Drawing in Three Dimensions

John Stell

This essay is a slightly modified version of:

Stell, J. G. (2006) Drawing in three dimensions.
Chapter 1 of Stell, J. G., Cameron, L. & Hay, K. G. (Eds) *Explorations in Spatiality*, Leeds: Spatiality in Design.

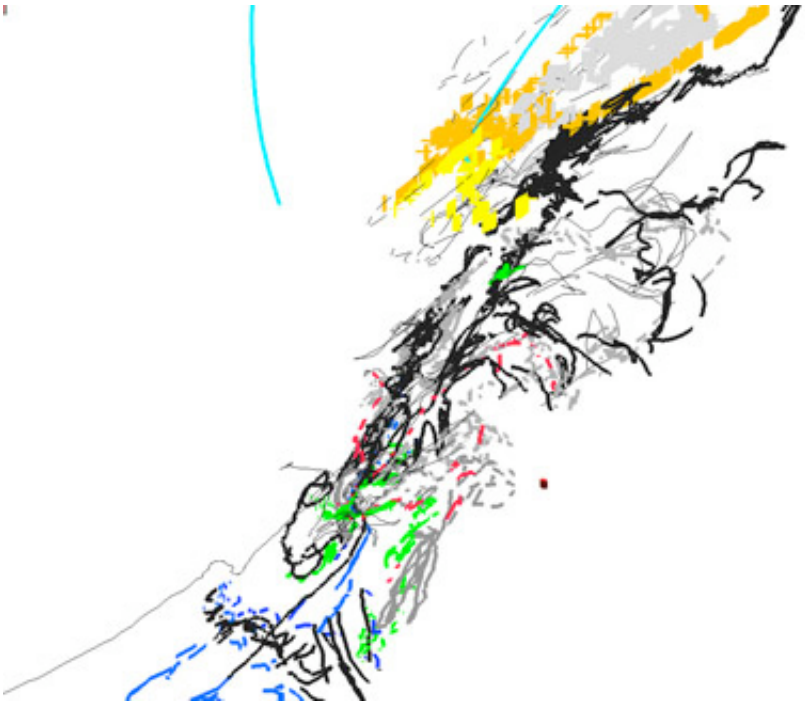
Acknowledgements

The work has been supported by EPSRC and AHRC through funding for the Spatiality in Design research cluster during 2005 under the Designing for the 21st Century initiative.

The three-dimensional drawing activity has been in collaboration with the artists using the system: Claude Heath and Trish Cain. The implementation was by Ben Hammett with advice from Roy Ruddle. Various other members of the Spatiality in Design cluster have used the system and provided useful input. The two artists have also written about their experiences with the system and Lynne Cameron has analysed their use of spatial metaphor in:

Heath, C., Cameron, L. & Cain, P. (2006). The practice of three-dimensional drawing. Chapter 2 of *Explorations in Spatiality*.

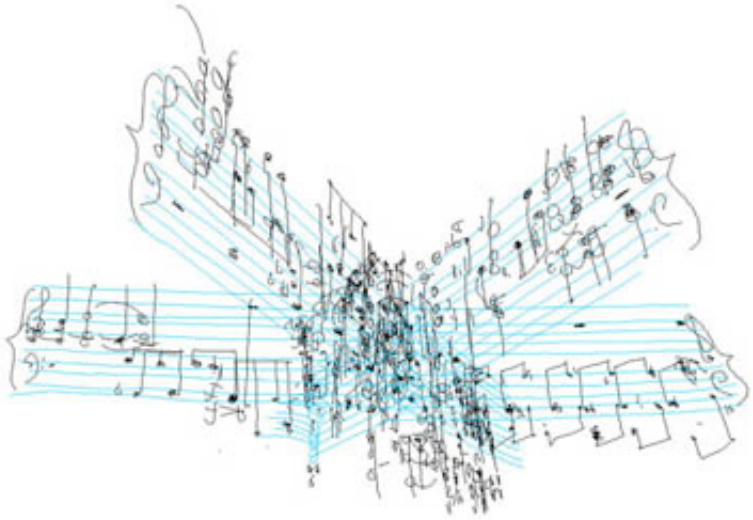
1. Introduction



Ben Nevis Claude Heath, 3D drawing (2005)

"Drawing is flat and monochromatic" (Ginsborg 2001, p7) is a deliberately provocative stance, but can we have drawing which is not only not flat, but also not two-dimensional? Can we be drawing if the marks are so distributed that they cannot be said to lie on one or more surfaces but require a three dimensional volume to exist? As part of the Spatiality in Design project, we do claim to have been, 'drawing in three dimensions', and in this essay I begin an exploration of what this means and where this kind of practice might lead.

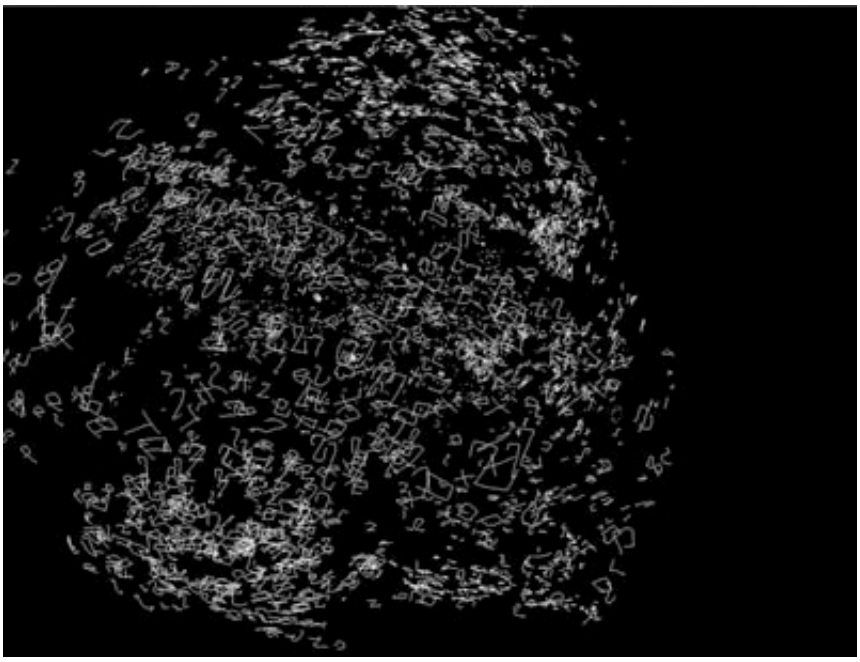
The three dimensions considered here are all taken to be spatial. It would be possible to take two of them to be spatial and the third temporal, as in considering the evolution of a conventional two-dimensional drawing over time. The issue of time is certainly important, and cannot be entirely ignored even if we only admit three spatial dimensions, since we cannot move in space without also moving in time. However, I will restrict myself as far as possible to purely spatial issues here.



Quest (1935) Claude Heath, 3D drawing (2005)

Two collections of images provide us with examples to inform the discussion. One consists of the images produced by Claude Heath using the system built by Hammett (unpublished), at the School of Computing, University of Leeds, and described below. The other set of examples come from my own recent work, discussed in section 4.

All the illustrations here are of course just two-dimensional, so it is clear that even if we agree that three-dimensional drawing is possible, and not just in some metaphorical sense, these illustrated examples can at most be projections or traces of such drawings, and not copies of them. The question of what are the drawings behind these examples is one which deserves careful consideration. We will see that one possible answer is that there are indeed three-dimensional drawings to be found here, but although there are physical marks in space, the marks need not be visible to the unaided eye.



Universe Claude Heath, 3D drawing (2005)

2. Supporting drawing

Expanding the question 'what does it mean to draw in three dimensions?' leads us to consider what does it mean to draw and what might it mean to do this in three-dimensions. We cannot expect to define drawing precisely, and criteria for what counts as a drawing are often left wide open, as in the *Jerwood Drawing Prize 2005, Conditions of Entry,* where a drawing is taken to be anything that the selection panel think is a drawing. However, one key attribute of most drawing is the use of some kind of support and of marks which are sufficiently insubstantial to require this support. The essential nature of the support can be captured in an equational slogan:

Drawing = Support + Medium.

The most traditional form of support in recent times is paper, and the surprisingly restrictive working definition of a drawing as any unique work on paper was used by The Drawing Center in New York (Wigley 2001, p28). However, drawings have been executed on stone walls since prehistoric times, and the wall drawing today would hardly count as being on paper, even if there is a paper layer in the plaster board construction of the wall. Besides walls, supports for drawings include skins of animals, both alive (for example Wim Delvoye's tattooed pigs) and dead (vellum being the obvious example), the skins of humans, and leaves of living plants. In all these and many other cases, the marks cannot be separated from the support – there is a relationship of dependency just as we cannot separate the boundary of a field (not a fence marking the boundary) from the field itself.

In contrast to drawing, many art forms have a more substantial presence and do not require support in the same way. A sculpture may be supported by a plinth on the ground, or be suspended from above, but the support is at discrete points rather than all over the form itself. Painting is closer to drawing than sculpture, and indeed there are works, especially in watercolour, which resist categrorization as either paintings or as drawings. However, a thickly executed painting in which the canvas is entirely obscured provides an example where we can imagine the paint being detached from the support, even if this is not physically possible. The role of the support in painting is raised by the work of Alexis Harding (Schwabsky 2004) where layers of still wet paint partially detach themselves from paintings under the action of gravity. Drawings do not seem to permit this disengagement of medium from support – we can imagine holding a sheet of partially dried paint, but not a sheet of powdered graphite.

Other features of drawing are often proposed as defining attributes, but in many cases these can be seen as consequences of the marks' need for support. The qualities of provisionality and immediacy arise from the use of a support which enables drawing's fragile and spontaneous gestures. Marks and forms that can support themselves generally require too much investment in their construction to be explorations of possibilities or direct responses to thought or experience.

Drawings may be two-dimensional without being flat, as for example in the spherical work of Russell Crotty illustrated in (Dexter 2005, p67). Even drawings which are made on flat surfaces can be easily transformed into ones on surfaces. The cylinder is noteworthy as a temporary form for many drawings – which spend part of their lives rolled up. Cones and Möbius strips can readily be fashioned from flat surfaces and must surely have been used as the final forms of drawings. These supports are all two-dimensional, although they can only exist in these forms in three dimensions.

Many two-dimensional drawings bear the imprint of three-dimensional movement perhaps visible in varying pressure of line or in the trace left of a gesture coming down onto the

surface with impact. In this case the mark is forced into the structure of the support rather than lying on the surface. In fact an early method of drawing, used in architects' technical drawings up into the 18th century, was to incise lines in the support with a scoring instrument and afterwards to fill the lines with ink (Hambly 1988, p11). We can imagine this at a greatly magnified scale with the fabric of a hand-made paper as support being a three-dimensional network of matted fibres. The incising modifies the network and forms a channel for the ink. At a scale visible to the naked eye, Greenberg (cited in Lucie-Smith 1969, pp104, 106) found this kind of three-dimensional network in the paintings of Morris Louis in the late 1950s.

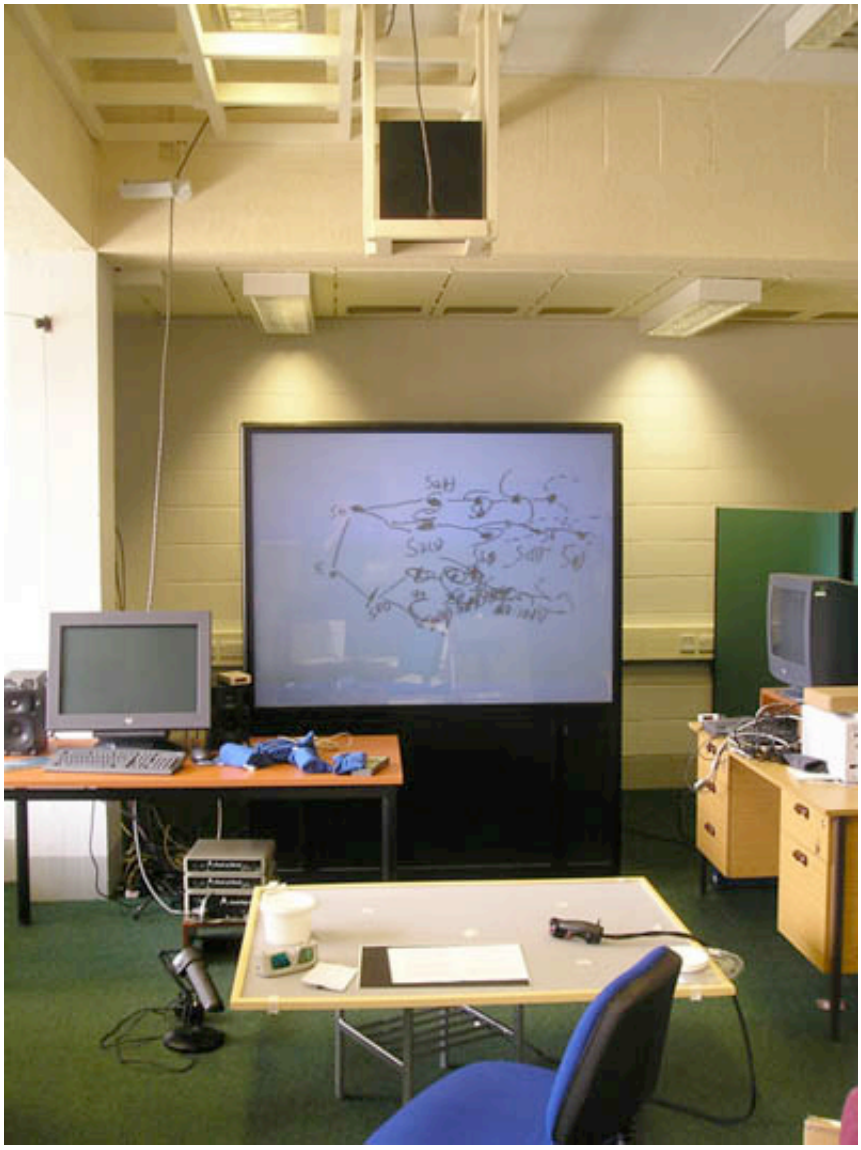
> Louis spills his paint on unsized and unprimed cotton duck canvas, leaving the pigment almost everywhere thin enough, no matter how many different veils are superimposed, for the eye to see the threadedness and wovenness of the fabric underneath.

Crucially for our interest in support beyond the superficial, he then notes that 'underneath' fails to capture the relevant spatial relationship. The fabric is not a surface *on which* the paint lies, but a spatial form *in which* it lies.

> The fabric, being soaked in paint rather than merely covered by it becomes paint in itself, colour in itself, like dyed cloth; the threadedness and wovenness are in the colour.

The reference to wovenness signals the three-dimensional context – this quality cannot be found in just two dimensions, just as tying knots requires three dimensions. Although the depth of physical space in these paintings is very shallow, the paint is clearly seen as supported in a three-dimensional way by the framework of threads which make up the canvas. If these threads could be made less substantial, so they did not obstruct the hand, but still able to bear marks in some sense, we would have a means of making marks in a three-dimensional space. This is effectively achieved by replacing the physical network by a magnetic field, as in Hammett's system, which I describe next.

3. Hammett's system for three-dimensional drawing



At the School of Computing, University of Leeds, a system for drawing in space was implemented by Ben Hammett in his final year undergraduate project in 2004–5. The details of the implementation are described in his report (Hammett, unpublished), but here we need only review the basic features of the system. It uses a 'Flock of Birds' magnetic tracking system from Ascension Technology.

The artist works within a volume, roughly a 2m cube. A magnetic field pervades the volume, and a drawing instrument with various buttons is linked by a cable to the tracking system. The position of the drawing instrument in space is detected by sensing the magnetic field and the trajectories of the drawing instrument held in the artist's hand are represented in a virtual space on the computer. These trajectories are displayed in a visual representation of the virtual space (which is imagined as corresponding to the physical space within which the artist moves). The display is capable of creating a three-dimensional illusion when the appropriate stereo glasses are used. It is possible to disable the stereo effect to see a straightforward two-dimensional rendering of the model in virtual space. Lines may have a variety of colours and thicknesses, and the model can be rotated in virtual space about a vertical axis.

The lines in virtual space are represented in an internal format in the system, but this can

be exported to produce a VRML file. These VRML versions do not record the thickness of the lines, so in some cases may give a quite different appearance from the original display on the system. Where, however, the artist is only using lines of one narrow thickness the VRML version is a reasonably faithful representation, and most of the illustrations of drawings with the system in this book are from the VRML representations. It is easy to display these representations on any computer equipped with a web browser suitable for the Cortona plug-in, which is freely available. Using the Cortona software, or other VRML viewer, the images can be manipulated as three-dimensional objects – rotating them about various axes as well as zooming in and out and taking up different viewpoints.

You can download a 3D drawing made by John Stell using the system here. To view the drawing you will need a VRML viewer, which can be obtained as a plugin for your browser. One possible one is Cortona. With the Cortona viewer you may need to click on Fit before any of the image is visible. You can then experiment with the various buttons, Study and Turn (in the left hand tool bar) are a good place to start.

Viewing the two-dimensional projections of the VRML models we are some distance removed from the artist's original hand movements. It is unclear what exactly should count as the drawing in this process. Does the drawing exist just in virtual space, or is (or was) it something physical? Even what we think of as virtual space is always recorded in physical space in some way, whether recorded on a CD or printed on paper. These representations are distinct from the virtual space itself, but the fundamental nature of this space seems to be as elusive as that of mathematical objects such as numbers. Avoiding for now the possibility that drawings might be purely conceptual, the most likely physical site for the drawing seems to be the magnetic field acting as a three-dimensional support.

The artist does not alter this field when using the system; the field induces certain physical effects in the drawing instrument which depend on location within the field, and this allows the position of the instrument to be determined. These physical effects are transient but data derived from them is stored as a record of where the drawing instrument has been within the field. One interpretation is thus that the magnetic field is the support and the transient physical effects which occur within the field are marks upon the support. However the quality of the marks (attributes such as colour or line width) are not represented by these effects, but are controlled by a context held in the computer which includes which menu choices are in force at the time. In the case of this system the nature of the support seems clear, but the nature of the marks is much less so.

The magnetic field in Hammett's system is not the only three-dimensional structure in which we can make drawings. One we encounter frequently is formed by light, for example the light from street lamps, cars and buildings in a city at night. Collecting traces of this field while moving through the city is one way to build a map and the three-dimensional drawing where light is the medium is explored in the next section through the ideas of mapping and movement.

4. Drawing as mapping

Movement by people in space can be seen as creating drawings. For example Richard Long's *A Line Made by Walking* 1967, illustrated in (Dexter 2005, p7). Here the line is visible, the documentary photograph showing a straight line made by walking repeatedly over the grass until a visible track is present. Lines of another, much less purposeful quality, are found in the situationists' activities. The situationists are well known for their exploration of the dérive, or drift, when they wandered through the city following routes dictated by instinct. Wigley (2001, p47) sees the dérive as a kind of drawing – the trace

mapped out by the drifter as a line in the three-dimensional form of the urban environment. These drawings take place in space leaving no visible mark, but later led to new mappings of the city in terms of psychogeographic intensity.

One of the founders of the Situationist International was Constant whose New Babylon project for an ideal city (1958 - 1974) is seen by Wigley (2001, p50) as enabling three-dimensional drawing.

> Constant ... designs a support on which the inhabitants' play will be the medium. ... each occupant of New Babylon will be an artist. Crowds of these passionate artists will collectively mark the support with ever changing materials: light, color, texture, temperature, ... The inhabitants draw, as it were, in three-dimensions.

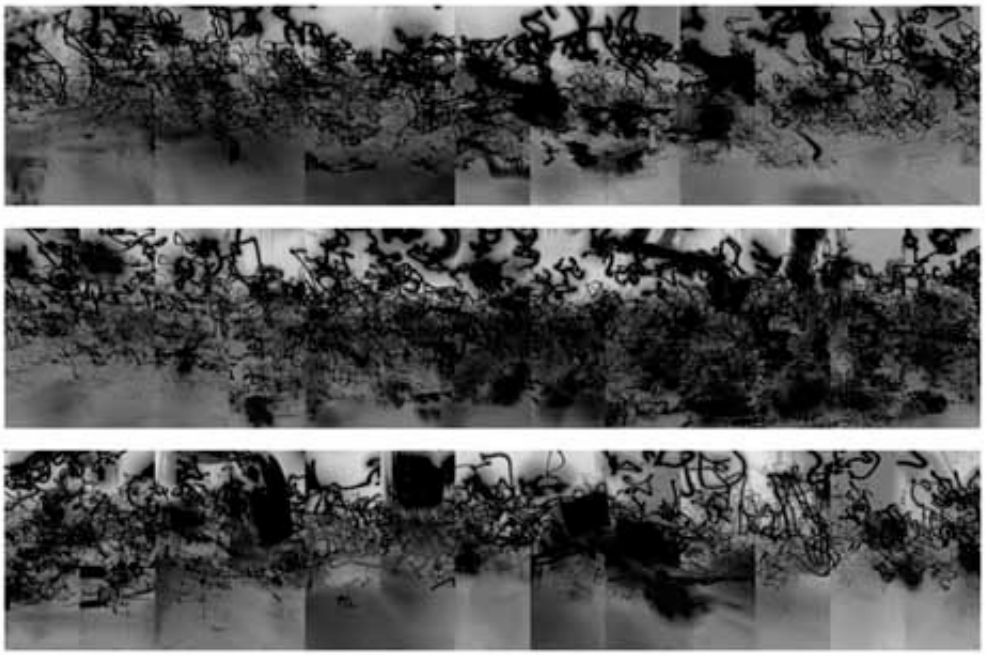
In saying that Constant designs the support, the suggestion seems to be that the fabric of the city forms the support, rather than the three-dimensional space which the city occupies. The fabric would be continually changing, and the technological form envisaged by Constant in drawings in 1960 was, as McDonough (2001, p99) reports,

> transparent space frames beneath which mobile walls (some opaque, some transparent) arranged contingent spatial patterns.

The drawing *Mobiele Warden* (Mobile walls) 1960, illustrated in (de Zegher & Wigley 2001, p122) shows this phase, although Constant's later drawings, such as the 1962-63 *Labyratoire* discussed by McDonough (2001, p99), show a move from this kind of commitment to architectural representation to a more notational suggestion of what it might feel like to experience this combination of labyrinth and laboratory.

Although New Babylon was only every a 'paper project', the urban environment as a support marked with light and other materials is readily found today. The obvious way to do this is to look upon the physical surfaces of the city illuminated by cars and streetlights or marked with graffiti. This can be seen as a three-dimensional drawing, but the marks always appear on surfaces, not genuinely throughout space. The actual drawing here is not that on the surfaces, but is present in what we think of as empty space which is really occupied by light. Light travels through space, but we only see it when it strikes a surface, or particles in space, or our own eyes. Streetlights and cars at night make continually changing marks in space by creating a three-dimensional field of light, much of which (the light in transit between source and surface) is invisible to us. We have an invisibly marked three-dimensional volume similar to the case of the magnetic field bearing invisible marks in Hammett's system.

We can thus treat the urban environment at night as the location of found drawings - the continually changing pattern of lights from both stationary and moving sources. How then can these drawings be experienced, how can the invisible marks which are there be revealed? Some recent work of mine provides one possible response.



Bingley places 1–39 John Stell (2006)

These drawings are made by the superposition of many digital photographs taken at approximately regular intervals in a series of walks at night following roughly the same route. Different arrangements of superposition can yield an atlas-like perspective of all the places showing the data gathered on all the walks (as in the image above, which is just the first part of a sequence of 90 places, which if printed out in full at the intended scale would be about 16 inches high and 40 feet long), or an accumulation of of all of the places on a single walk as in the next image.

22nd November 2005 John Stell (2005)

The visible marks owe their character to the fact that during the length of the exposure the camera has moved sufficiently that the stationary streetlights and the moving traffic leave trails. The images are thus not static observations of the three-dimensional field, but also reveal the effects of motion through the space. The significance of motion is highlighted by Hayter (1966, p232) when he writes

> ... it appears that motion is inevitably involved with the concept of space – motion either of objects situated in space or, on a smaller scale, of the observer.

Motion in all the three-dimensional drawings we have been considering is inescapable and in my own work the idea of moving through space collecting data echoes the community mapping process enabled by Christian Nold in his Bio Mapping project (http://biomapping.net). In this, participants have a device recording both galvanic skin response (GSR) and location (via GPS). Readings are taken at intervals throughout a walk, resulting in a record of the individual's response to the environment. These records can be used to produce maps where the third dimension is not spatial but emotional arousal as indicated by GSR – maps of psychogeographic intensity as envisaged by the situationists.

Bingley series, Place 16 (detail) John Stell (2005)

5. Research directions for 3D drawing

In Hammett's system, the artist initiates, making marks supported by the magnetic field – in my drawings the artist finds evidence of other invisible marks. In the former, the artist plays the more active role, the creator making things, in the latter the artist works more passively recording and mapping, but not in an objective way. The two are significantly complementary, and indicate the potential for three-dimensional drawing, but how can we take these practices forward and what applications might the process of three-dimensional drawing find?

One direction is suggested by the situation of drawing somewhere between representation and notation. The three-dimensional is often seen as delivering greater fidelity for representations, as in the move from still photography to silent black and white moving images through the addition of sound and colour and on to 3D cinema. Much virtual reality work and computer modelling is also driven by a desire to construct representations which appear close to our perception of the real world. In drawing, this representational fidelity is rarely important. The challenge in drawing is often to find 'the right notation' for something, whether it be a physical object, an emotion, a concept or something else. In two dimensions the notation can be related to representation, as in the drawings of Gordon Cullen (1961). These frequently serve as notations for arrangements of urban space in an abstract way, although representational features are used as part of the notation. The diagrams drawn by scientists and engineers are frequently notational, not because they may use literal symbols, but because whole diagrams or parts of them serve as symbols referring, to ideas or concepts. In three-dimensional drawing, we are beginning to explore new ways of making marks, the possibility that these will enable us to develop new notations is an exciting one which will require collaboration between drawing practitioners from diverse disciplines to realize.

References

Cullen, G. (1961) *Townscape* The Architectural Press, London.

Dexter, E. (2005) *Vitamin D. New Perspectives in Drawing,* Phaidon Press Ltd, London.

Ginsborg, M. (2001) 'Introduction', in Kingston, A. (ed) *The Centre for Drawing, The first year,* pp7–10, Wimbledon School of Art, London.

Hambly, M. (1988) *Drawing Instruments 1580 – 1980* Sotheby's Publications, London.

Hammett, B. J. (unpublished) *Drawing in 3D Space,* Final year undergraduate project report, School of Computing, University of Leeds, 2005.

Hayter, S. W. (1966) *New Ways of Gravure* Oxford University Press, Oxford.

Jerwood Drawing Prize 2005, Conditions of Entry
http://www.wimbledon.ac.uk/jerwood/entry/insert.pdf visited 23/01/06

Lucie-Smith, E. (1969) *Movements in Art since 1945* Thames & Hudson, London.

McDonough, T. 'Fluid Spaces: Constant and the Situationist Critique of Architecture' in (de Zegher, C., & Wigley, M. 2001) pp93–104.

Schwabsky, B. (2004) Alexis Harding: Andrew Mummery Gallery – London', *ArtForum,* Jan 2004.

Wigley, M. 'Paper, Scissors, Blur' in (de Zegher, C., & Wigley, M. 2001) pp27–56.

de Zegher, C., & Wigley, M. (2001) *The Activist Drawing. Retracting Situationist Architecture from Constant's New Babylon to Beyond.* The Drawing Center, New York.