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Schematic Aspects of an Aesthetics of Diagrams

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What could diagrams possibly have to do with aesthetics or the arts? The prototypical diagram is a stylized graphical model facilitating interrelated information about some subject - hence, as a tendency, pragmatic, no-nonsense, fact-oriented, obvious. Facilitating the retrieval of information – scientific, political, practical or otherwise – diagrams seem to emphasize direct accessibility over aesthetic depth and elaboration of representations.

This first consideration, however, covers certain complications.

1) Diagrammatic perception

A first thing to note is that ordinary perception have certain diagrammatic qualities. Contrary to a widespread common-sense (and sometimes phenomonological) conception, perception does not simply consist of 100% determinate, particular sense data - so that all sort of general content or schematic structure should be something derivative, pertaining to secondary, higher order cognitive processing. Rather, the structuring of perceptive contents is part and parcel of the perception process and, in the central example of vision, begins already in the retina. Thus, central features like contour enhancement begins with interaction between retinal cells, and the basic distinction of *where* and *what* in the visual field is provided by the basic structural separation of the dorsal (*where*) stream and the ventral (*what* or *how*) stream of visual processing in the brain. The former continuously updates structural information about immediate environmental space in terms of attention, object borders, accessibility etc. - the latter continuously categorizes objects and events within that space. Each of these have diagrammatical qualities. The former structures space into connected subspaces and thus lays the foundation of the ability to articulate and rationally connect a spatial whole into parts which is so central to the understanding of diagrams. The latter involves the schematic representations of the semantics of categories - the basic visual structure of chairs, tables, birds, clouds and all the mesoscopic inventory of our surroundings which we categorize automatically without explicitly intending it. These processes – and many more – yield the highly structured character of the resulting visual perception experience. It contains many diagrammatic aspects, even if we may not realize it at every glance – accustomed as we are to its appearance. But those diagrammatic aspects of experience are what

allows us to draw immediate inferences from it and act in a matter of moments – as well as to draw more complicated, longer-lasting inferences from certain perceptions which merit our more detailed attention. But it is not as if we could "switch off" these ongoing structurings and fall back on the unstructured, fleeting experience of the simple flow of incoming light.

2) When making pictures, including diagrams, we may choose to further emphazise such features of perceptual content as have already been highlighted in the perceptual process. This gives pictures and images of all sorts a potential degree of further diagrammatization. Contour enhancement may be further strenghtened, e.g. by means of the addition of contour lines. Stylization may simplify and typify the representation of categorized objects so as to make them easier to recognize – or more general in their reference. Discretization may simplify the amount of colours and shapes used to conform to a smaller repertoire of selected such features. Selecting the right moment of an action, from which an optimum of information about the near past and future of the process may be inferred (the Lessing principle, as it were). Compacitfying several different moments within one picture may represent a diagrammatical timeline, facilitating the reconstruction of a longer process beyond the immedate snapshot quality of moment representation. Thus, the amount of diagrammatic qualities in ordinary perception is typically (not always) only increased in pictural representation. Of course, artistic strategies may take as their aim rather to minimize diagrammatic representation by all sorts of blurring, ambiguization, abstraction (in the painterly rather than the logical sense).

3) Thus we arrive at diagrammatic representations proper – typically explicitly articulated graphical structures on screen, blackboard, paper, – realizing that in a certain sense, they form the tip of the iceberg only. Diagrammaticality there is already in perception, it typically increases in pictures and images only to reach full, explicit and often intended expression in charts, maps, matrices, tables, block or pie charts, curves, graphs, and so on. Diagrams in this sense are known since antiquity and reach an early apogee in Euclid. Diagrams in this sense express wholes composed from rationally related parts, where the rational relations are represented by spatial position, sequence, connection, continuituy etc. Diagrams presuppose abstractions in the sense that they represent a few selected properties only of the object they depict – those properties are idealized and made the focus of the diagram. Topographical maps constitute an exemplary case: they depict selected landscape features such as buildings, roads, forests, lakes, elevation, coastlines while other landscape features and variation are abstracted away. This generalization inherent in diagrams implies that very often, a diagram holds for a number of individual cases: the topographical map, unlike the aerial photograph, does not refer to landscape conditions in one single moment only, but holds for a whole period, that is, an

indefinite amount of moments, until landscape changes makes it invalid. The object of the diagram is thus more or less general – but generality also characterizes the diagram sign itself. It may be reproduced in a number of variations without ceasing to be the same diagram. This may be expressed, also in the opposite direction, so to speak: the individueal diagram token as printed on a page or emitting light from your computer screen, occurring in the present now, constitutes a window to the more general diagram type which it represents. Diagrams thus make possible the direct contemplation of general subject matters. This quality is a basic reason for their pragmatic ubiquity: they facilitate the easy grasp of a complicated matter of fact in one or a few gazes. But their generality has several sources: one is the graphical formalism in itself – idealized, stylized, simplified as it is. Another is the accompanying (or implicit) symbolic informaiton which indicates the type of diagram and type of object referred to. Take Harry Beck's famous 1931 London Underground Map, in its continously updated versions in use to this day, and arguably one of the world's most famous diagrams. For a first user, the text "London Underground" gives the double information that this spaghetti of colored lines should be read as referring to the structure of subterranean city train lines. This indicates how the diagram should be read, in general. Thus, diagrams generalize Kant's famous definition of a *schema*: it unites spatiotemporal representation with symbolic understanding of the entity represented. The spatiotemporal layout of the diagram plus the indication of what type of object it represents unite to perform that function.

A yet unsolved question with regard to diagrams pertains to their subtypes: is there a rational taxonomy of diagram types? Charles Peirce proposed, as a first hypothesis, that they comprise maps, algebras and graphs. The appearance of algebras in this list may surprise as they are not typically regarded as diagrams in our ordinary parlance. The reason for this lies in his important observation that diagrams may facilitate reasonings.

4) To Peirce, diagrams comprise all structures that are fit to make deductive inferences from. In the topographical map, e.g., you may trace possible routes from one location to another – thus inferring an information which was only implicitly present in the diagram. The routes thus found are truly there as real possibilites in the landscape, given that the map as a premise is, in itself, a true representation of the landscape (if the map is false, of course, you can not be sure to draw true conclusions from it). Thus, Peirce's argument is that diagrams form the proper generalization of the various formalisms of deductive logic. And this is why algebras, to him, come under the headline of diagrams: algebraically expressed states-of-affairs may be used to infer other truths – e.g., an arithemetic equation, algebraically expressed, may be solved. Diagrams are ideal models with deductive possibilities.

This implies that diagrams, as signs, importantly differ from the pneumatic-dispatch model of communication: the idea that the sender has an intended

claim, codes it in a message which is, in turn, decoded by the receiver. In diagrams, the manipulation or experimentation with the diagram icon makes possible the retrieval of information from the diagram which was never explicitly put there by the sender. There is no reason to believe that the producer of maps have already calculated e.g. the distance between any two points of interest on the map – or any other particular information which may be deduced from the map. Diagrams, of course, differ enormously as to the extent implicit knowledge derivable from them. Some, like topographical maps, seem to have an indefinite amount of information which may be inferred from them – others, such as algebraic equations may, in some cases, be yet unsolved so that important knowledge possibly derivable from them has not yet been established. In any case, the fact that diagrams hold implicit information, simple or complex, easy or difficult to derive, is probably what gives them their immediate appearance of *depth* - something is, to some degree, concealed here, and it may require work to derive it and make it appear.

5) Are all diagrams graphic? Indeed graphically expressed, 2D visual diagrams form the core of our everyday diagram conception, but for a closer gaze it is not obvious that the rational category of diagrams is thus delimited. If diagrams are all formalisms from which implicit information may be derived, there is no reason why diagrams may not exist in other sense modalities. Particularly spoken language may represent a large amount of 1-D diagrams in an auditory, temporal medium which overlap with the 1-D visual, spatial medium of linear writing. Tactile diagrams are used by blind people. So one set of subtypes of diagrams is that of their different sensory representations. Here should also be counted *imagined* diagrams – whole diagrams up to some threshold of complexity (which is probably highly individually variable) may be imagined and manipulated before the mind's eye. An in many cases, the use of externalized diagrams on paper or screen requires the use of imagination – quick inferences may be drawn from maps by means of imagined manipulations of them rather than real, physical manipulation

A basic distinction is that between pure and applied diagrams. The London Underground map can be seen as a purely topological network structure if we bracket both the general interpretation of it as depicting train lines and its indexical reference to the particular city of London. In that case, it is a purely topological object whose general properties may be investigated. What is found on that pure, general level will be inherited by the virtual applied uses of the structure, for instance, to refer to those subway trains running under London. Thus, all applied diagrams have a formal spatial structure whose possible transformations may be studied in and of itself, regardless of application.

Another important distinction is probabaly that between continuous and discontinuous diagrams. Topographical maps are continuous in the sense that any full-dimension part of them are also, in itself, a map - which is not the case with

algebraical expressions or other diagrams using symbol sequences on a line or in a matrix.

A further distinction is dimensionality. Human language, spoken or written, interpreted as diagrams, are in a certain sense 1-D, just like many logic or algebraic languages. The most typical diagrams are probably 2-D – maps, charts, Cartesian planes, etc. – but there seems to be no apriori reason why diagrams could not have any dimensionality. Particularly idealized 3-D models inherit the easy accessibility with whole-part structure, the derivability of information by (imagined) manipulation and so on.

6) What has been said until now is probably the very least needed to be reflected before, by means of hypotheses, some aesthetic possibilites pertaining to diagrams may be discussed.

First – depending, of course, on use, materials, context, reference, style and other expressive variants – a number of potential aesthetic qualities of diagrams, exploitable for artistic purposes, may be listed. Unavoidably, some of the qualities here indicated will have overlaps

Abstractness. Diagrams are abstract in at least two ways. First, they abstract away certain variant or irrelevant aspects or properties of the object they depict. Second, the properties and relations selected are, themselves, subjected to an idealization which may, sometimes, also be called abstraction. "Abstraction" in 20C high modernism often approach diagrammatic qualities,

Analyticity. Diagrams not only select certain properties, they also analyze them and their mutual relations. Diagrams do not display object parts, properties and relations isolated from each other, rather, they portray them in (some of) their interrelations, that is, the diagram as a whole synthesizes, in turn, the parts first analyzed.

Arrows. Far from all diagrams use arrows, however, many do. Arrows may mean rather different things. They may signify some relation between two parts connected by them, be it a temporal, spatial or semantic relation. They may, e.g., signify a cause-effect relation, they may signify an oriented flow of material or energy, they may signify an intention, a dependence or an inference.

Constructivity. Diagrams are constructs of the intellect. That does not make them constructivist, rather the opposite; diagrams are typically realist with respect to the aspects of some reality which they isolate. But their construction, simultaneously, hints at the intellect able to isolate those aspects and connect them in the proper manner. Depending upon the degree of simplicity or complexity of the diagram in

question, this implicit intellect may be a simple mind or a genius; most often diagrams intimate a mind with analytic interests and powers.

Dots. Again, far from all diagrams use dots, but in those who do, dots typically indicate some entity which is a localized part of a larger structure, be it a person, a place, an institution ... In maps, dots may be cities, mountain tops, depth of valleys, stations, location of the treasure buried, in short any place of particular interest – it may be categorized by means of a legend giving dots with particular shapes or colors particular meanings, or it may be described directly.

Economy. Diagrams are basically economical structures – in the sense that they leave out of consideration an immense amount of information in order to focus on the essential, thus serving economy of thought. In many cases, it is easier to make use of a diagram than of a full-detailed description of the same object, because in the diagram, irrelevant structures have already ben filtered away, and the important and relevant information immediately leaps to the eye.

Essentialism. This word has had, for unknown reasons, a bad press recently, but there is really nothing wrong with searching for the essence of an object which is just equivalent to those properties without which that object would cease to be that kind of object. The economy and abstraction of the diagram serves this purpose. Of course, like all signs, diagrams may be fallacious or even mendacious, in which case the purported essence is not real.

Filling-In. The idea is the philosopher Ingarden's: that in many cases, when confronted with ideal, indeterminate signs such as diagrams, the observer is called to fill-in the *Leerstellen* with more or less concrete, imagined realizations. This filling-in is undertaken from the observer's own fantasy, sometimes supported by indications in or accompanying the diagram.

Fragility. The structural, skeletonized character of the diagram may, in many cases, give it a fragile expression – a frail composition of lines which may seem to be about to fall or disintegrate, if we (erroneously) interpret it as a real object.

Idealization. Diagrams not only abstract away properties deemed irrelevant, they also (unlike sketches) subject the remaining properties to idealization. This gives the diagram a sort of Platonic, outerworldly quality – as the deep reality behind many related appearances.

Imagination. Diagram use requires imagination – the individual diagram sign is not in itself ideal, consisting of physical lines and figures. So, in order to arrive at

ideality, imagination must strip away irrelevant features of the diagram sign – for instance, often the color of lines is insignificant and the user must imagine a line with no particular color.

Indeterminacy. The very same quality as idealization, viewed from another angle, gives the diagram a certain openness. The fact that many properties of the object referred to are left indeterminate makes the diagram fit many possible concrete, particular cases and thus, in itsef, gives it a quality of partial emptiness. Such emptiness may be taken in different directions such as desolation on the one hand or space of possibilities on the other.

Intersubjectivity. The diagram as an outer representation can be addressed, developed and used by a multiplum of persons at one and the same time, as well as sequentially over hours, days, centuries. This takes it far away from the idea of representations being only in the head, and gives it an optimistic air of collaboration, dialogue and even possible progress. Simultaneously, when seeing a diagram, unlike natural objects, you know somebody has seen it before you do, and unlike most other cultural objects, you know it is indeterminate, unfinished and that somebody, maybe you, could improve it.

Line. Probably the most widespread semantic tool of diagrams is that of lines. The signification of lines is really an issue of polysemy. Lines may signify all sorts of connection between their end points, they may signify contours of objects, they may signify opposition between the areas on each side of them, they may delimit an area of interest from one of irrelevance, and much more.

Manipulability. To Peirce, real or imagined manipulation is the key to retrieving implicit information from diagrams. The experimental manipulation with the diagram following certain rules, explicit or not, gives the user the possibility of inferring new claims from it which will be true, given that the information put into the diagram is true. This gives the diagram the character of an ideal-machine. Its possession of implicit information also may give it a quasi-mystical quality of the looming presence of something not explicitly there.

Mereology. The diagram is a whole of connected parts – claiming to mirror the structure of a real or possible object. So, any diagram involves a double, or multiply layered, gaze, one, distant, giving the outline of the whole, the other, closer, giving the internal organization connecting parts of that whole, sometimes on several different, nested levels.

Objectivity. In most cases, diagrams are used to claim something about the structure of some object, event or plan. That gives the diagram a cool, detached, objective, no-nonsense quality.

Overview. The mereological structure of the diagram implies that it may give the observer the overview of something otherwise difficult to synthesize. The object may be seen from impossible viewpoints, it may be dissected, analyzed or laid out in counterintuitive ways in order to give that overview. Oftentimes, the overview may synthesize different temporal phases into one, ideal glimpse of a whole sequential structure otherwise bound to stepwise experience.

Planning. Diagrams are often used as planning or construction tools due to their overview capabilities. That gives them, in many cases, a prospective quality of possibilities not yet realized, manipulation or realization possibilities to come. Its use in planning, of course, may also carry less positive associations of compulsion, constraint, even exploitation or totalitarian politics.

Rationality. The analytical and inferenctial quality of diagrams, of course, give them an acute air of rationality. To Peirce, diagrams are simply tools with which to make deductions – the core of logic.

Regularity. The ideal quality of diagrams makes them, in a sense, rules for many individual realizations. Simultaneously, the manipulation of them relies upon rules explicitly or implicitly given. This gives them a strong quality of regularity which, importantly, does not conflict with their openness. This is due to the fact that their regularity is not that of an algorithm to be followed blindly, rather it is like the rules of a game, facilitating an indefinite amount of games played.

Remoteness. The overview quality of diagrams also gives them, conversely, a certain remote quality. They conceive of their object from afar, making the observer (falsely?) at safe distance.

Schematicity. This is almost another word for diagrammaticity – however, with a stronger emphasis on their selective, skeleton-like character.

Scientificity. Diagrams have, of course, been used by most sciences, and often a scientific paper is built around one or a few central diagrams able to synthezise all of the conceptual preconditions and empirical findings into one irreducible whole the understanding of which often amounts to the understanding of the paper as a whole. Diagrams thus very often come with a strong association of science, discovery,

experiment – but also the possible dullness and repetitive quality of secondary science.

Sheet. The white piece of paper or blank screen on which the diagram appears require special attention. Peirce, in his "Existential Graphs" formalizing elementary logic, makes of the Sheet a universe of discourse, so to speak an undeveloped photograph of all the implicit knowledge that the users of the diagram tacitly agree upon. Sometimes the sheet directly depicts the object – thus the surface of the earth in topographical diagrams. Sometimes it displays an ordered field of possibilities, like in an ordinary Cartesian plane. The empty page, in short, may mean rather different things; in any case its blank quality gives the diagram a certain emptiness or, conversely, richness of possibilities.

Sketchiness. Sketches often have spontaneous diagrammatical qualities, so to speak on the way to full diagrams. Conversely, diagrams are typically sketched before they reach ideal completion, and in any case, the individual diagram token sign invariably keeps certain irrelevant qualities giving it a sketchy quality.

Slenderness. Oftentimes, the skeleton-like quality of the diagram gives it elegance, simplicity, delicacy – or emaciation.

Technicity. The affinity to planning and science points the diagram in the direction of technology. It is, in itself a technology of knowledge, of remembering, of analyzing, synthesizing, inferring, but it may also associate to other technologies of which it may serve as blueprint or construction device.

Unfinishedness. Openness and sketchiness may take the diagram in the direction of unfinishedness. More properties and relations of the object than actually selected could have been there – maybe, in some cases, they are lacking. Complicated diagrams may be work in progress over very long periods –like for many centuries the geographical task of the mapping of the earth.

Virtuality. The indefinite amount of implicit information in the diagram gives it a virtual, hypothetical quality, just like its ideality makes it an object different from ordinary, non-ideal and determinate objects.

In a certain sense, all of these qualities are not isolated but different aspects of the same diagram essence. Different designers, scientists, and artists may select or emphasize some of those aspects over others.

These qualities, then, may go into many different aesthetic strategies. Diagrams may be used as objets trouvées, exploiting their well-known or strange

qualities as they appear. Diagrams may be cut up, suspending parts of full-blown diagrams to investigate effects of dysfunctionalized diagrams. Diagrams may be challenged by reconnecting diagrammatic structure with that substance from which they were abstracted in the first place – or by combining incompatible diagrams on the sheet. More generally, diagrams may be subject to all of the enormous toolbox of artistic strategies developed over 150 years of modernism. Those strategies, however, will exploit some of the possibilities sketched in this overview.

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