

Drawing Interpretations from the Atmosphere; Graphical Information, Patterns of Behaviour and the Negotiation of Knowledge.

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Abstract. The drawing of 'outlines' can be shown to be dependent upon the bounding edge aspect of visual cognition, which is a principal means of discerning 'identity' from other features of experience in the visual field. Visual 'signatures' can be noticed while using techniques for the scientific visualization of data.

Using examples from an ongoing art-science project between the Faculty of Arts and Architecture (Brighton) and the Meteorology Dept at the University of Reading, the paper will explore the boundary between the 'rational' and the subjective, and between the representation of knowledge and the uncertain complexities that such representations may obscure. Examples will be shown from work in progress on 'The Breathing City' project, with Dr. Janet Barlow from the University of Reading, and Chris Rose and Holger Zschenderlein, University of Brighton.

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The drawing of 'outlines' can be shown to be dependent upon the 'bounding edge' aspect of visual cognition, but the process is not limited to visual concerns only. A line can divide two *behaviours* (hot, cold, fast, slow etc) when using diagrams to conceptualise complex interactions in the air for example. The bounding edge can be thought of as is a principal means of discerning 'identity' from other features of experience in the visual field, and for discerning discrete identities from each other in complex situations. At a 'sketching' phase in a conversation addressing the diagrammatic representation of abstract concepts, the existence of such identities is suggested prior to being formalized; an activity that promotes critical consideration and allows the sharing of trial concepts at a formative phase. Visual 'signatures' can be noticed while using techniques for the

scientific visualization of data. For example in *Flow Visualization* a 'passive scalar' is defined as something that responds to the flow without changing it. [note; flow visualization typically has two aspects; 1/ experiments in the real world where flow is studied or modeled in 3D, and 2/ graphical representations that draw abstract or conceptual mappings from these studies]. Heat is not entirely passive, since the buoyancy fields that can be created by uneven heat distribution give rise to forces. As Newton said, an acceleration (movement) is just a force acting upon a mass. Putting something passive into the flow can reveal trajectories (streaklines, ribbons,) and clear lines; or areas of turbulent mixing smearing out, or points of stagnation. What would a cityscape look like if urban airflow and its consequences were considered an important design constraint?

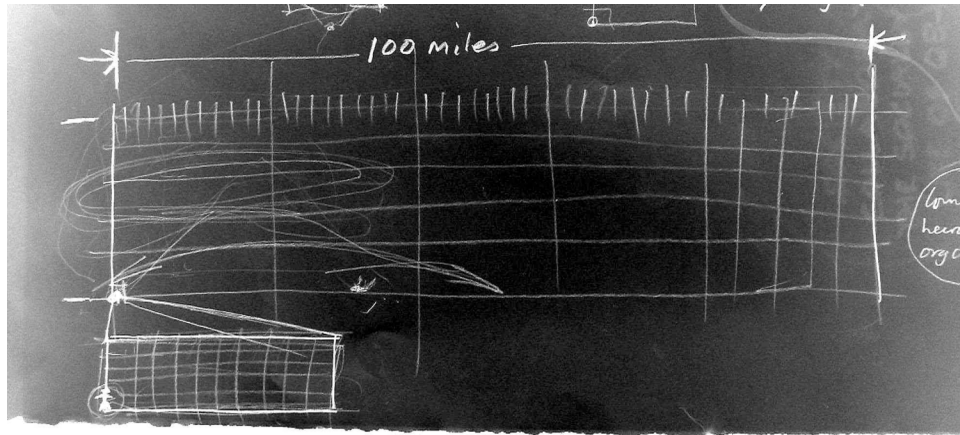
In the popular imagination, it may be thought that data 'exists' out there in the atmosphere, waiting to be collected and brought in to the lab. In fact data does not exist; it is a conventionalized way of expressing the product of an interaction between a device and the forces that act upon it. For example, if we put a mast into the air holding an anemometer at roof level, the output from the device may be converted into streaming data in which we may perceive recognizable patterns of behaviour concerning wind. In order to understand any 'meaning' in data, the design of the device must be explained in conjunction with the data it produced, since the data is best thought of as co-constructed between the device and the atmosphere.

Working within "the breathing city" project, a composer interested in sound design and the science of sonic phenomena, a designer interested in the cross-referencing of the senses in relation to the formation of knowledge, and a scientist with a passion for music and for the performance aspect of conveying ideas, are working together to gain insights into graphical representations of complex phenomena and our understanding of the issues at play. In working between these fields, we repeatedly encounter boundaries between the 'rational' and the subjective, and between concepts, constructs, and experience; and must attempt to find a language that addresses what connections there may be.

Graphical representations may obscure the complexities implicit in atmospheric modeling. 'The Breathing City' project is a sound-arts exhibit that forms part of the larger 'Spring Group' Research activity across differing arts practices and specialisms in meteorological research. The individual projects within the group, of which 'the Breathing City' is one, vary in scale from the urban to the global. The Breathing City makes use of visual, theoretical and sonic techniques in order to locate human sensory experience with questions of meaning and scientific analysis in the urban environment; it strives to understand complex atmospheric effects in a way that connects the personal with the general; the intimate with the environmental. Distinctive conceptual features may be discovered by cross-referencing techniques that straddle practices in Art, Design, and the scientific challenges of understanding 'data' through visual representation.

A map is a way of making sense of circumstances that extend from our immediate sensory experience; In a well known hand drawn diagram published by Edward Tufte of the “Historic Salyut 6 Cyclogram”, astronauts plotted co-ordinate points on a graph in order to ‘fix’ things for which their natural frame of reference had been removed; principally all conceivable ways of mapping the passage of time. (Tufte, Edward R Visual Representations, Graphics Press). Graphs allow a relationship between two or more things to be described visually. This can be a creative process – finding the ‘right’ plot can take time to work on; also different relationships of variables can be tested, and the ‘process’ of constructing a representation or indeed a theorem can be considered with a visual expression of the salient features to assist reflection, recognition, and choice.

An example of ‘finding the right plot’ that emerged from a public presentation of the Breathing City, is the ‘100 mile block’ sketch which was initially an aid to thinking about the domain in which we were working, but upon reflection revealed a particularly significant problem with the manner in which ideas may be communicated. The diagram took its cue from an observation in the Stern Report about climate change, specifically the limitation of the global climate model as computed with the present technical constraints which limit the resolution of the mapping of the whole atmosphere to a horizontal unit of 100 miles (and about 20 miles deep). In the Breathing City we have been concerned with the accessible realm of human sensory experience from the personal scale to the largest we can directly perceive, say a jet plane passing overhead or hearing a thunderstorm 10 miles distant. An experienced surfer can step outside and ‘feel’ what the tidal conditions are likely to be several miles away, because of a complex of haptic and sensory experience in three dimensions of space and all the senses working together to contextualise each other. In sketching these two concepts together, i.e., the surfer and the 100 mile block, it became obvious that there is a significant discrepancy of scale between the finest level of resolution of the global climate model and the maximum extent of expert human senses. The implication is that representations of the global climate model do not yet ‘connect’ clearly to human experience. The concerns of the whole Spring Group, in which projects at different atmospheric scales from the urban to the global are connected to each other, can be thought of as occupying areas of discrepancy between representations of the global climate model and the nuances of everyday experience. This has become an interesting connecting idea for the group.



The Surfer and the 100 mile Block of the Global Climate Model (Breathing City project 2007)

To explore these processes in an art-science context, the boundaries or challenges that exist between the 'rational' and the subjective, and between the representation of knowledge and the complex competing themes that lie behind attempts at representation, require a critical attitude to all forms of communication in the process of attempting to work in this way. It is proposed here that an effective way of addressing these cross-disciplinary challenges will provide the basis for successful communication of abstract scientific concepts for non-specialists such when trying to promote the public understanding of science.

An intellectual, philosophical and ethical issue lies at the heart of this problem. That is, that if the 'rational' and the 'subjective' have been traditionally seen as mutually exclusive, an area of great potential significance to the development of understanding may be missed, namely the consideration of the *relationships between* the rational and the subjective, and practices that assist an appreciation of this relationship. This is where art-science practices can assist us. By this is meant practices that constructively influence both the art and the science, not one done after the other. The kind of practice we are looking for is neither the scientisation of art nor the decoration of science with art. (Why would a meteorologist be a keen swimmer? Why does an electrical expert like opera better than jazz? Why does a surfer understand gravity? Why does a sculptor want to find out about cosmic rays? Why does a musician want to work with data? Etc.)

In the history of science, the ‘scientific project’ had to begin by making a defence against superstition and so-called ‘folk knowledge’; hence the establishment of the concept of ‘rational truth’ as an ideal to be sought after. Although a discrete rationalizing capability is posited for humans throughout the history of western philosophy, this concept (or to be more accurate, the way it is described) is thrown into doubt by research into the embodied mind. (e.g., Lakoff and Johnson, *Philosophy in the Flesh*). Embodied mind research proposes that ‘rationality’ can only be a concept; a concept given cognitive location by both its *antithesis* (irrationality) and its *context* (experiential phenomena affecting sensory processes in the body). Returning to the basis of art-science collaboration as we began to discuss it above, we have therefore two vectors with which to address questions of the relationship between the rational and the subjective; namely (rational - irrational) and (subjective – objective). We also have the useful vector of (naive – expert) to apply when querying what we regard as ‘knowledge’. We may ask an interesting question about this concerning the operation of our senses; what do we, as humans, have, other than our subjectivity? We have sensory experience including such things as balance, pain, light, sound, touch etc, and we have concepts, theoretical conditions or narrative constructs which we may call objective reality and rational truth. If both the ‘Rational’ and the ‘Objective’ are shown to be ideological or imaginary constructs, we are left with the effects of phenomenal experience upon our senses, which we narrate to each other in order to create a body of knowledge. Thus ‘how we tell the story of the weather’ reveals as much about ourselves as it does about complex phenomena, and attempting to understand complex interactions can be seen to involve something of the art of storytelling.

It is hard to imagine a condition in which our personal internal ‘aesthetic’ reading of our complex experience simply could not affect our attempts to rationalize complex information. It has been interesting to discover within the art-science scheme that is the ‘Spring Group’ that while the participating scientists could be prepared to discuss such relationships, however oblique, within the art-science grouping, they would not feel able to do this within the more formal peer group setting where theories and representations are proposed and accepted. The implication being that the human aspects, the sensory, aesthetic experiential aspects of being ‘alive’ to something in the emotive sense, tend to be disallowed in science, or at least have not yet found a vocabulary with which to locate their effects upon mathematical and physical research.

The Breathing City project and the Spring Group are exploring these issues in a context that must be the most common to all human experience everywhere; i.e., the weather. In working together we draw upon many approaches of attempting to discern meaning from experience, from the traditional to the scientific, and from the aesthetic to the analytical.

Chris Rose. Jan 4th 2007 in conjunction with Janet Barlow and Holger Zschenderlein

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