when they are moved across to different locations within the picture as their contexts will change accordingly.[17]

The broader point that statements such as (2) imply is that the specific kinds of pictures Neurath was striving at do have a clear, defined meaning. They are assertoric and have propositional content. They achieve what they do not simply because they are visual and hence 'catch the eye', but because of the specific iconic modalities that are more directly linked with cognition than the conventional symbols of natural language are. Language pictures are "living signs" (Neurath, 1936), which is a phrase interestingly reminiscent of what Charles Peirce had asserted iconic signs to be in his theory of semiotics.[18]

3. "It is not possible to give a word for every part of such picture or a statement for every group of parts. The parallel in a normal language of a complete 'language picture' is a complex group of statements; and an account in words of what is in a group of language pictures would make a book. The sense of every part of these pictures is dependent on the sense of the complete picture and on its relation to the other parts of the picture" (p. 20).

In contemporary terms, Neurath is stating here that pictures are not compositional.[19] We do not derive the meaning of the picture by contemplating first the meanings or senses of its constituents and then assembling these constituent meanings together according to some appropriate functional method, in view of thus arriving at a comprehensive grasp of the meaning of the whole. The meanings or senses of the parts of the picture hinge on to the whole so much so that the translation of these constituents to any counterpart assertions given in the symbolic form of natural language is liable to fail.[20]

4. “But the uses of a picture language are much more limited than those of normal languages. It has no qualities for the purpose of exchanging views, of giving signs of feeling, orders etc. It is not in competition with the normal languages; it is a help inside its narrow limits” (p. 20).

   Neurath is making a valid point that a picture language is not a substitute for a spoken or written language. Pictorial expressions are not used and applied in the same way or in the same circumstances as natural languages are used and applied. Rather, Isotype pictures are complementary to natural languages. They do not supplant what can be stated with natural language. Neurath acknowledges in addition that picture languages will not be well geared for reciprocal communication in actual communicative situations, nor do they facilitate assertions of non-declarative statements.[21]

5. “The effect of pictures is frequently greater than the effect of words, specially [sic] at the first stage of getting new knowledge. The number of pictures which come before everybody’s eyes in newspapers, in motion pictures, in the street advertisements, is getting greater and greater, and today it is most necessary for the schools to take note of this fact, if the effect of the streets is not to be greater than that of the school” (p. 20–22).

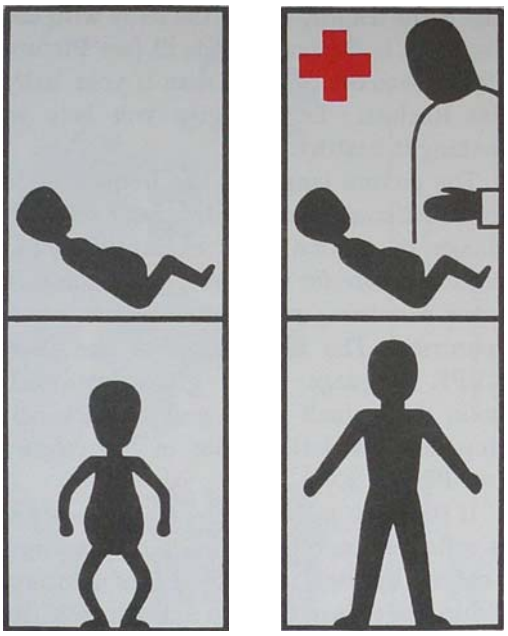
   This is a most acute observation on the sustaining effects of information and data visualisation and its educational value. Neurath emphasised the value of pictures purged of any unnecessary detail when displayed within the public sphere. The increasing information flood was evident in his time just as it has been in our ongoing digital IT era. Contained in Neurath’s remarks is also the idea that the economy of expression is much greater with thoughtfully crafted pictures than what can be accomplished with the limited linear structures of symbolic languages. Cognitive economy is a common quality of any

iconic representation, of which Isotype pictures are to be seen as a subspecies. Moreover, picture languages have educational value in raising general awareness and in portraying introductory material to the masses. However, we must learn to read and use such pictures correctly to avoid social chaos. It is apparent that any schooling must take a note of this fact today just as they needed to do so in Neurath's time. Yet he did not envision picture languages in order to attract the widest possible audiences or to enable adjustment of teaching or curricula according to the weakest of learners. Pictures are not rivals to, but harmonious and complementary with texts, lectures, and the rest of the entire spectre of pedagogy.[22]

6. "Every process, however simple, has to be in harmony with the rules of logic and mathematics. No process, however clear-cut, and however well based on science and delicate thought, will have any value for science or for education if it is not in harmony with the rules of this poor logic and mathematics. … It has never come to our knowledge that experts in mathematics or logic have come across such errors in the ISOTYPE. This system does not take for its field the more complex part of science; its field is only the teaching of the very first stage" (p. 103–104).

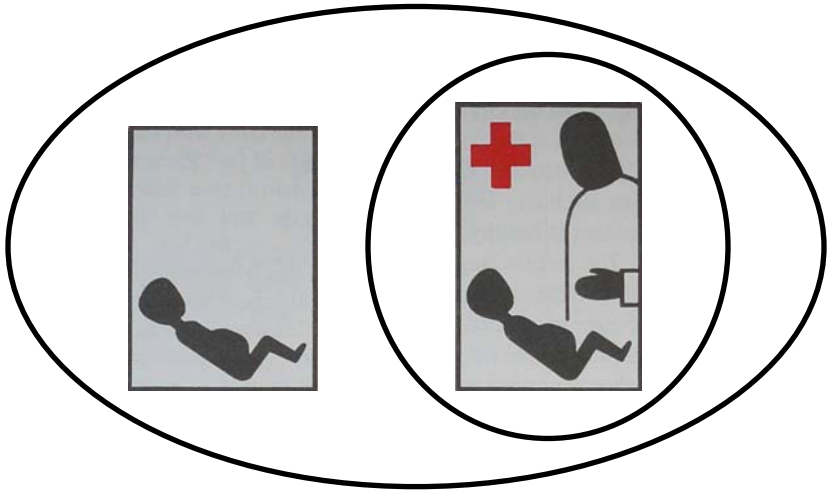
   The final remark extracted from Neurath's *International Picture Language* is at the same time the most enigmatic and visionary. For Neurath, all real thought processes and reasonings are rational activities not in conflict with the rules of logic or the rules of mathematics. But he does not make clear what the rules are that he intends here. Nevertheless, we may conjecture that Isotype, in its fully developed form, would not only be a carefully crafted pictorial language of some graphical information or representation of useful facts but also an elementary *logic*. But how could that be accomplished? Unlike Peirce before him, Neurath and his followers did not attempt

merely to build a pictorial logic. However, we would be well advised to look further and add some logical characteristics to the Isotype system. Taking cues from Peirce's iconic and diagrammatic logic is helpful towards this goal. Just to give a simple example how that can be done, let us remark that Neurath wanted to express with Isotype pictures complex assertions. But we can observe that they will contain some basic logical information such as connectives. For example, Neurath grafted a picture for the assertion "Go to the medical man, if your baby has Rachitis" (Neurath 1936, p. 55) as follows:[23]



The sentence contains an indicative conditional. But apart from the left to right ordering of images, the picture does not contain anything corresponding to the conditional. In Peirce's diagrammatic logic (Peirce 1931–58, 4.400, 1903),[24] however, the conditional is represented with a nested structure in which the antecedent lies within the outer nest and the consequent within the inner nest. He thought that such iconic forms are directly apprehended in cognition, and even without prior knowledge of how the system as a whole is supposed to work, because such icons are capable of showing their own meaning.

Now it is perhaps more commonplace to use an arrow as a symbol for the conditional, but let us assume that such a convention has not been established in the community of picture users. Then the iconically communicated information concerning the nested structure of images is how the untrained eye is able to get the meaning even when the conventional meaning is yet to be established. The picture with the added logical structure of connectives may be drawn thus:



We read this picture as if we were now to assert the following indicative conditional: ‘If you have entered the area of situation depicted by the pictures in the outer nest, then you are capable of entering the area of situation depicted in the inner nest enclosed within the outer.’ It naturally remains to be seen what the logic of pictures that is emerging here would look like in the end, including the semantics and the inferential relationships that are needed to describe various kinds of situations and to perform reasoning upon picture-like assertions.[25]

Be this as it may, what is evident is that for the overall idea of Isotype to be viable the presupposition of language as calculus has to be assumed. A picture language is a language among many. It is not a universal medium of expression, since to understand it

other methods and languages must be augmented into its expressions. We are not ‘prisoners of our pictures’: we can discuss their meanings using other means than those provided by the picture language in question. Pictures are closely related to the processes of human thinking and reasoning and not to the structures of the world our concepts talk about. The holistic and non-compositional nature of pictures means that there is little hope of formulating semantics in an inductive fashion. Assuming that comparable impossibility results arise in the logic of pictures as in symbolic logic, such semantics is effable though it cannot be defined in the same language of pictures.

Moreover, we should note that the meanings of pictures are reinterpretable. For instance, by varying the locations of some of its subcomponents, the meaning of the picture as a whole can change. Since pictures – qua icons – so to speak show their own meaning, syntax is secondary to the semantic and pragmatic concerns of pictorial meaning. But iconic meaning is possible only because icons are closely linked with contextual and collateral information in the communities of interpreters. Because such information and observation of how it is used is required for the interpretation of pictures, semantics and pragmatics are not separable components of picture-like languages such as the Isotype.[26]

* * *

Otto Neurath has a good claim to having been a pioneer in information visualisation. Image-like iconic representations allied to his Isotype conceptualisations are today in global use throughout the public sphere as well as on the Internet. Computer technology has greatly expanded the development of such representations, originally static pictures, towards picture languages that enable movement and animation with notably amplified educational value. Nyíri (2003) has gone as far as to claim that, with Neurath’s vision of an international standard for information visualisation, a new

‘unity of science’ lurks around the corner after all. There is a certain respect in which this bold claim is nevertheless to be taken quite seriously, however, as how the mechanisms of pictures work is quite different from the logical empiricists’ – first and foremost Carnap’s – largely failed attempts to create a unifying language of science. Thus an appropriate and expressive enough picture language might accomplish in the philosophy of science more than Carnap, but also bring about new modes of thinking and meaning that excel the mere educational and pedagogical merits of the particular system of Isotype emphasised by Otto and Marie Neurath.

Information visualisation of the broadly same kind that was envisioned by the Neuraths will play an ever-more important role in areas from public education to the software development for a broad spectrum of web-based statistics and presentations. But this role will be more than just raising general awareness on emerging global issues. Information visualisation is likely to change the very fundamentals of how human beings can think and communicate. Inventions of new communication methods have done precisely that from the time immemorial. A new ‘major transition’ in the evolution of language may thus await us here: from static symbols, speech and text we are moving towards the era of iconic signs and societies, such as using dynamic images, pictures, charts, diagrams, emoticons and metaphors to communicate our fundamental meanings.[27] Maynard Smith and Szathmáry (1995) identify eight major transitions in the evolution of complexity, the last of which is from primate societies to human societies, mediated by the emergence of language. Now that the human species has learned and mastered how to communicate with the conventional language and speech, why wouldn’t the next major transition be from humans as a ‘symbolic species’ to the ‘iconic’ societies partly human (natural) and partly computerised, automatised and agent oriented (artificial, online), with visual and other diagrammatic means of communication as the emerging standard?[28]

Acknowledgments

Supported by the University of Helsinki Excellence in Research Grant (2006-2008) and the Jenny and Antti Wihuri Foundation (2009).

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[1] Curiously enough, in his own words he was the one "promoting the term LOGICAL EMPIRICISM", which was his "expression-baby". But he "did not succeed", and the term logical positivism was to prevail. Neurath writes to Morris (18 November 1944, p. 4): "I remember hwo [sic] I tried to convince Schlick of the usefulness of this term, he tried to promote consistent empiricism or something like that. I think always with a look at JAMES, (all other proposals, as radical empiricism, scientific empiricism etc are all of the same brand) and just that seemed to me dangerous, since James, who is to a certain extent somebody who helps us, is on the other hand full of metaphysical trends, liking Bergson, etc the same is right of Peirce. Therefore we should avoid to be in too close a contact with these fine people, who neverthelss [sic] do not belong to our movement as such." Quotations are from letters deposited in the *Charles S. Morris Archives* at the Institute for American Thought, IUPUI (Indiana University–Purdue University Indianapolis), Indianapolis.

[2] The contrast in the historiographies of logical empiricism has commonly been that of between Neurath and Carnap on the one side, and Schlick and Waismann on the other.

[3] Quotations in the following two paragraphs are from Neurath's nine-page letter to Morris, 18 November 1944, page 7.

[4] Neurath's date for the *Antispengler* (his spelling) is 1919; however, the book was published for the first time in 1921 (Neurath 1921). His early book was a critique of Spengler's ambiguously titled *Der Untergang des Abendlandes*.

[5] See van Heijernoort (1967) and Hintikka (1997).

[6] Just how long has been given some elucidations in Hintikka (1992). Hintikka takes Neurath to be a member of the universalist camp, too, but evidence from Neurath's correspondence with Morris contradicts that claim.

[7] Though communicating Neurath's political and military outcry, Neurath's remark to Morris on Heidegger – who could certainly be regarded as a staunch representative of the universalist position – is instructive in suggesting that Neurath is indeed an opponent of that philosophical view: "I did not see the Journal of Phenomenology. It is a sad thing, that now the German illness enters the States …. but that is the same in many other cases. In history etc. The Nazidom of Haidegger [sic] did not sufficiently shock people on the other side of the Atlantic. I bought his Nazideclarations, they are TERRIBLE, of the

worst Goebbels type, full of distorted details, freely told lies etc but you feel through all these sentences the HIGHER language of his philosophy" (Neurath to Morris, 18 November 1944).

[8] Let us be wary of the fact that both Tarski's and Carnap's viewpoints kept evolving throughout their careers and thus their positioning in the calculist-universalist axis should likewise reflect those changes.

[9] Quotations in this paragraph are from Carnap's two-page letter to Morris, 19 June 1944.

[10] "It seems that the whole has been formulated in a very hasty and careless way; no care and time has been taken to work it over, make things clearer, and give it some coherence. It jumps from one idea to another, while the poor reader looks in vain for a connecting thread" (Carnap to Morris, 19 June 1944).

[11] Neurath admits these to Morris by confessing that "impatience is disturbing all things" and suggesting that his "always overstimulated activity has to be tamed by patience" (Neurath to Morris, 4 September 1942).

[12] From Neurath to Morris, 18 November 1944.

[13] According to Hintikka's study (Hintikka 1997b), in the time close to Neurath's death, Carnap was giving up universalistic tenets and fitting better in with the calculistic position.

[14] Neurath (1936), see also Neurath (1973).

[15] See Twyman (1975) for a bibliography. Isotype has been continued, both in the name and in the signs, for instance in an Italian profit-making information design project of http://isotype.org/. This initiative fails to give credit to Otto Neurath as the originator and the innovator, however. The site http://www.fulltable.com/iso/ is an Internet gallery of the material possessed by the Isotype Institute. The University of Reading Department of Typography has an archive of the Otto and Marie Neurath Isotype Collection holding material relating to the Isotype movement (http://www.reading.ac.uk/typography/collectionsandarchives/typ-collections.asp).
The site http://www.vknn.at/neurath/ is a web page on Neurath's visual education project. It contains an online version of his *International Picture Language*. http://www.dada-companion.com/neurath/ possesses material and further information on Neurath's pictorial statistics and details the extant archives and collections of Otto and Marie Neurath. Related ideas have emerged recurrently – see, for instance, the broadcastings in YouTube about *Ecolanguage*, which is a graphic language designed for biology showing the interactions of ecology and economics. Its opening statement is very much reminiscent of the Isotype programme: "We lack the ability to see everything, but we need to show many basic facts, so we must use as few symbols as possible" (http://www.youtube.com/watch?v=GrVsLdTtepM). Similar motivations were behind the development of Energy Systems Language by Howard T. Odum (Odum 1994). Von Engelhardt (2002) is a detailed study on language-like characters in graphical representations, such as maps, charts and diagrams.

[16] The quoted six statements are all from Neurath's *International Picture Language* (1936).

[17] "Visual aids do not lead to only one statement in words and that there are several different ways of handling the same visual material. … This possibility of various ways

suggests looking at pictures again and again to deliberate how to proceed" (Otto Neurath in Nemeth & Stadler 1996, 267).

[18] See Pietarinen (2006, Chapters 4 and 5: *Moving Pictures of Thought I* and *II*), Peirce (1931-58, 4.531, 1906).

[19] Whether natural languages are compositional is a matter of ongoing debate (see e.g. Sandu & Hintikka 2001; Lee 2008).

[20] Neurath's term 'sense' is not a Fregean one, and it is therefore fine to talk of meanings interchangeably.

[21] In the late 19th century, Peirce developed a graphical, diagrammatic logic of Existential Graphs, which he suggests are in fact not limited to representations of declarative expressions only (Pietarinen 2006; Pietarinen 2008a). Peirce claimed that "there are countless Objects of consciousness that words cannot express; such as the feelings a symphony inspires or that which is in the soul of a furiously angry man in [the] presence of his enemy" (Manuscript 499, 1906, *On the System of Existential Graphs Considered as an Instrument for the Investigation of Logic*). Neurath believed pictures to be more neutral and charged with less emotional intensity than language, which of course does not contradict Peirce's attempt to *represent* 'non-propositional content' with diagrammatic icons. Neurath seems to be right in at least one respect: witness the various contemporary phenomena found, say, in the ease of the use of all kinds of emoticons in online chats, which interestingly are much more neutral and weaker in their locutionary effects than any corresponding verbalisations. That said, the rapid increase in today's visual communication methods may fundamentally change the ways we are able to grasp and assign significance to these suppressed emotive meanings in the long run.

[22] "It is unnecessary to say in words what we are able to make clear by pictures. And on the other hand, it is frequently hard to make a picture of a simple statement. Education has to put the two together, and a system of education has to see which language is best for which purposes" (Neurath 1936, 26–27).

[23] This statement is continued "; he will give you help in making it healthy." This latter clause is omitted for simplicity.

[24] As likewise is the case in some expanded versions of the discourse-representation theory (Kamp & Reyle 1993).

[25] Pietarinen (2010a) studies the characteristics of the logic of images from the Peircean perspective, with some suggestions as to the logical aspects in such non-diagrammatic images as constituents of diagrams.

[26] Pietarinen (2007) suggests that from the game-theoretic point of view, in which strategic habits of action are constitutive of meaning, the alleged semantics/pragmatics distinction turns out to be moonshine.

[27] See Pietarinen (2008b) as to the possibilities of placing metaphors within the framework of pictorial logic of diagrams.

[28] Pietarinen (2010b) develops upon the possibility of a 'sonorisation of logic', namely to use non-visual diagrammatic representations such as auditory diagrams for the purposes of logical representation and reasoning.

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