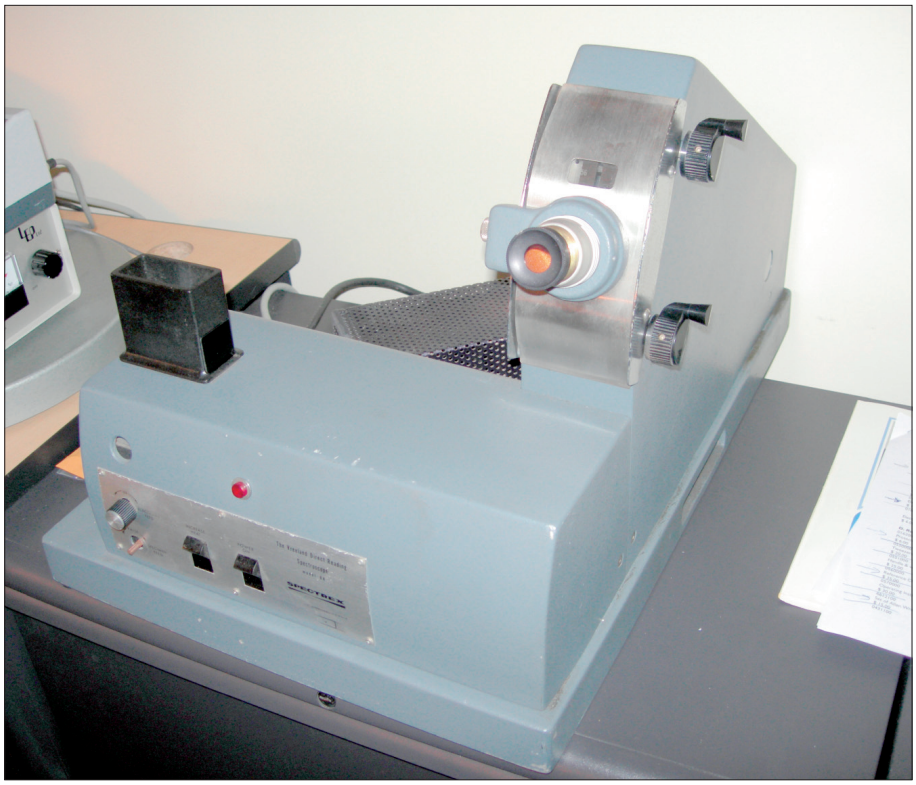
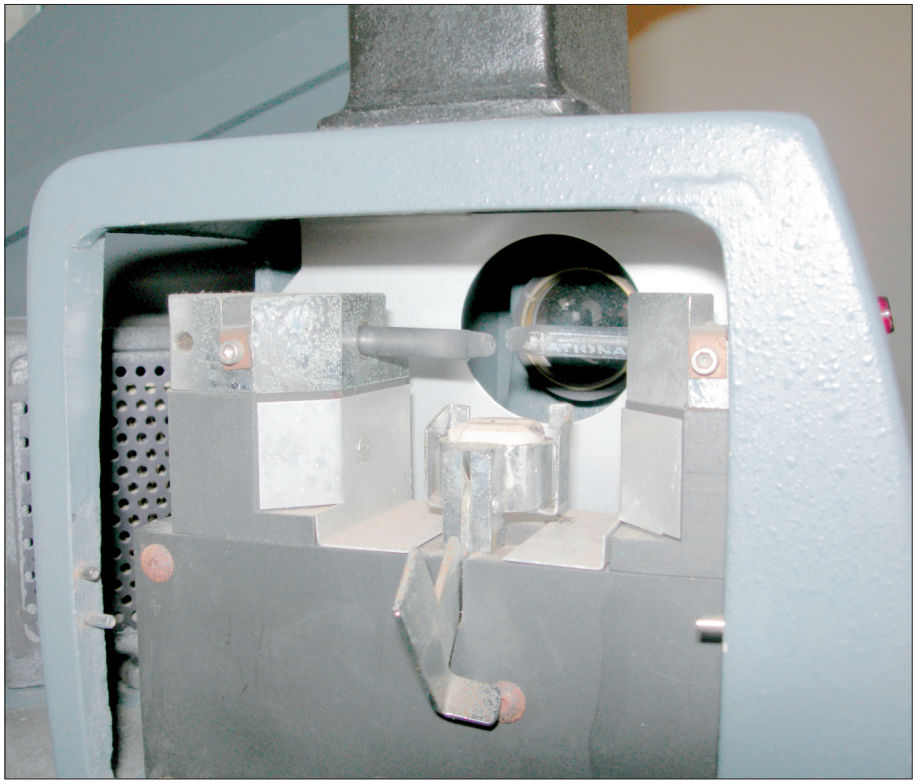
1

Spectroscopy

Pierre Laszlo and James Elkins

The large photograph is a spectrum. It records the wavelengths of light, from the deep violet near the end of the visible spectrum (at the top) down into the warmer colors that lead to infrared (at the bottom). The machine that made this is a Vreeland spectroscope, a fairly ugly machine that works very simply.



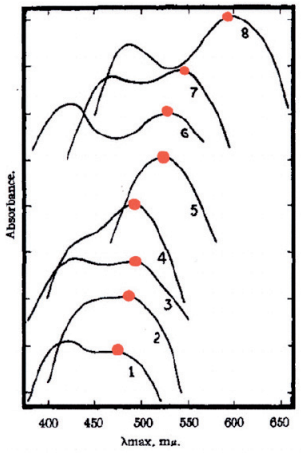


The sample, usually powdered rock, is put on a small ceramic plate; the plate is just visible beneath the dark opening. Above the plate are two carbon rods, which are arranged so they do not quite touch. When the machine is turned on, an arc of electricity sparks between the plates, creating a rasping noise and a blinding light (far brighter than sunlight). The arc melts and vaporizes the rock sample; the spectrum is produced when light is reflected off a diffraction grating inside the machine.

When a viewer looks in the eyepiece, he or she sees the spectrum in brilliant colors. The Vreeland spectroscope has two film reels that can run on either side of the spectrum. They can be rolled along using the two black handles visible in the first photograph. The left-hand film reel, in this case, has the wavelengths of light on it, for reference. The right-hand reel has the spectral lines that are characteristic of different elements. Here the large "Sn" indicates this is the portion of the film that shows the typical lines of Tin. The green line and the blue line match lines in the spectrum, and in fact the powder on the crucible in this case was pure tin from a chemical supplier.

From color to monochrome

This is simple spectroscopy, done with a rough-and-ready machine that was designed to be used in the field, by geologists. Machines like this are rare in laboratories now; they have been replaced by massive, and massively expensive, machines that produce very accurate quantitative results.

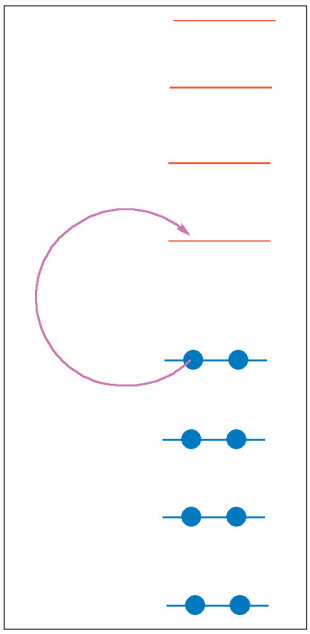


It may come as a surprise that spectroscopy, in science, does not often involve any color reproductions. This is a series of ultraviolet spectra, numbered 1-8, illustrating an experiment carried out in an organic chemistry laboratory during the 1950s — that is, almost exactly a full century after Bunsen and Kirchhoff invented spectroscopy.

The curves show how the molecules absorb light of different wavelengths. Note that there are no spectral colors here, and really no colors at all; the original publication had no red dots, and this was its only illustration.

What are we looking at?

The picture on the top depicts a stack of spectrograms — spectra for short. Each spectrum is that of a different molecule, numbered 1-8. The underlying physical phenomenon is absorption of light, in the UV-visible part of the range of electromagnetic radiation, that is, from 400 to 800 mμ (a micron, μ, is a millionth of a meter, or a thousandth of a millimeter).



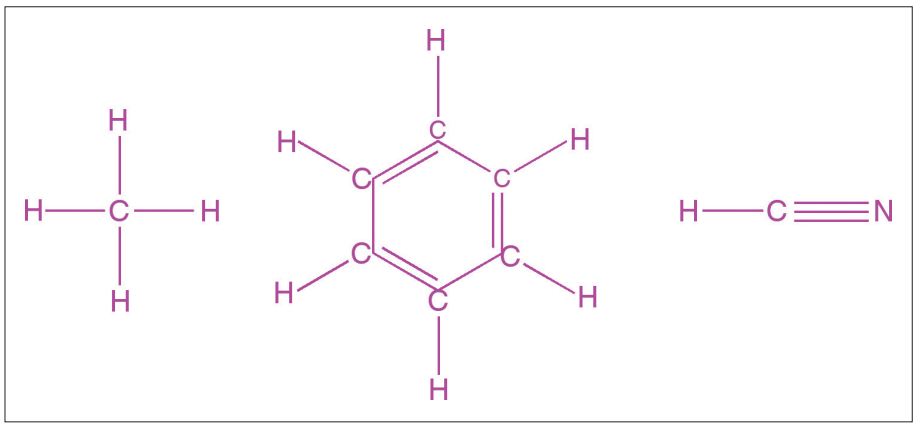
Why do certain molecules absorb light in that range? Because absorption of a photon lifts an electron — hence the name "electronic spectroscopy" — from a doubly occupied energy level (blue) into a vacant energy level (red).

As the light excitation sweeps through the accessible range, in this case from 400 to 650 mμ, it probes various electronic energy levels within a given molecule. The manifold of such light absorptions, across the whole range monitored, is termed the "spectrum."

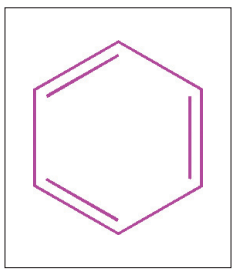
The iconic language of chemical formulas

The simplest formulas, termed berzelian formulas, provide information only about composition. For instance, the methane molecule (natural gas) is CH_4, benzene C_6H_6 and hydrocyanic acid is HCN. In these, C stands for carbon, H for hydrogen and N for nitrogen.

A major step forward was taken during the 1860s when structural formulas were devised. They show in how atoms are connected. The very same examples are shown below:



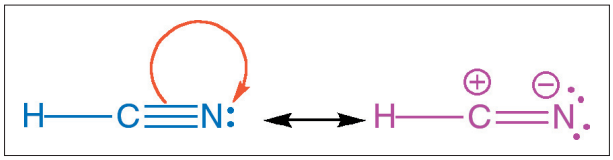
Chemists soon realized that rather strict rules governed these formulas. Notice, for instance, how each carbon atom bears a total of four lines (bonds) to neighboring atoms? Accordingly, a shorthand was quickly established: one would display only the framework of interconnected carbon atoms without showing explicitly the attached hydrogen atoms. Thus, the benzene molecule is written, in this simplified manner as shown at the lower left.



In a benzene ring, all twelve atoms are in one and the same plane. To distort a benzene ring from such coplanarity demands considerable energy.

During World War I, Gilbert N. Lewis (1875-1946), a professor of chemistry at the University of California, proposed to integrate the then newly discovered electron into the structural formulas. Each line (bond) is equivalent to a pair of electrons. For instance, there are three such pairs between the C and N atoms in HCN. Moreover, there exist also pairs of electrons which remain uninvolved in bonding atoms. In the same HCN molecule, one such pair sits on nitrogen:

It remained for Linus Pauling (1901-1994) to perfect this iconic language by making the representation somewhat more involved. Consider again the HCN example. The three pairs of electrons in between C and N are drawn towards the atom on the right (N) since its nucleus has an additional proton. Protons have a positive electric charge, electrons are negativelycharged. Thus, protons attract electrons. To account for such a polarization, Pauling wrote the HCN structural formula as a *hybrid* of two limiting forms:



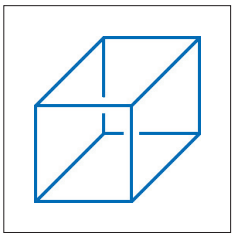
The red curved arrow shows transfer of an electron pair, from in-between C and N, to the N atom only. In the purple limiting form on the right, N has gained negative charge, from now bearing two instead of just one lone pair of electrons. Carbon, having lost negative charge, has become positively-charged. The HCN molecule is best conceived of as a hybrid (indicated by the black double arrow) of the two formulas in blue and purple.

What "physical organic chemistry" consists of

In chemical history, physical organic chemistry, which appeared during the 1920s and 1930s, was another hybrid. Organic chemistry studies molecules derived from hydrocarbons such as methane or benzene. Physical chemistry, a close relative of physics, studies the equilibria between molecules and the rate of the chemical reactions which interconvert them. Physical organic chemistry is thus physical chemistry applied to organic structures.

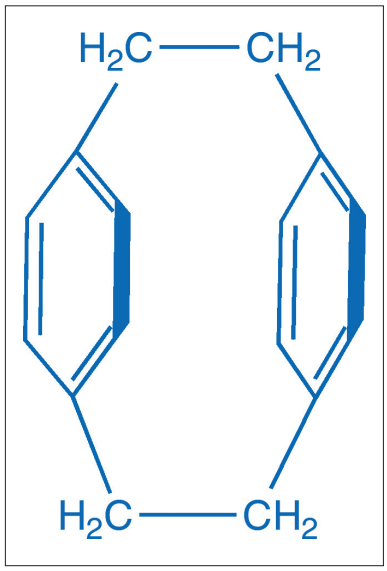
A defining trait of physical organic chemistry is the synthesis of novel molecular architectures in order to test theories of chemical structure. For instance, about the time Cram and Bauer published their paper, Philip E. Eaton, from the University of Chicago synthesized cubane.

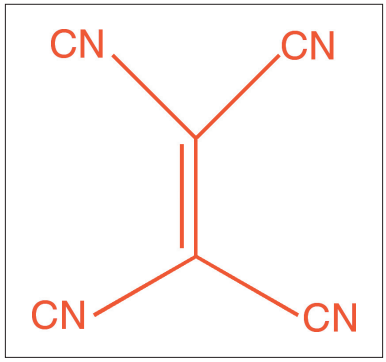
In that structure with berzelian formula C_8H_8, the angles at the eight carbon atoms are constrained as 90° instead of the "natural" angle of 109.5° found in methane. What would be consequences of such a huge internal strain in the cubane molecule, Eaton wondered. We now know that one such consequence is the feasibility of manufacturing much more powerful explosives than previously known.



What are paracyclophanes, and why make them?

Donald Cram, in an early line of research, chose to synthesize paracyclophanes for similar reasons as Eaton's in making cubane. Paracyclophanes are molecules in which two benzene rings are bridged at positions diametrically-opposed, by a number of hydrogen-bearing carbon atoms. This is, for example, the formula of [2.2]paracyclophane (shown below, in blue).





Why become interested in such a molecule? Its internal strain. The presence of the two bridges, each made of two mutually-bonded carbons, pulls on the benzene rings. Such double bridging tends to distort the benzene rings from their coplanarity. Would this, besides the geometry, affect the ability of the benzene rings to either accept or donate some of their electrons to another entity?

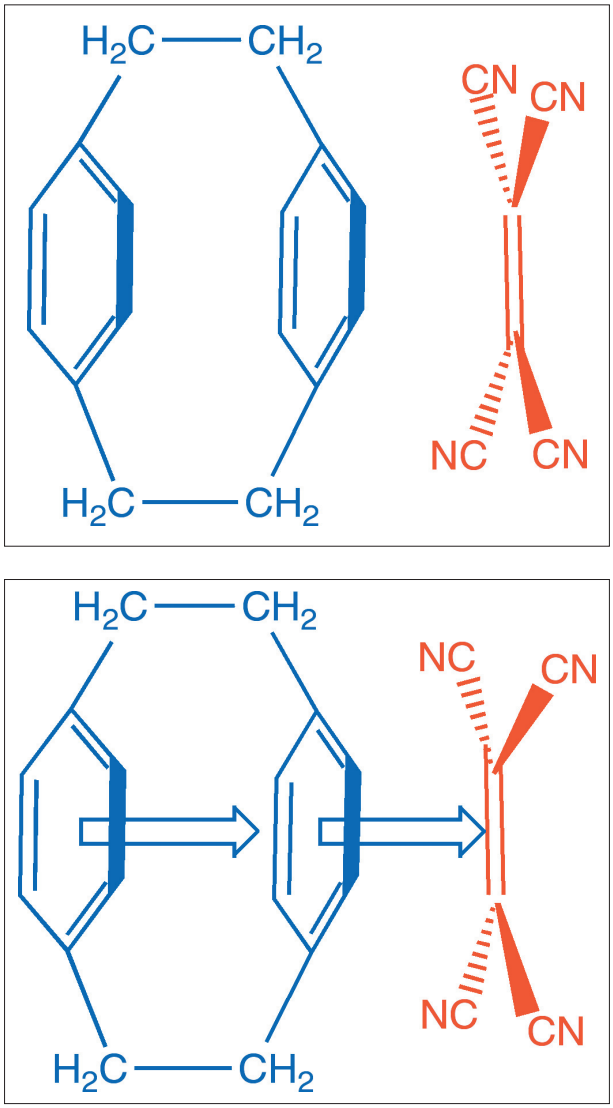
When Cram and Bauer did this work, chemists at the Central Experimental station, of DuPont de Nemours in Wilmington, Delaware had just made tetracyanoethylene (TCNE) in quantity (shown at bottom).

TCNE is a powerful attractor of electrons, because each CN group is polarized in the same manner as in HCN, with a positively-charged carbon. Moreover, TCNE is a planar molecule just like benzene.

Cram and Bauer thus studied the so-called charge-transfer complexes which occur when a paracyclophane comes together with a TCNE molecule. Such a complex is depicted below depicted in the top illustration on the next page.

The two benzene rings are in roughly planar and parallel vertical planes. The TCNE molecule, also in a vertical plane in this image, stacks next to one of the benzene rings, but on the outside (it is too bulky for the internal space of the paracyclophane).

An electronic interaction is thus set: the TCNE moiety (red) pulls electrons away from the paracyclophane moiety (blue). Each of the two benzene rings donates electrons, as shown by the horizontal arrows, which the TCNE avidly pulls:



But we are moving too quickly: this last image already translates into the iconic language of *chemistry* the information latent in the very first image as provided by *spectroscopy*.

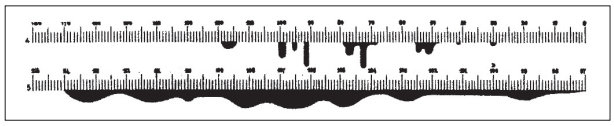
Extrapolating to a trend from discrete data points

At the time of the study by Cram and Bauer, the study of charge-transfer processes was in full bloom. A charge-transfer process occurs when, because of a

sticky collision between two different molecules, electron density flows from one molecule to the other. Each curve in the spectrum results from such an event.

A relevant question, left unanswered by these spectra is that of the geometry of the collision complex: is it a sandwich-type, with the TCNE inserted in-between the two benzene rings; or is it an outer complex, with the TCNE positioned on top of one of the benzene rings? Spectroscopy of other sorts can help answer such questions.

Spectroscopy was devised in mid-nineteenth century by Bunsen (1811-1899) and Kirchhoff (1824-1887). Art influenced science. The very first mode of representation chosen by Bunsen was to depict a spectrum in silhouette manner; it looked like a mountain range, shown upside-down (1864):



The lingering effect of this initial choice, now that spectra are shown as line drawings, is in the vocabulary, with its "peaks" and "valleys." Each of the eight curves in the first diagram on page 61 — each on a different paracyclophane — has two peaks. They document a gradual shift of one of the peaks toward longer wavelengths (toward the right in this graph). It turned out that the more basic the paracyclophane hydrocarbon (that is, the better it is at electron donation), the more electron pumping into TCNE occurs. The attendant charge-transfer band shifts to longer wavelengths.

Looking at that diagram, a chemist's eye immediately sees the trend for gradually greater basicity of the paracyclophanes. In an instat, then, a chemist can extrapolate from a set of separating pictures to a unifying hypothesis.

From simple to complex

This is the gist of this work, generalizing the notion of basicity (the converse of acidity) to these chemicals, called aromatic hydrocarbons. (And thus, to give it its technical explanation, to *pi* electrons instead of *n* electrons as is the case for traditional bases, such as nitrogen-containing molecules.) There is much more that spectroscopy can do with these molecules. The authors, Cram and Bauer, did not attempt to "deconvolute" each spectrum into its component absorptions. Thus it would be mistaken to equate the apparent absorption maxima (the red dots added to the figure) with the true maximum, as is often done. The "real" spectra are far more complex and spiky than these smooth curves suggest.

So spectroscopy is a signal example of a technology that began as a sensuous science, with all the colors of the rainbow, and gradually lost its visual content. We reproduce the one illustration from the 1950's experiment in a small size because it does not need to be any larger: it has no crucial visual details except the progression of peaks to the right. The Vreeland spectroscope is a survivor of the field's past. Today spectroscopic analyses do not even need to be given as graphs, although they often are. Numbers are all that is required in the end.

Resisting big science

More generally, spectroscopy is the handmaiden of chemistry. At the time when the work on paracyclophanes was carried out, research was on the rise on account of Vannevar Bush's report to the President of the United States, titled *Science: The Endless Frontier* (1945); chemistry laboratories were undergoing a qualitative and quantitative mutation. They were equipping themselves with extremely expensive commercial spectrometers. Within a few years, the cost of running a chemical laboratory increased between one and two orders of magnitude.

Chemists, who were following the lead set by physicists, were thus presented with the dilemma of embracing Big Science or sticking to their traditional, low-tech craft. For the most part, they opted for the latter. They went for the heavy equipment, but they managed to avoid it affecting the style of their research; chemistry continued to be done in small groups, with emphasis on manual dexterity, and on quick experiments which could be initiated in the morning and provide results in the afternoon. In a sense, spectroscopy retains the simple formats it once had.

For further reading

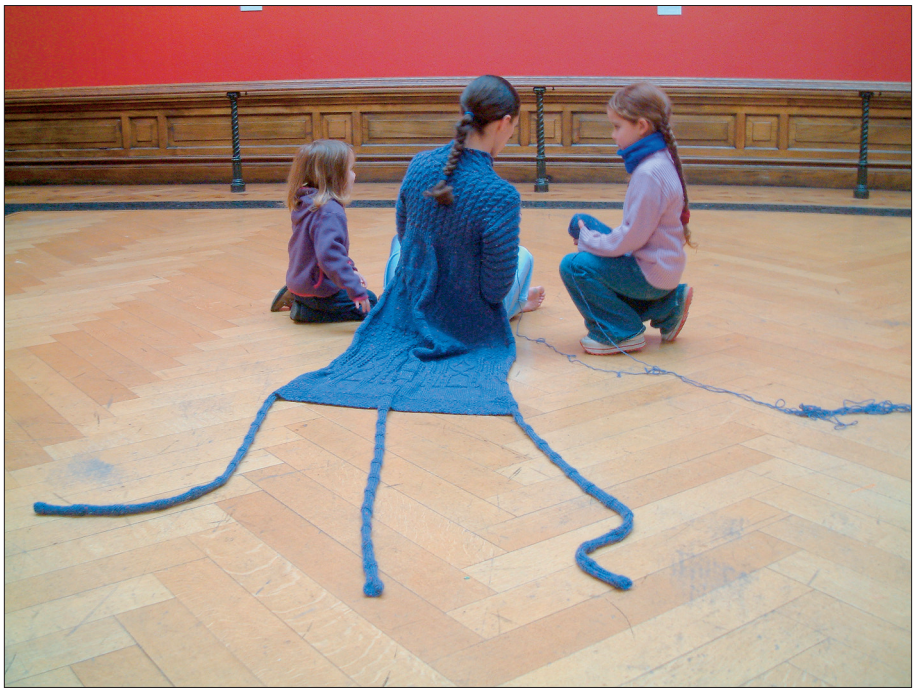
The report *Science: The Endless Frontier* is available at www.nsf.gov/od/lpa/nsf50/vbush1945.htm. For the early work on paracyclophanes, see D. J. Cram and S. H. Bauer's paper in the *Journal of the American Chemical Society* 81 (1959): 5971-77.

2

How is Performance Documented?

Bernadette Sweeney

Performance is a notoriously ephemeral medium. Some artists make a virtue of that, but for others it presents a problem: how can a work whose meaning is in the making be preserved? The photos in this chapter record performances by the artist Jools Gilson-Ellis and others. In the nature of performance, these events varied hugely: one was a large outdoor event (held, as it happened, in a misting rain), and others were seen by fewer people.



The idea

Performance art, which has become increasingly important since its beginnings in the 1960s, continues to present difficult problems for historians and critics. Once the performance is over, what remains? Usually written descriptions, photographs, and sometimes also video.

Are those documents then the performance, as it will be known to future artists, historians, and critics? Or are they a kind of documentation that will always be inadequate? (And if so, how can we say how inadequate?)

Problems: the body

One crucial problem is that performance is about the body, and so it can never be put adequately into words. As Peggy Phelan has observed, performance moves from the "grammar of the word" to the "grammar of the body." How, then, to do that justice in videos and photographs? Two of these images document a knitting project, in which the artist worked with people in many different settings; part of those events was a closeness between people. Photographs can only capture that by reminding us of what it might have been like: a mnemonic prod, as much as a realistic record.

Problems: time

A second problem is that performance is a "time art": it cannot, by its nature, be documented in 2-D or 3-D. W.B. Worthen has noted that "all writing about performance must face its own impossibility: the event is gone, [and] the records are always partial and suspect."

It is a difficult starting-point for any documentary project. In one photo at the top of the previous page, a man is slightly out of focus, giving a sense of his motion; in the photo below, two figures move across a dark field and are intentionally blurred to evoke their gestures and speed. In such ways photography translates bodily motions, and our perceptions of them, into conventional equivalents.

The uniqueness of performance art

Recently, Phelan and others have proposed that performance art is unique exactly because it cannot be documented. Irit Rogoff and Gavin Butt at Goldsmith's in London have suggested that an entirely new kind of writing needs to be developed to adequately respond to performance. It is not enough, they say, to simply describe or document: the critic or historian has to enact the performance through writing. Journals like *Performance Research* and books such as *ReMembering the Body* try to embrace the new ideals.

In this way of thinking, performance demands not only sensitive and thorough documentation, but a new kind of documentation. The practice reflected in these documents is one of questioning: I ask about the relationship between the languages of the script, the stage, and the critic, and about what happens during the performance moment when "the word" is made flesh — or, in the end, what then happens when the performance is critiqued and the "flesh" is made word.

The place of the visual

Visual documentation, whether it is video or photography, brings with it an ideology and an aesthetic which prevent it from functioning simply as evidence. The visual becomes suspect: it is no longer evidential, but contentious. That is true, in varying degrees, of every image in this book: but here it can be perceived as a crippling defect. Performance art is, in this sense, immune from the danger of being reduced to documentary evidence.

For further reading

After Criticism: New Responses to Art and Performance, edited by Gavin Butt (Maiden MA: Blackwell, 2005); Peggy Phelan, *Unmarked: the Politics of Performance* (New York: Routledge, 1993), quotation on p. 150; *ReMembering the Body,* edited by Gabrielle Brandstetter and Hortensia Völckers, with contributions by Bruce Mau and André Lepecki (Ostfildern-Ruit: Hatje Cantz, 2000) (I thank Michelle Tupko for this reference – J.E.); W.B. Worthen, *Theorizing Practice: Redefining Theatre History* (New York: Palgrave Macmillan, 2003), quotation on p. 6; and Bernadette Sweeney, "Wordmadeflesh: Writing the Body in Irish Theatre," *Modern Drama* 47 no. 4 (2004), quotations on p. 686.

3

Deductions from Smooth Rocks

Bettie Higgs

Most of the rocks in this photograph are about 360 million years old, so the grains that comprise them are substantially older.

The grains came originally from a mountain range, as large as the Himalayas, whose roots can still be seen in counties Mayo and Donegal, in the northwest of Ireland. The grains were carried south by rivers and deposited in this area; the smallest grains were carried all the way to the ocean, which was far south of Cork at the time, in what is now the Atlantic Ocean south of Ireland. (There was very little rainfall at the time: the portion of land that is now Cork was 10° south of the Equator. This can be deduced from the properties of the iron in the rock.)

The water in which the grains were transported was oxygenated, and the iron precipitated out as iron oxide (hematite), which cemented the grains and which accounts for the red colour.

Aeons underground

The grains were buried by overlying sediment, forming fine layers. (They can be seen in the photo on the next page.) As the grains were cemented into rock, and the layers built up, the sea encroached from the south. The sea slowly flooded the land, and for a time it was nearly 1000m deep in this area. These rocks were several kilometres beneath the ocean floor.

Then the layers were uplifted, and folded, forming the Variscan mountains. The remains of these mountains are seen today throughout counties Cork and Kerry, in the west and southwest of Ireland. Once again the area subsided under the sea (between 200 million and 100 million years ago). More sediment accumulated — this time chalk.

Then, during the past 60 million years, the strata uplifted again, as a distant part of the Alpine mountain building event. The layers on top eroded away; and in the last 1 million years glaciers scoured off still more layers. Eventually, the rocks you see now were exposed.

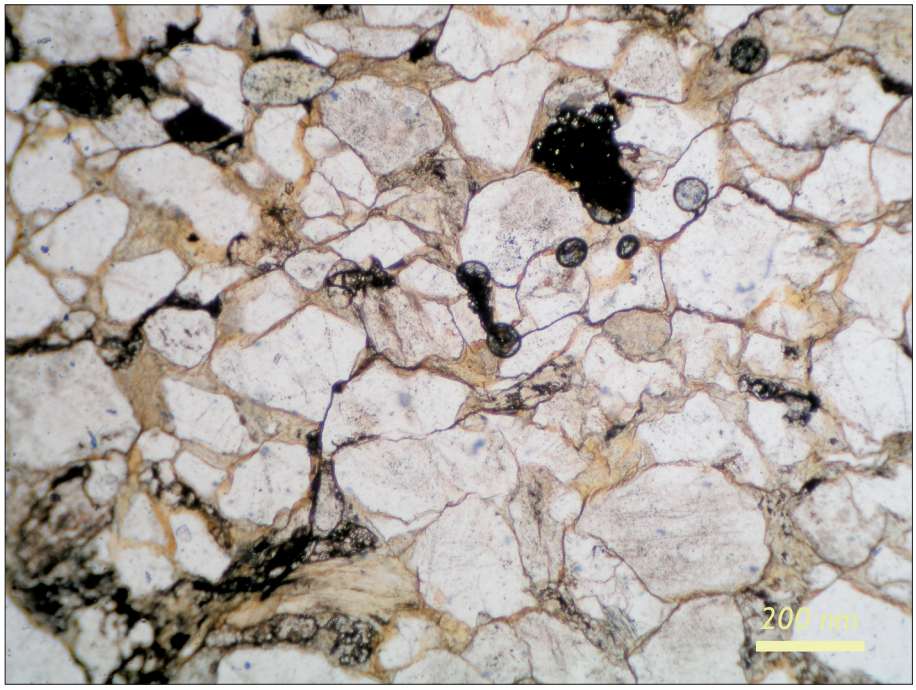
The pieces the glacier scoured were sharp and angular. These rocks were rounded by glacial melt water and by ocean waves during the last 10,000 years.

Shape of grains

The same reasoning can be applied to the grains in the rock, which are from mountains and strata older than 360 million years. Through a magnifying glass it is possible to discern some angular grains and some rounded ones. A microscope shows the shapes even more clearly (see the photo on the next page).

Differential wear

The shape of grains depends on the nature of the mineral: some grains in the rocks are made of quartz and so are relatively hard and resistant to weathering. This quartz is white or colorless, and has a glassy appearance. Other grains are composed of softer minerals, such as mica, which wear more quickly. Mica is visible as silvery flakes in the rocks.



How much can be told by shape?

There is a limit to how useful this is. Some of these rocks are comprised of materials which are harder and wear more slowly than others. The pink crystalling rock at the right in the opening photograph was actually a "grain" in a 360 million year old sediment. The rounding to give the rock this almost spherical shape took place before this time. Here the layers — seen close-up on the next page — are not sedimentary layers. Heat and pressure has caused the separation into bands of quartz and pink feldspars, and dark coloured micas and amphiboles.

Another limiting factor is that the rocks become rounded more quickly in quick-flowing streams, and more slowly in lakes where the water current is less energetic.

Likewise some grains are very round — nearly perfect spheres — but that does not mean they are the oldest. By looking at the shape of the grains within the rock geologists can tell if the grains were transported by water or by wind. Windblown quartz grains are perfectly rounded, and have a matt surface texture. Grains transported by water are not so well rounded and have a glassy surface texture.

This is the beginning of the analysis. There are many more factors to consider, including the composition of the grains, and the heat and pressure to which they

were subjected when they were buried. Those factors are part of Pat Meere's study, Chapter 23.

For further reading

Ivor Mccarthy and Pat Meere, *Geology of the Devonian-Carboniferous South Munster Basin, Ireland* (Cork: Department Of Geology Report, UCC, 2004); A.G. Sleeman and M. Pracht, *Geology of South Cork* (Dublin: Geological Survey of Ireland, 1994); Raymond Siever, *Sand* (New York: Scientific American Library, 1988); F. J. Pettijohn, P. E. Potter, and R. Siever, *Sand and Sandstone*, second edition (New York: Springer-Verlag, 1987); and Elkins, *How to Use Your Eyes* (New York: Routledge, 2000), chapter 23, "How to Look at Sand."

CONSTITUTIONAL POLITICAL ECONOMY

Vol. 2, No. 2 Spring/Summer 1991

ARTICLES

REVIEWS

Center for Study of Public Choice
George Mason University

4

A Wandering Image of the Sirens

Brendan McElroy, John Considine and James Elkins

The picture on the cover of this journal is Odysseus, tied to the mast of his ship, listening to the song of the Sirens: a familiar image, but an unexpected icon for this journal. The familiar story comes from the *Odyssey:*

> First you'll approach the Sirens, who charm all
> Men who come near them. He who witlessly
> Draws near and listens to the Sirens' voice
> His wife and infant children never shall
> Stand joyful by, when he comes home. Instead
> The Sirens with their shrill song shall him charm.
> They sit in pastures. Yet around them lies
> A heap of rotting men, mere skin and bone.
> Drive past this place, but first knead honeyed wax
> And stop your comrades' ears, lest any hear.
> But if you wish yourself to hear their song,
> Have your men tie you up both hand and foot
> Upon the swift ship's mast-box, standing up,
> With cables lashed around, so that you may
> Delight in listening to the Sirens' song.
> But if you beg your comrades and demand
> Release, they are to bind you closer still.
>
> — Homer, *Odyssey* 12.39–54: *The Sirens*, newly translated by Keith Sidwell

The sirens in economic theory

Two economists at the University College Cork, Brendan McElroy and John Considine, were interested in the fact that this journal has taken the picture of Odysseus and the Sirens as an emblem of what is called in economics the *time inconsistency problem.* This arises when it is known that the incentives facing

individuals will change due to the passage of time, making it unlikely that they will carry out plans that benefit all participants. The journal of *Constitutional Political Economy* uses the image of the Sirens to illustrate the use of binding rules to overcome the time inconsistency problem. Here is how the editors of the journal explain it in the journal's inaugural issue:

> [*Constitutional Political Economy's*] logo is a representation of the familiar Homeric account of how Ulysses heard the Sirens' singing, and survived. By exploiting elements of his natural and social environment, Ulysses was able to subvert certain inclinations of his future self, inclinations that he knew would be destructive of his overall interests but which would nevertheless prove irresistible when they arose. Ulysses imagined the alternative possible futures; he isolated the best for himself; but he required the technology of mast and rope to secure the best possible future. He established for himself a private constitution, a set of more or less binding rules that constrain his future choices (Brennan and Kliemt, 1990, 125).

The time inconsistency problem in more detail

The less than perfect enforcement of contract in some third world countries, for example, results in the majority of markets in these countries being *spot markets,* where both sides of a transaction fulfil their obligations on the spot. Similarly, a government may seek to balance the public sector budget over the business cycle, running a deficit to stimulate the economy during recessions and keeping a surplus during boom times. However, the temptation to spend the surplus or cut taxes during boom times may prove too great, leading to a fiscal policy that has a destabilizing effect on the business cycle, with excessive booms and deeper recessions.

The inability of individuals to commit to a course of action means that many potentially beneficial economic exchanges are not consummated. To avoid such a problem there is a need to provide a commitment mechanism such as enforceable rules and laws.

The time inconsistency problem arises in many areas of Economics including investment decisions in developing countries and budgetary policy. Many entrepreneurs do not undertake potentially profitable investments in developing countries because the less than perfect enforcement of contract law means that they cannot get a credible commitment from other entrepreneurs in these countries. Would you produce and deliver goods if you knew that if payment is not received, the contract may be unenforceable?

Budgetary policy provides another example of the benefit of rules. A government working in the public's interest would attempt to balance the public sector budget over the business cycle, running a deficit to stimulate the economy during recessions and keeping a surplus during boom times to balance things up. However, the temptation to spend the surplus or cut taxes during boom times may

prove too great, leading to budgetary policy having a destabilizing effect on the business cycle, with excessive booms and deeper recessions. To prevent governments from succumbing to this temptation, some economists believe that governments should be bound by the constitution to balance their budget. Indeed, the E.U.'s Growth and Stability Pact is a variant of such a rule.

The sirens in the history of art

So: the image seems appropriate for *Constitutional Political Economy,* but there are other dimensions to the image that have — apparently — little to do with economics.

In the history of art, the image of the Sirens has been used for many purposes. They have represented licentiousness and "animal appetites." They have been taken as emblems of the *femme fatale,* and they were popular in turn-of-the-century decadent art. In the late nineteenth century, they represented Oriental culture (even though they were Greek).

The sirens in philosophy

And there is still more to the story of the Sirens: it has also been used in Anglo-American philosophy, as an emblem of the problem of *akrasia,* weakness of will: a philosophic problem wholly unrelated to the time inconsistency problem or to the moralizing uses of the past. In this way the history of images continues on its uneven way.

What's strange about this

In the history of art, images are usually thought of as having continuous histories: a picture like this might be used to make an ethical point, then a moral one, then a sexual one — all the meanings flow into one another, growing organically as cultures and communities change. The study of such meanings is part of iconography.

But in recent art history, scholars have been paying more attention to images that don't behave so well: their meanings jump and shift unpredictably. Historians such as Georges Didi-Huberman have pointed out how images can resurface at unexpected times and places, and with unpredictable functions. The result is a kind of psychoanalysis of culture rather than a historiography. Images have lives that go well beyond their intended uses, and beyond the disciplines that may want to own them. (In the United States, Ajax, a great hero of the *Iliad,* lives on as a laundry detergent.) Even an image from the journal *Constitutional Political Economy* can make its way into a history of images that is open to wider models of influence. The time inconsitency problem is just one episode in the

history of images of the Sirenes, and the methodology that might link it to its other appearances in art and in philosophy has get to be invented.

For further reading

G. Brennan and H. Kliemt, "Logo Logic," *Constitutional Political Economy* 1 no. 1 (1990): 125-27; J. Buchanan and G. Tullock, *The Calculus of Consent* (Ann Arbor, MI: University of Michigan Press, 1962); G. Brennan and J. Buchanan, *The Power to Tax* (Indianapolis, IN: Liberty Press, 2000); Jean Seznec, *The Survival of the Pagan Gods: The Mythological Tradition and Its Place in Renaissance Humanism and Art* (Princeton, NJ: Princeton University Press, 1953); and Georges Didi-Huberman, *l'Image survivante, Histoire de l'art et temps des fantômes selon Aby Warburg* (Paris: Minuit, 2002). The "logo" was also noticed by Hartmut Kliemt of the University of Duisburg-Essen, in an essay called "The Rationality of Rational Fools: The Role of Commitments, Persons and Agents in Rational Choice Modeling" (available on the university's website, accessed August 2006).

5

Color Terms in Medieval Ireland

Caitríona Ó Dochartaigh and John Carey

Some languages have hundreds of words for colors; others have just a few. According to one linguist, the normal number of "basic" color terms in any language is eleven: beyond that the color terms are dependent on particular references ("peach," "lavender," "Payne's gray").

There are three variables in color names: their forms in different languages ("red," "Rot," "rouge"); what they denote (reflectances, spectra); and the concepts that supposedly order them ("primaries," "color wheels"). According to some theories, color names evolve principally when there is a need: people coin them and adapt them in response to their environment. Another theory is that the evolution of color terms is governed as much by linguistic rules as it is by perceptual constraints.

In our field of medieval Irish studies, color theory remains largely unexplored, and many intriguing questions remain open. For instance, the Irish (and Welsh) adjective *glas* can refer to the colors which we call "blue," "green" and "grey"; how were these colors perceived by people who made no verbal distinction between them? According to the color theorists Brent Berlin and Paul Kay, languages which do not make this distinction stand at a relatively early point in the development of a color vocabulary: but how do we square this with the passionate love of color which is so obvious in medieval Irish art and literature?

The Book of Ballymote *and Ogam script*

The manuscript illustrated here is in the Royal Irish Academy in Dublin. It was written around 1400 in the town of Ballymote, in County Sligo in northwest Ireland, under the patronage of a family named MacDonagh, by various hands. Much of the content of the *Book of Ballymote* consists of Gaelic historical, legendary and genealogical material, as well as translations of classical works, but it also includes a unique grammatical treatise entitled *Auraicept na n-Éce*s or "The Scholars' Primer." *Auraicept na n-Éce*s is the first attempt at a systematic analy-

sis of the structure and grammar of the Irish language and is one of the earliest European vernacular grammars in any language. The author was interested in many aspects of the Irish language, including the Ogam alphabet.

Ogam (pronounced AWG-am or OH-am; spelled Ogham or Ogam) is a script whose letters take the form of lines, like hatchmarks. The earliest Ogam takes the form of notches carved in standing stones; it is known as Orthodox Ogam. This early alphabet used a series of twenty characters arranged in four groups. The first photo is a standing stone in Ireland, marked with Orthodox Ogam; the inscriptions are usually names.

There is another, later type of Ogam, usually referred to as Scholastic Ogam, which is found in medieval manuscripts. This later form takes Orthodox Ogam as a starting point and develops many variations of the alphabet.

The author of *Auraicept na n-Éce*s was particularly interested in the classification system of Orthodox Ogam: the different sets of names for the Ogam letters, which are arranged in four groups of five characters. These four groups in the Ogam alphabet are identified by the first letter of each group: B, H, M, A. In *Auraicept na n-Éce*s the author was so taken with this classification system that he tried to group many other things, in no way connected with sound, under the letter headings. This resulted in groups which he labeled with titles such as "King Ogam." "Boy Ogam," "Water Ogam," "Cow Ogam," and "Sow Ogam." The page illustrated here has a number of such schemes. One paragraph in particular concerns visual metaphors for Ogam letters (in the red rectangle).

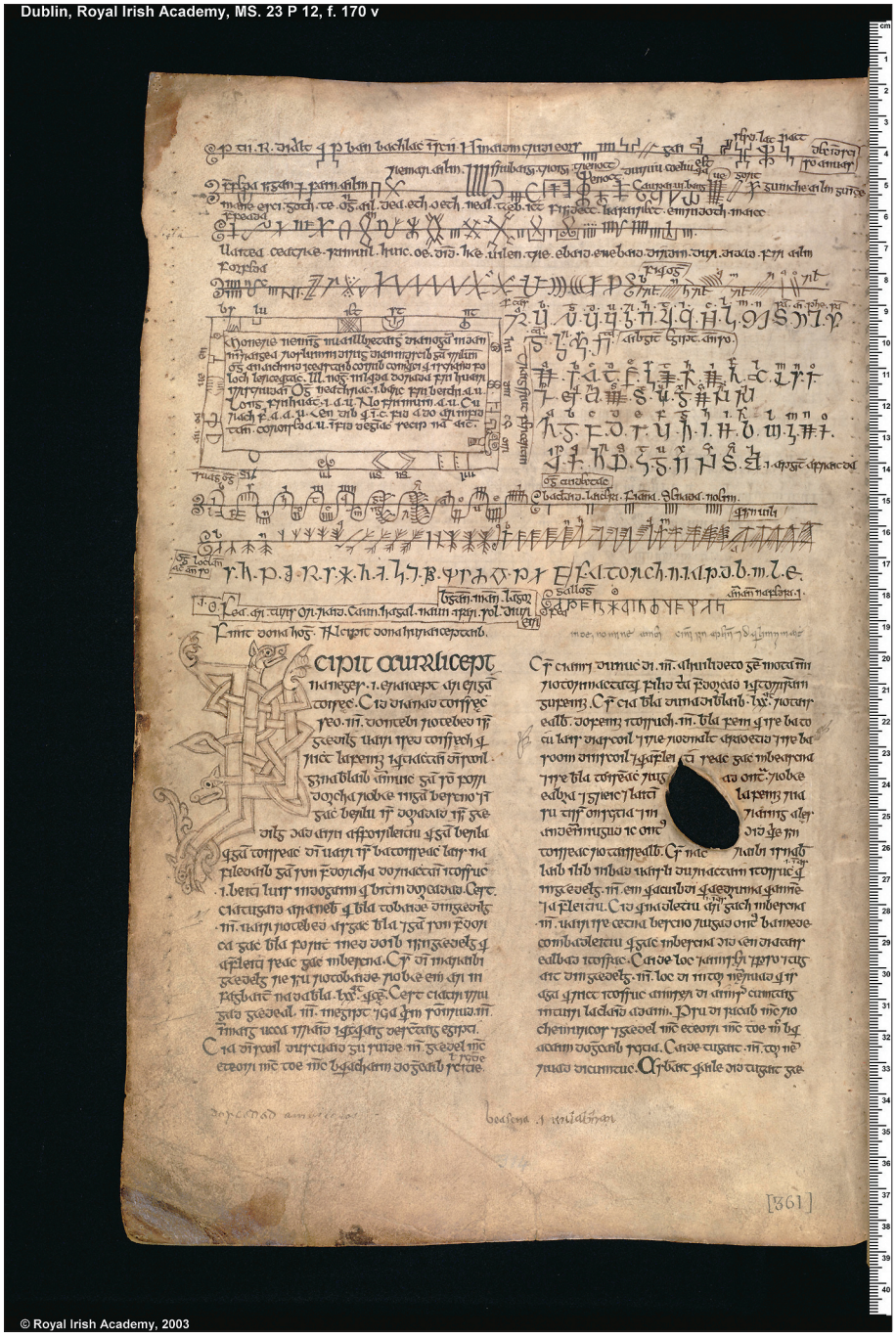
"Color Ogam"

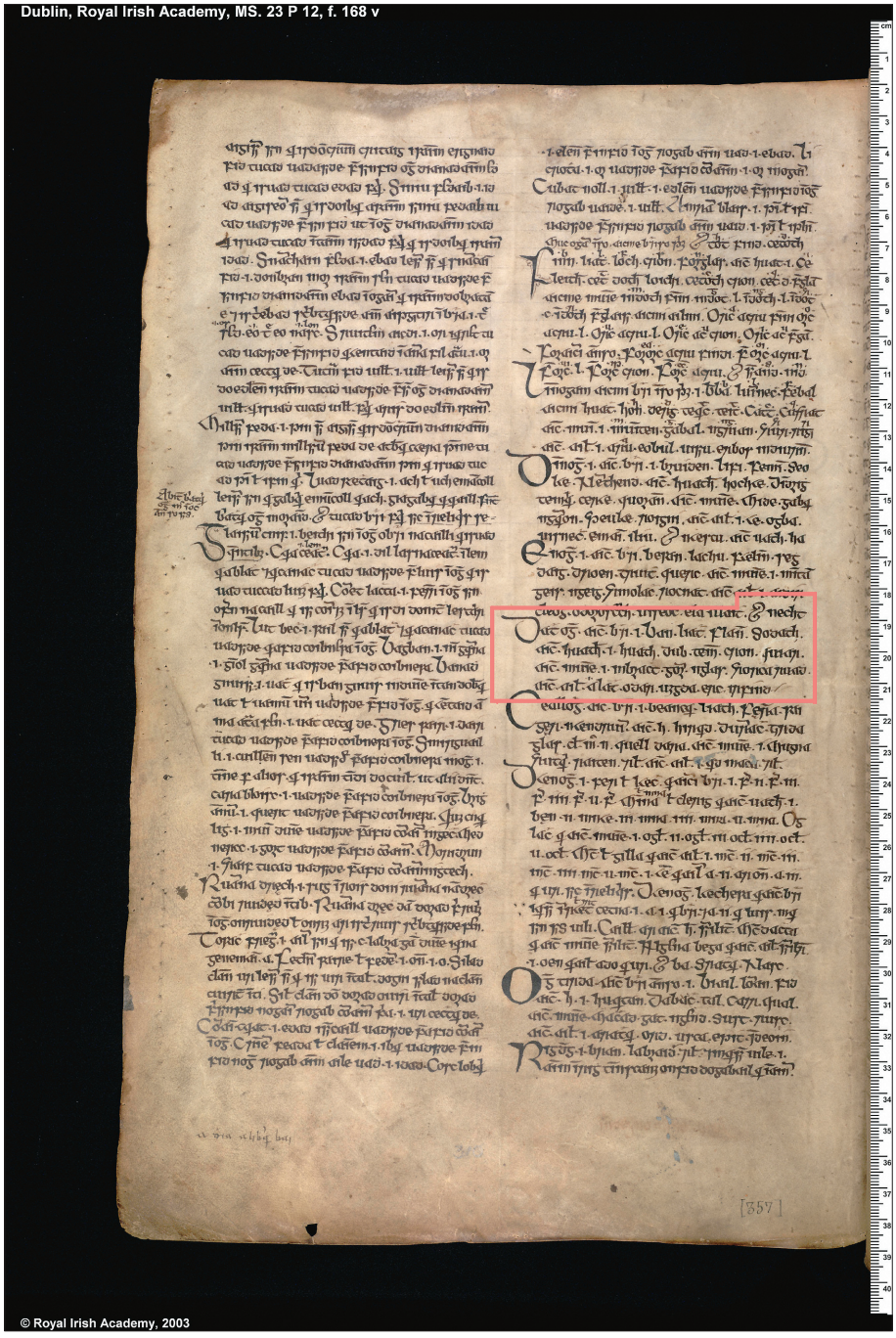
What we are interested in here is "Color Ogam"; it is of particular significance to those researching the history of color classification and terminology. The final illustration here is a detail of the "Color Ogam" passage. Below it is a transcription, in traditional Irish font, followed by the same in a modern font, and finally a translation. The groups are groups of letters in the Ogam alphabet, so the author is saying that one letter, like "A" in our alphabet, symbolizes "white," and another, say "B," symbolizes "grey," and so forth.

The inaccessibility of past color worlds

What, then, was the color experience of this writer? Are these color-terms meant to convey the range of his perceptions?

Why did he group certain colors together? Some of these color words are familiar in modern Irish, but the history of color terms warns us not to conclude that if the scribe who wrote this were here, he would agree with us on the identification of any of the colors.


Dublin, Royal Irish Academy, MS. 23 P 12, f. 170 v
© Royal Irish Academy, 2003


Dublin, Royal Irish Academy, MS. 23 P 12, f. 168 v

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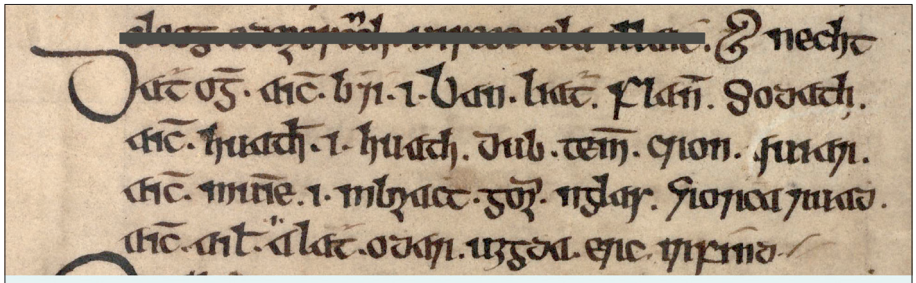


Dathogam. Aicme bethi .i. ban, liath, flann, sodath, necht.
Aicme huatha .i. huath, dub, temen, cron, quiar.
Aicme muine .i. mbracht, gorm, nglas, srorca, ruadh.
Aicme ailme: alath, odhar, usgdha, erc, irfind.

Dathogam. Aicme bethi .i. ban, liath, flann, sodath, necht.
Aicme huatha .i. huath, dub, temen, cron, quiar.
Aicme muine .i. mbracht, gorm, nglas, srorca, ruadh.
Aicme ailme: alath, odhar, usgdha, erc, irfind.

Colour Ogam. Group B, i.e., white, grey, blood-red, fine-coloured, clear.
Group H, i.e., earth-coloured, black, dark, brown, jet.
Group M, i.e., variegated, deep-blue, light-green/blue, bright, brownish-red.
Group A. piebald, dun, resin-coloured, speckled, very white.

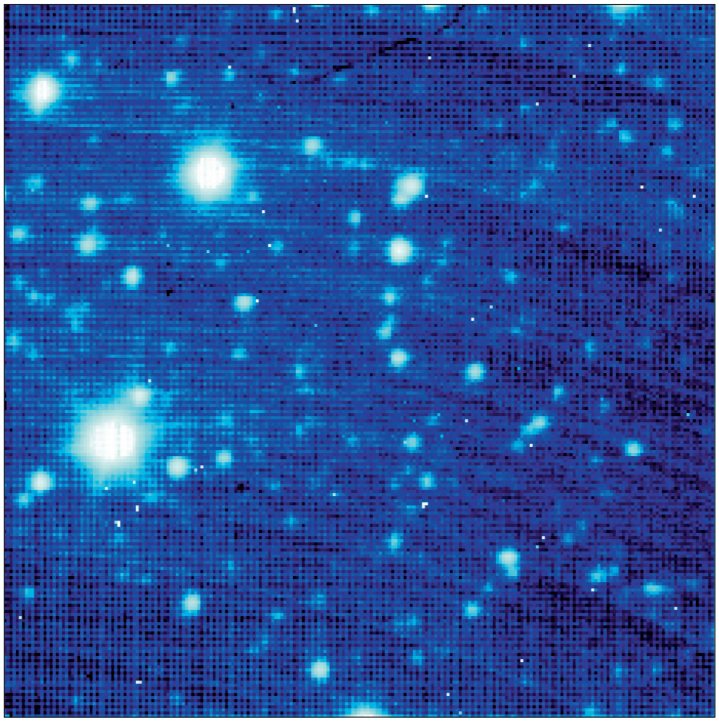
Other terms are unfamiliar, and some would not be thought of as a color at all. (What color is "speckled"?) The conceptual problem of re-imagining words into visual phenomena is even more intractable here than it is in, say, contemporary color science, where at least the problems can be quantified. In this case, color is entangled in language, culture and history.

A hidden motive

This example shows just how difficult, how tricky, it can be to try to understand other people's color perceptions. It also shows how odd the history of Ogam script is, from inscribed stones — studied in Chapter 22 — to elaborate and eccentric symbolic schemata. But there is another message here as well: this is the length to which we have to go if we want to enlist medieval Irish as a "visual" discipline. Some fields are just intrinsically non-visual, or resistant to visual meaning, and that recalcitrance has to be taken seriously in any project of analyzing visuality.

For further reading

The manuscript can be seen in all its 100MB splendor on www.isos.dias.ie (Royal Irish Academy: MS 23 P 12, ff. 168v, 169r, 169v). Information on Orthodox Ogam: Damian McManus, *The Ogam Stones at University College Cork* (Cork: Cork University Press, 2004); Francesco Benozzo, *Landscape Perception in Early Celtic Literatures* (Aberystwyth: Celtic Studies Publications, 2003); James Elkins, *The Domain of Images* (Ithaca NY: Cornell University Press, 1999). For Scholarly Ogham see: Heidi Lazar-Meyn, "Color Terms in *Táin Bó Cúailnge*", in *Ulidia*, edited by J.P. Mallory and Gerard Stockman (Belfast: December Publications, 1994), 201-205; George Calder, *Auraicept na n-Éces: The Scholars" Primer* (Edinburgh: John Grant, 1917). General background on medieval Irish color perception: John Carey, "Cosmology in *Saltair na Rann*", *Celtica* 17 (1985), pp. 33-52; Clare Stancliffe, "Red, white and blue martyrdom" in *Ireland in Early Mediaeval Europe*, edited by Dorothy Whitelock et al. (Cambridge: Cambridge University Press, 1982). Good introductory sources for color philosophy and science: *Color: Art and Science,* edited by Trevor Lamb and Janine Bourriau (Cambridge: Cambridge University Press, 1995); John Gage, *Color and Culture: Practice and Meaning from Antiquity to Abstraction* (London: Thames & Hudson, 1993); Hazel Rossotti, *Color: Why the World Isn't Grey* (Princeton NJ: Princeton University Press, 1983); Berlin Kay, *Basic Color Terms: Their Universality and Evolution* (Berkeley: University of California Press, 1969).



6

Doppler Tomography of Accretion Disks: Ultrahigh-Resolution Astronomy

Paul Callanan

One of the many achievements of astronomy over the last few decades has been to greatly improve the detail in astronomical images. This has occurred right across the electromagnetic spectrum — in radio, optical and even X-ray wavelengths.

High resolution radio images are accomplished by the techniques of interferometry. The best optical images are obtained using similar techniques from the ground, or by direct imaging from space. Even in the X-ray, the finely polished mirrors of the Chandra X-ray observatory (with surfaces fashioned to an accuracy of a few atomic diameters) generate images of comparable detail to those obtained optically from the ground.

Despite these advances, it remains very difficult to resolve the disk of a star, or of a planet orbiting another star. If astronomical image-making were possible with even higher resolution, then the door would be open to the study of many new phenomena.

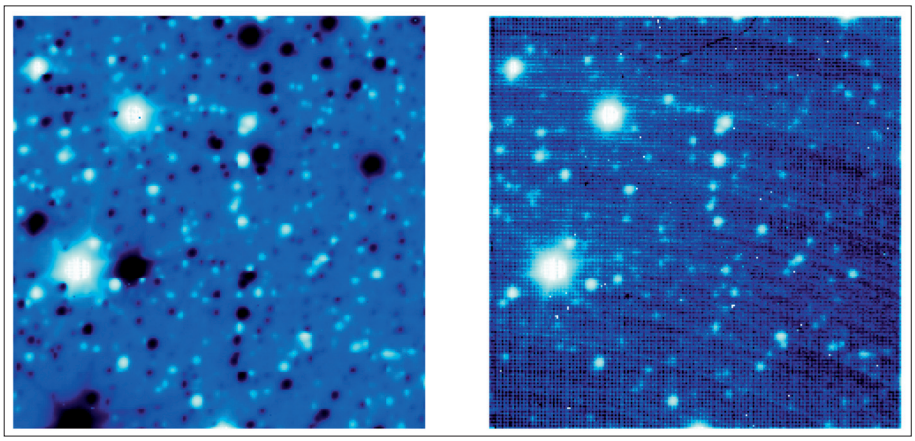
Two-dimensional stars

A relatively new technique has been developed to study a particular type of astronomical object, found in many parts of our Galaxy (and others).

Disks of gas are known to orbit many different types of stars. For example, a residue of material orbited the "proto-sun," before it settled down to life as a normal star. This material was initially in the form of a disk, from which the planets eventually formed. Such disks are observed around other young stars today.

Many binary star systems in our Galaxy also harbor such disks. In these systems, a neutron star, white dwarf or black hole orbits a companion star. The binary is so "tight" that material is accreted from the companion star to the

compact object, forming a disk as it does so. This "accretion disk" is heated by the viscous interaction of the gas and any irradiation from the compact object (often a highly luminous emitter of X-rays). It appears almost like a two-dimensional star, with a temperature that increases dramatically towards it center.



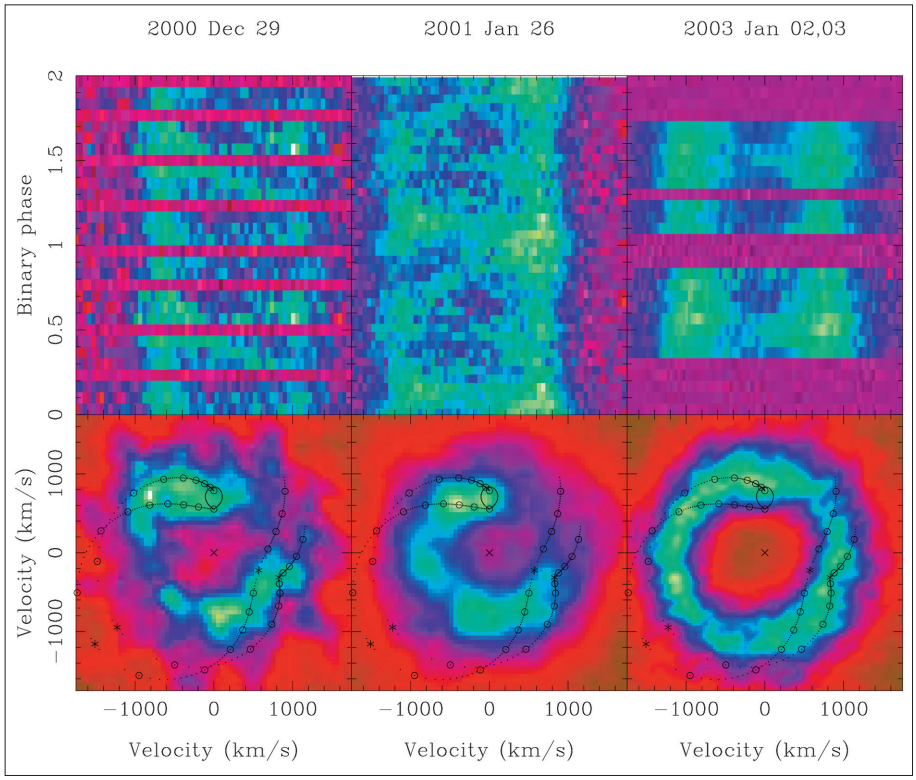
Indirect imaging of accretion disks

At first sight, the idea of studying the structure of such disks seems technically impossible. A disk comparable in size to the sun even at a moderate distace would require an angular resolution of a few millionths of a second of arc: that is 100 to 1,000 times smaller than the best resolution radio or optical observations can offer. Here, a candidate system is shown, but the phenomena that require study are nearly beyond the limit of the telescope.

However, many of these accretion disks are in binaries with relatively short orbital periods (several hours to days). Hence, we get to see various aspects of the accretion disk projected along our line of sight, and this allows us to construct maps of the accretion disk, in a way similar to that used in X-ray Computer Aided Tomography (CAT) scans. Indeed, the technique is called Doppler tomography of accretion disks.

In a CAT scan, X-rays are passed through a plane of the body from many different angles, and an image is obtained for each. These images can be combined using the "maximum entropy method" (MEM) to produce a reliable 2-D image of the X-ray absorption within the body.

In the case of a binary star, the system itself rotates for us. Hence we can observe the spectrum of the accretion disk from many lines of sight. This spectrum contains many emission lines; the structure and location of such lines provides us with information about the speed of the material from which they came. A



line with a laboratory wavelength of λ_0, say, is shifted to either longer wavelengths (to the red) or shorter wavelengths (to the blue) depending on whether the gas emitting the line is travelling towards or away from us. This is called the Doppler effect. (See Chapter 12 for another example.)

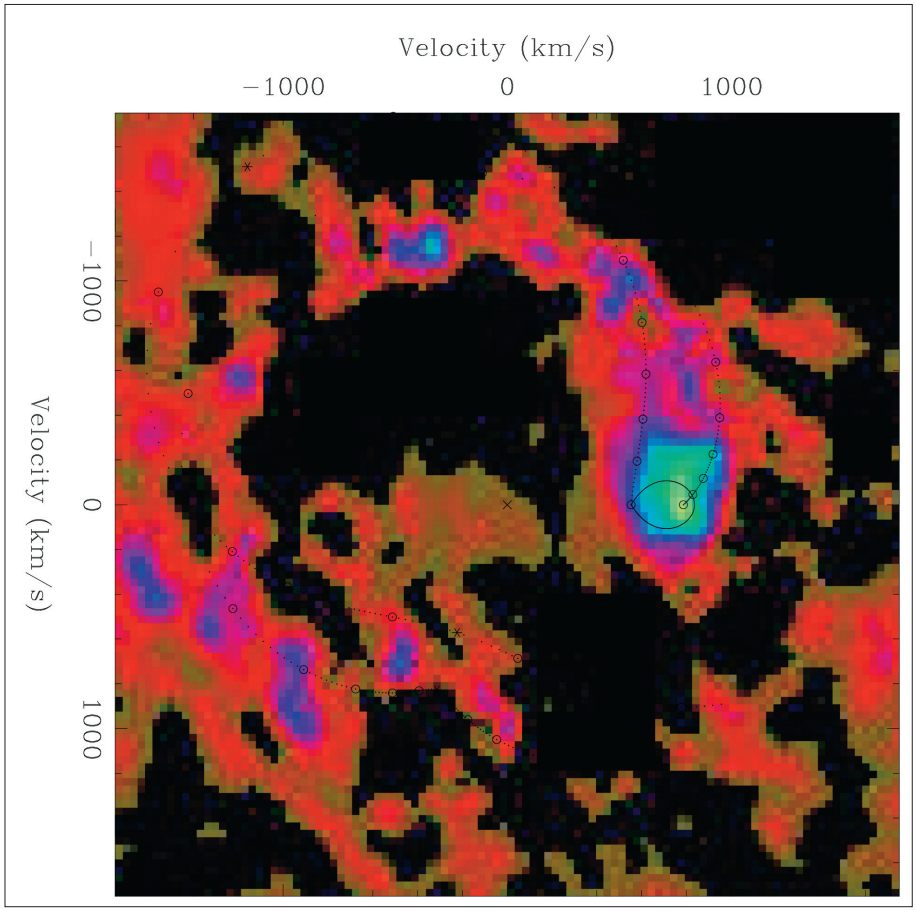
Spectrograms and Doppler images

Hence, these line profiles give information about the velocity of the gas in the disk, and from the variation of these profiles over the orbital phase we can create a map of the intensity distribution over the accretion disk — not in normal space but "velocity space".

The object here is the binary system with "black hole candidate" (a suspected black hole), numbered XTE J1118+480.

The top images here are "trailed" spectra of Hα emissions.

They are used to make "MEM Doppler maps," bottom, which record the position of the stars in the binary system in "velocity space": notice that both axes record velocity, and not position.



The result

By subtracting out symmetrical elements, it is possible to visualize emission concentrated toward the expected position of the secondary star of the pair.

The gas stream between the stars is the lower curve; the upper curve is the Keplerian disk along the stream; and the cross is the center of mass of the entire system.

If the material obeys Kepler's Laws as it orbits in the disk, then we can use the relationship between the gas velocity and its distance from the centre of the disk to generate, in theory, a map of the disk in real space.

As indirect as this technique is, it allows us to study phenomena that are otherwise completely inaccessible using other means.

For further reading

M.A.P. Torres, Paul Callanan et al., "MMT Observations Of The Black Hole Candidate XTE J1118+480 Near And In Quiescence," preprint at arXiv:astro-ph/0405509 (May 26, 2004).


M-0054-0021
Save View
Walkthrough
24
GLENFADA PARK NORTH
Close

7

The Bloody Sunday Tribunal Video Simulation

Darius Whelan

On Sunday, the 30th of January 1972, thirteen people were killed by British soldiers on the streets of Derry. The circumstances in which they died have been the subject of enormous on ongoing controversy. At the time, the British Army said that the soldiers had been firing at nail-bombers and gunmen. Many witnesses disagreed strongly, arguing that none of the shootings were justified because all of the victims had been unarmed civilians. A report was issued in the same year by the Widgery Tribunal; it found that there had been "no general breakdown in discipline" on the part of the soldiers, although some of the firing "bordered on the reckless." The coroner, reporting in 1973, concluded very differently that "it was sheer, unadulterated murder." In 1998, a new Tribunal was established to reassess the facts and provide a new report (photo at right). This Tribunal, chaired by Lord Saville, heard evidence for a number of years and is preparing its report as of this writing (winter 2006).

An interactive virtual reality system was developed specifically for use by the Bloody Sunday Tribunal in order to aid the orientation of witnesses when they gave their evidence. The system consisted of thousands of photographs and computer-generated images of Derry, both present-day and as it was in 1972.

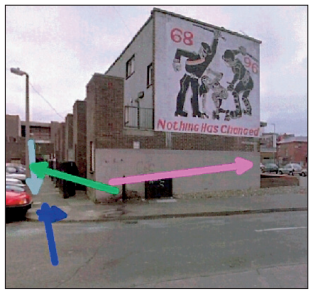
A combination of this application and touch-screen technology used in the hearing chamber allowed users to virtually walk the streets of Derry. Once a witness was viewing a particular "hotspot," he or she could view the scene from all angles. Witnesses could also draw arrows on the screen to record movements or events which they saw.

A sample piece of evidence using the virtual reality system

Ms. Nell McCafferty, a journalist, gave evidence that she witnessed certain events at a rubble barricade, including bodies being put into a jeep by soldiers (see the photo at the opening of this chapter). Mr. Christopher Clarke, QC, displayed a hotspot on screen and drew a blue arrow to indicate the line of sight she would have had from the window of a house in which she was located.

Following the line of sight indicated by the arrow, Mr. Clarke stated that Ms. McCafferty would have had a view of the rubble barricade. Earlier, another barrister, Lord Gifford, QC, had commented that as the house was slightly raised above the level of the ground, Ms. McCafferty would, when looking out of this window, have been able to see over the top of the fence.

A second piece of evidence

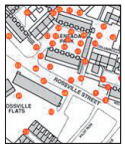


When Mr Denis Bradley (formerly Father Bradley) was called as a witness, he was shown certain hotspots on the screen and asked to point out exactly where he had observed a soldier standing when certain shots were fired. He marked the screen with various arrows. Then a barrister asked Mr Bradley the following question:

"The arrows show — the mauve arrow is where the people have been, the turquoise arrow is the route the soldiers came down, the green arrow is where the people were being taken by the soldiers back up into Glenfada Park North, the light blue arrow is approximately where the soldier was and the dark blue arrow is the direction into which he moved; is that right?"

Mr Bradley answered: "That is roughly correct."

The significance of the Virtual Reality system



In the earlier Widgery Tribunal hearings, extensive use had been made of maps, photographs and an architectural model of the area. The current Bloody Sunday Tribunal has vastly increased the amount of visual material available. The idea of bringing all of that information together into a virtual reality reconstruction (and including new images where necessary) proved to be of great assistance to the lawyers and witnesses trying to make sense of the complex events which occurred decades previously. Continuous reference was made to the photographs and maps, as well as the virtual reality recreation of 1972 Derry, especially as some buildings had been demolished since 1972.

Generally speaking, witnesses seemed to be quite comfortable with the virtual reality system, although it naturally took a few minutes for each witness to become familiar with this rather unusual means of representing the scenes. Witnesses quite often controlled the system, exploring the virtual space. Some witnesses corrected earlier statements based on what they saw on the virtual reality. For example, Mr Trevor McBride commented:

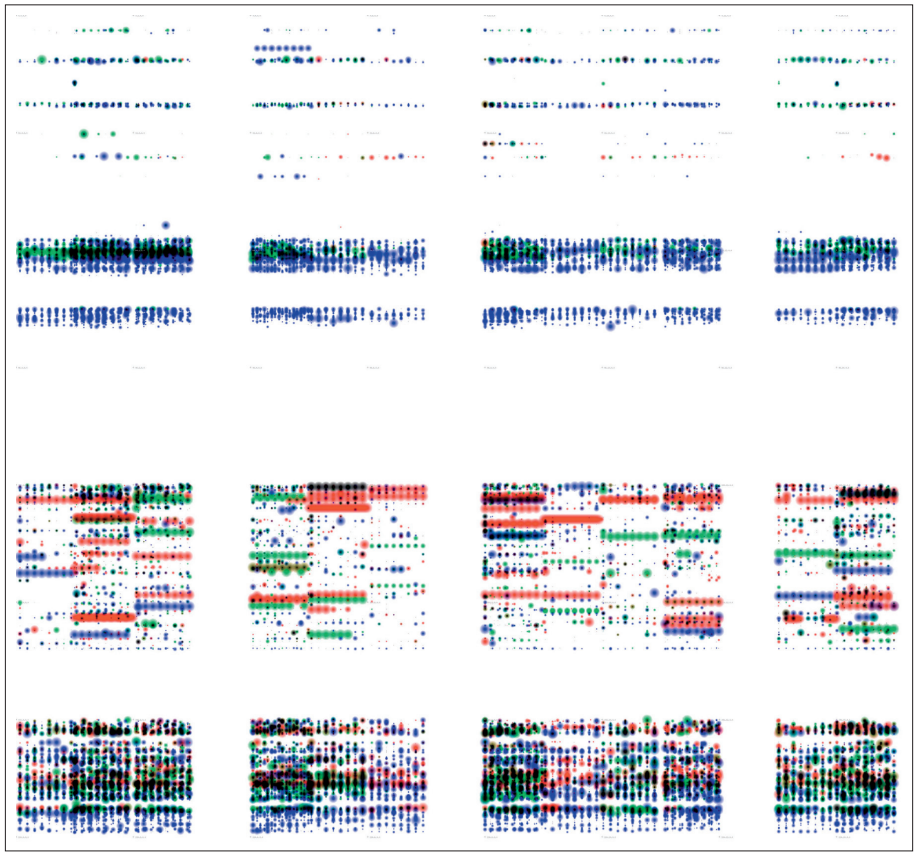
> Yes, if you can turn right, if I could put it like that again and maybe keep going right. I think just keep going right on. Now, if you could just stop there. I thought that I left the Shiels's home and came along this pathway, but I, I would not have been able to look to my right to have seen people lying at Abbey Park. So I think that the only route that makes any sense is coming down from Abbey Street down this little pathway where the tree is and then have glanced over to my right and have been aware of the people lying just where the car is, to the left of the car.

For the lawyers involved in the Tribunal, it was vital to be able to analyze the visual evidence in detail. It would not have been possible for a lawyer to participate in the Tribunal without studying maps, photographs, videotapes, and the virtual reality system in advance and being prepared to use those tools to clarify what witnesses were saying.

The Virtual Reality system made it possible to pose questions and to test witnesses' memories in a way that would not have been possible with photographs and maps. The Tribunal report is anticipated as this book goes to press; it will be interesting to see how the findings depend on the visual evidence and how it was deployed.

For further reading:

Bloody Sunday Tribunal website: www.bloody-sunday-inquiry.org.uk; British Irish Rights Watch Bloody Sunday Inquiry Reports: www.birw.org/bsireports/bsione.html; evidence of Nell McCafferty: Tribunal Transcript, Days 168 and 169; evidence of Denis Bradley: Day 140; evidence of Trevor McBride: Day 168. See further D. Mullan and J. Scally, *Eyewitness Bloody Sunday*, third edition (Dublin: Merlin, 2002); CAIN Web Service Bloody Sunday site: http://cain.ulst.ac.uk/events/bsunday/; UCR/California Museum of Photography Exhibition "Hidden Truths: Bloody Sunday 1972," January-March 2000: www.cmp.ucr.edu/photography/hidden/.

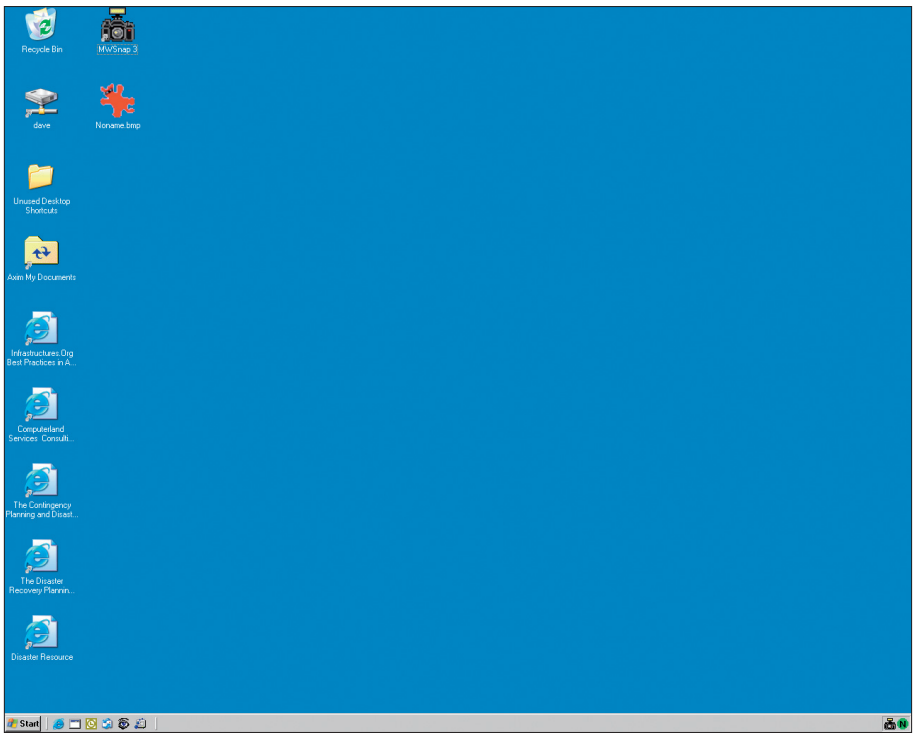


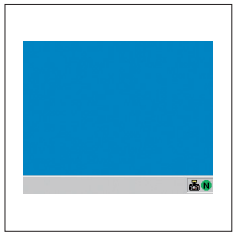
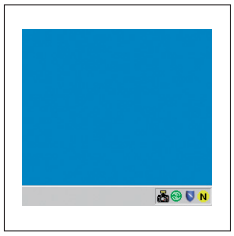
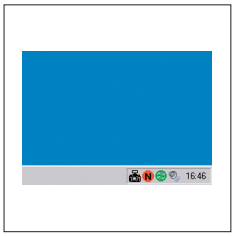
8

Maps of a University Computer Science Network, and the Internet

David O'Byrne and James Elkins

Nagios is software that monitors the status of computer servers; it is used for example in the Department of Computer Science at the University College Cork to watch the university's intranet. David O'Byrne has a copy of Nagios on his desktop computer, and he keeps an eye on the university intranet with the help of an icon in lower-right-hand corner of his screen.



When the Nagios icon is a green, all is well. If something is a slightly wrong, a yellow icon shows up; a more serious problem, and the icon turns red. This simple scheme means critical IT equipment cannot "die quietly" and saves the Computer Science IT staff from having to continuously check the status of the servers.

Pictures of the UCC network

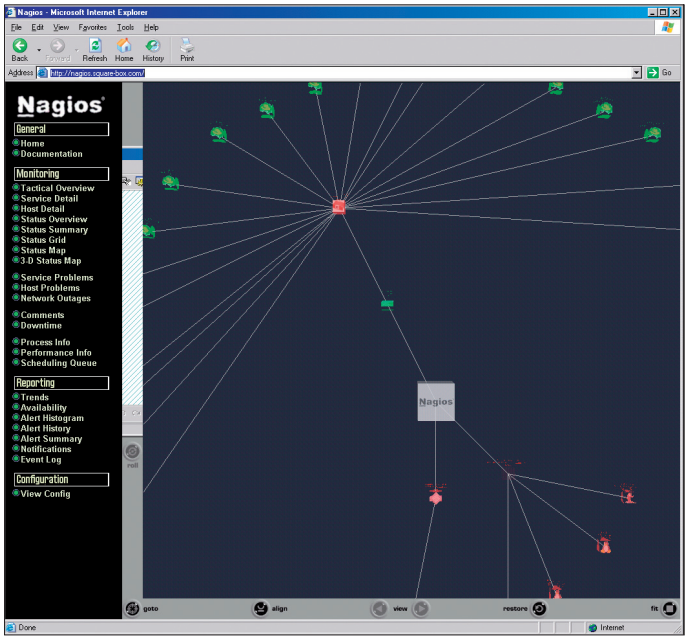
Once a problem is indicated, Nagios offers have choice of more detailed representations. There is a 3-D status map (top photo on the next page), but it does not give much information without zooming — notice the labels are illegible onscreen. The image shows a representation of the computer that has the Nagios software on it (the Large "Nagios" box) and a representation of the network links (lines) and Computer Science Server Computers (the green and red boxes). (In all these representations, the names of the servers have been changed for security reasons.)

Nagios also offers a 2-D status map (bottom photo on the next page). Here it is clear that connections between the net router (a server that communicates with the internet) are down, and also that the university firewall is not operative.

The non-graphical interface

IT staff prefer a non-graphical option: the tabular report called Host Detail (top foto on the second page following). It gives the most information, showing when the servers became inaccessible. Each server is listed. If the background is green, all is well for that server. If it is red, a problem has been encountered by the Nagios software. Further detail on what the problem was, and what time it was encountered are listed next to each server.

This is an instance of the limitations of images, because the 3-D view cannot provide the information that the tabular view can. But note that the missing information is not itself pictorial: what is missing is alphanumeric. It's a different question whether the 3-D representation *itself* conveys sufficient information to be useful. At UCC, at least, it does not.


Nagios - Microsoft Internet Explorer
Nagios
General
Home
Documentation
Monitoring
Tactical Overview
Service Detail
Host Detail
Status Overview
Status Summary
Status Grid
Status Map
3-D Status Map
Service Problems
Host Problems
Network Outages
Comments
Downtime
Process Info
Performance Info
Scheduling Queue
Reporting
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Availability
Alert Histogram
Alert History
Alert Summary
Notifications
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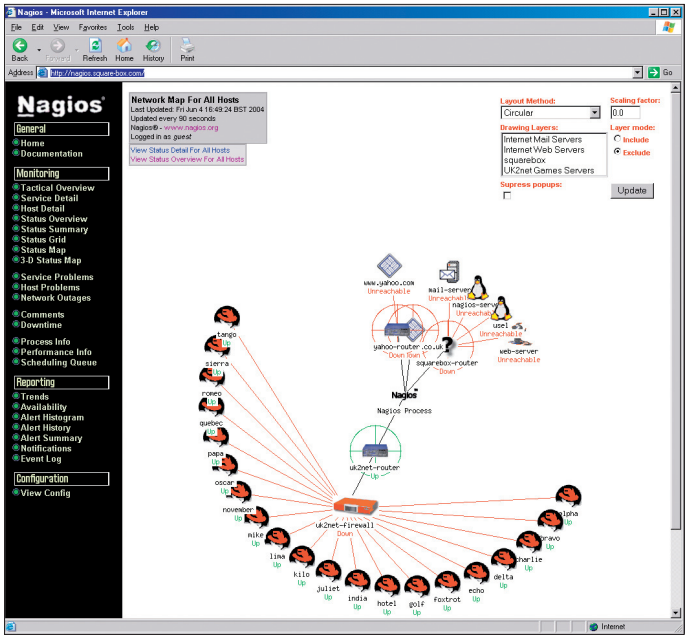
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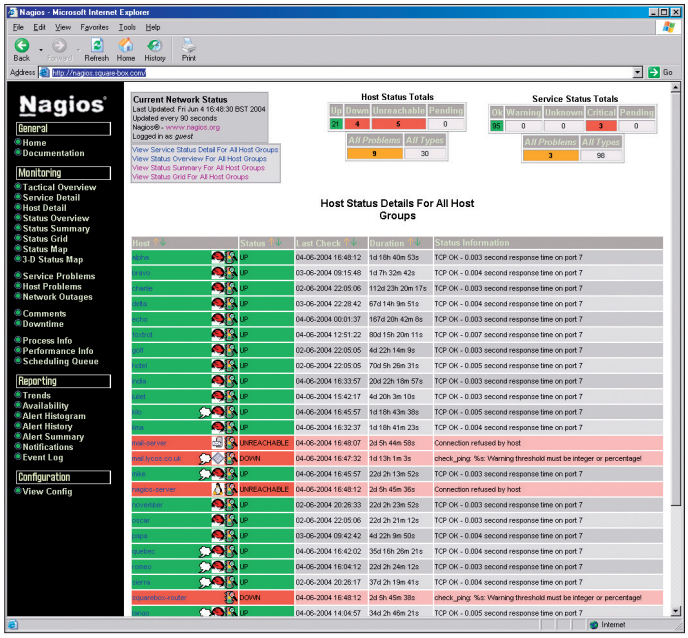
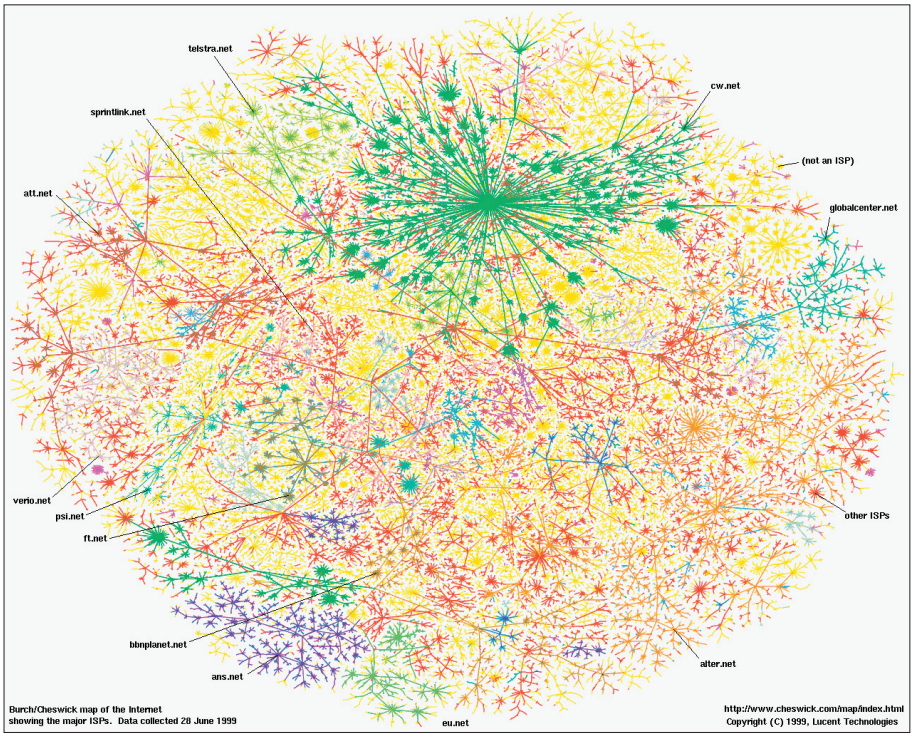
Drawing Layers:
Internet Mail Servers
Internet Web Servers
squarebox
UK2net Games Servers
Layer mode:
Include
Exclude
Supress popups:
Update
www.yahoo.com
Unreachable
mail-server
Unreachable
nagios-server
Unreachable
ussel
Unreachable
web-server
Unreachable
yahoo-router.co.uk
Down
squarebox-router
Down
Nagios
Nagios Process
uk2net-router
Up
uk2net-firewall
Down
tango
sierra
romeo
quebec
papa
oscar
november
mike
lima
kilo
juliet
india
hotel
golf
Foxtrot
echo
delta
charlie
bravo
alpha


Nagios - Microsoft Internet Explorer
Nagios
Current Network Status
Host Status Totals
Service Status Totals
Host Status Details For All Host Groups

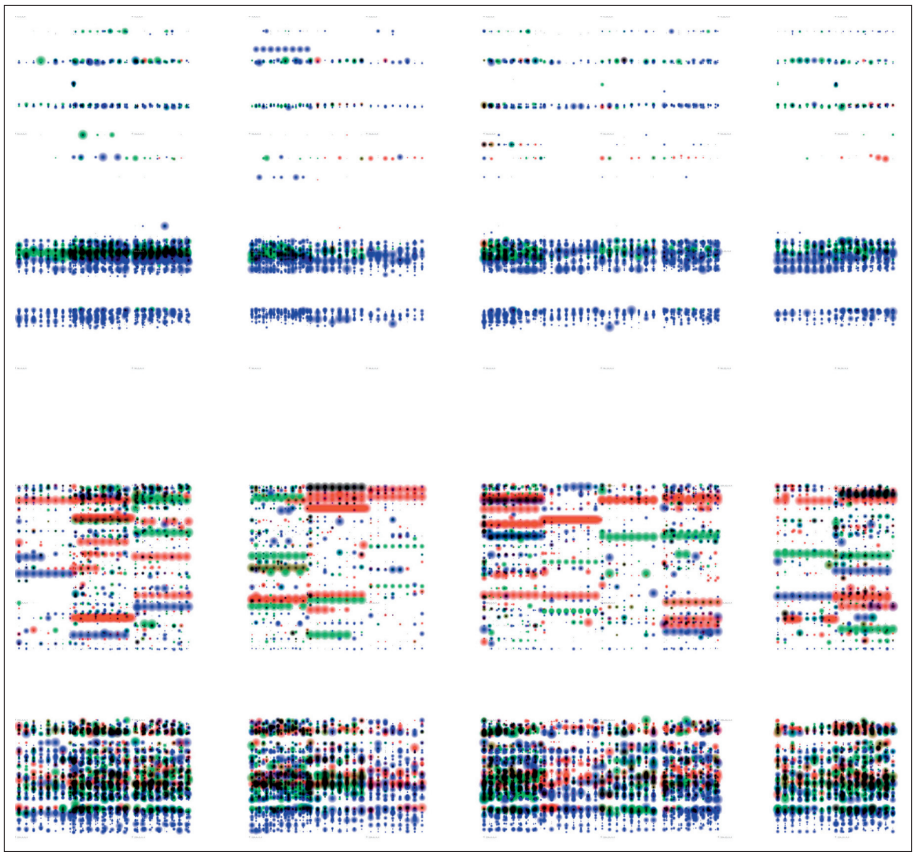

telstra.net
cw.net
sprintlink.net
(not an ISP)
att.net
globalcenter.net
verio.net
other ISPs
psi.net
ft.net
bbnplanet.net
alter.net
ans.net
eu.net
Burch/Cheswick map of the Internet
showing the major ISPs. Data collected 28 June 1999
http://www.cheswick.com/map/index.html
Copyright (C) 1999, Lucent Technologies

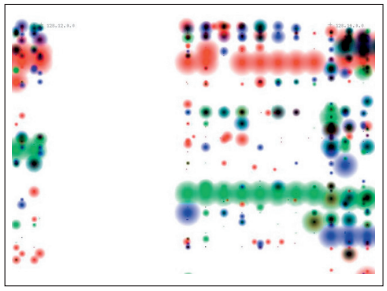
Other graphical representations

There have been many attempts to show the internet, and parts of it, as flowcharts and other 3-D and 2-D graphics. An online *Atlas of Cyberspaces* samples the possibilities, and the online journal *Mappa mundi* has published other kinds of maps. Most famously, Hal Burch and Bill Cheswick made a map of the entire internet that was featured in *Wired* magazine, showing the relative sizes of the principal internet domains (see the bottom photo on the previous page). There are a number of versions of this map, customized to showcase individual companies.

Artistic representations

In the world of internet art, there is also Lisa Jevbratt's work called *Migration: Interface 1*, which maps IP addresses in several different ways. This image is a map of the internet in 1999 (red), 2001 (green), and 2005 (purple), with each pixel representing 255 IP addresses. The image on the next page is a detail, with some IP addresses visible.





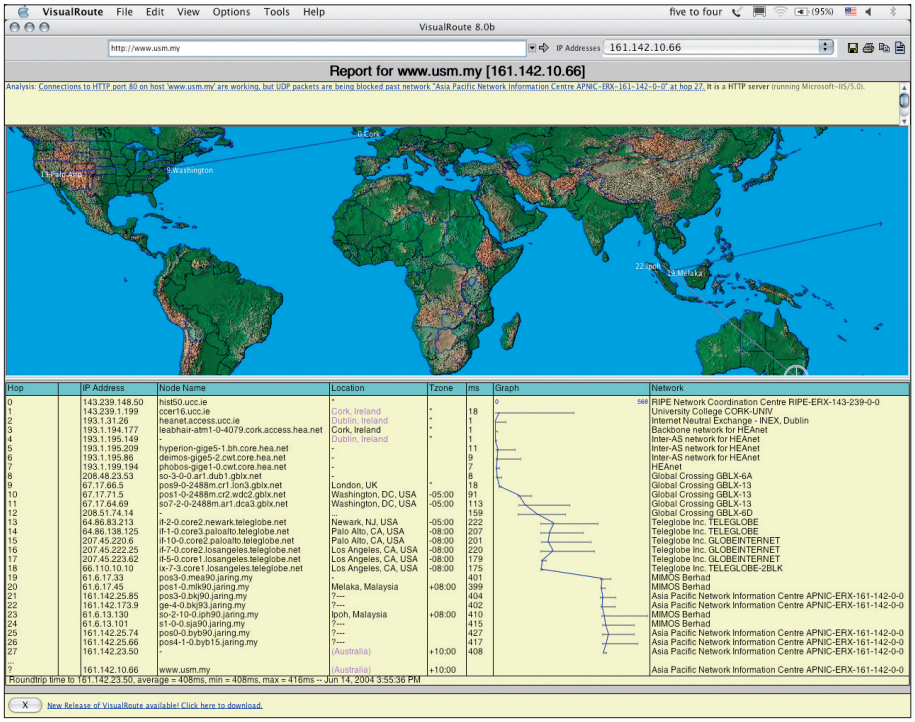
The image below is another of Jevbratt's maps of the internet showing all sites, in those same years (above and below). The colors are determined by the four parts of the IP address (eg., 0.0.0.0).

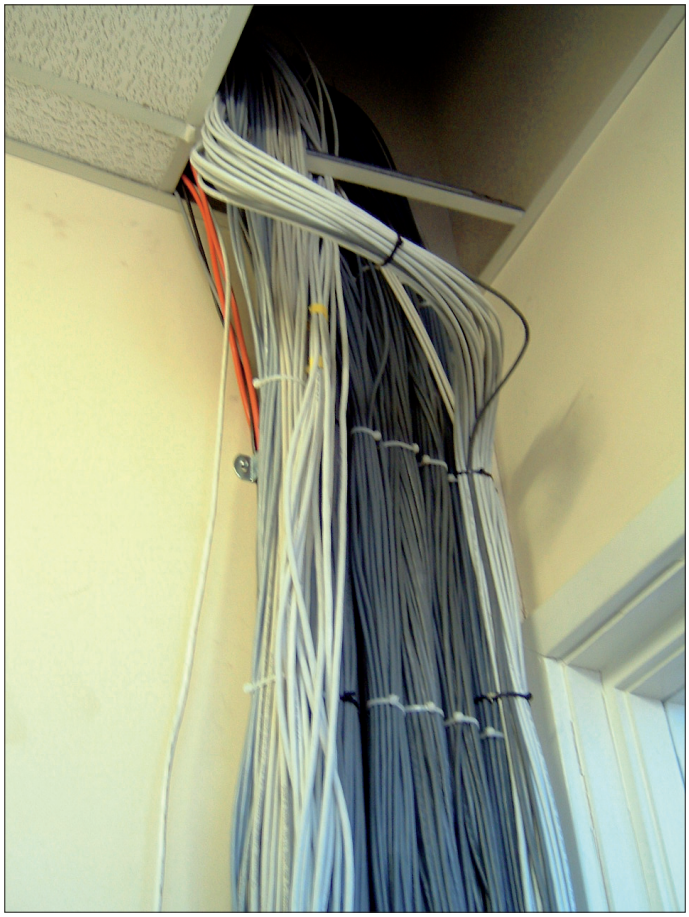
Try this at home

Any PC can run the software called Visualware, which traces the routes by which emails arrive, or by which your server finds another, and gives both graphical and tabular results. In the example shown on the next page, a web browser pointed at a university in Malaysia (the URL is in the box at the top) ends up routing through Dublin, London, Washington, Newark, Palo Alto, Los Angeles, two cities in Malaysia, and finally on to Australia before it finds the university's server. (Like a bad plane flight!) This is another "shape" of the internet, which of course has no "shape" and is not, in that sense, visual.

The internet itself

The actual, physical, internet is a mass of hardware and cables. On the next two pages are photos of the router that runs UCC's email, and the cables leading out


VisualRoute File Edit View Options Tools Help
five to four
VisualRoute 8.0b
http://www.usm.my
IP Addresses 161.142.10.66
Report for www.usm.my [161.142.10.66]
Analysis: Connections to HTTP port 80 on host 'www.usm.my' are working, but UDP packets are being blocked past network "Asia Pacific Network Information Centre APNIC-ERX-161-142-0-0" at hop 27. It is a HTTP server (running Microsoft-IIS/5.0).
8.Cork
9.Washington
22.Ipoh
23.Melaka
Hop | IP Address | Node Name | Location | Tzone | ms | Graph | Network
0 | 143.239.148.50 | hist50.ucc.ie | * | | | 0 566 | RIPE Network Coordination Centre RIPE-ERX-143-239-0-0
1 | 143.239.1.199 | ccer16.ucc.ie | Cork, Ireland | * | 18 | | University College CORK-UNIV
2 | 193.1.31.26 | heanet.access.ucc.ie | Dublin, Ireland | * | 1 | | Internet Neutral Exchange - INEX, Dublin
3 | 193.1.194.177 | leabhair-atm1-0-4079.cork.access.hea.net | Cork, Ireland | * | 1 | | Backbone network for HEAnet
4 | 193.1.195.149 | - | Dublin, Ireland | * | 1 | | Inter-AS network for HEAnet
5 | 193.1.195.209 | hyperion-gige5-1.bh.core.hea.net | - | | 11 | | Inter-AS network for HEAnet
6 | 193.1.195.86 | deimos-gige5-2.cwt.core.hea.net | - | | 9 | | Inter-AS network for HEAnet
7 | 193.1.199.194 | phobos-gige1-0.cwt.core.hea.net | - | | 7 | | HEAnet
8 | 208.48.23.53 | so-3-0-0.ar1.dub1.gblx.net | - | | 8 | | Global Crossing GBLX-6A
9 | 67.17.66.5 | pos9-0-2488m.cr1.lon3.gblx.net | London, UK | * | 18 | | Global Crossing GBLX-13
10 | 67.17.71.5 | pos1-0-2488m.cr2.wdc2.gblx.net | Washington, DC, USA | -05:00 | 91 | | Global Crossing GBLX-13
11 | 67.17.64.69 | so7-2-0-2488m.ar1.dca3.gblx.net | Washington, DC, USA | -05:00 | 113 | | Global Crossing GBLX-13
12 | 208.51.74.14 | - | - | | 159 | | Global Crossing GBLX-6D
13 | 64.86.83.213 | if-2-0.core2.newark.teleglobe.net | Newark, NJ, USA | -05:00 | 222 | | Teleglobe Inc. TELEGLOBE
14 | 64.86.138.125 | if-1-1-0.core3.paloalto.teleglobe.net | Palo Alto, CA, USA | -08:00 | 207 | | Teleglobe Inc. TELEGLOBE
15 | 207.45.220.6 | if-10-0.core2.paloalto.teleglobe.net | Palo Alto, CA, USA | -08:00 | 201 | | Teleglobe Inc. GLOBEINTERNET
16 | 207.45.222.25 | if-7-0.core2.losangeles.teleglobe.net | Los Angeles, CA, USA | -08:00 | 220 | | Teleglobe Inc. GLOBEINTERNET
17 | 207.45.223.62 | if-5-0.core1.losangeles.teleglobe.net | Los Angeles, CA, USA | -08:00 | 179 | | Teleglobe Inc. GLOBEINTERNET
18 | 66.110.10.10 | ix-7-3.core1.losangeles.teleglobe.net | Los Angeles, CA, USA | -08:00 | 175 | | Teleglobe Inc. TELEGLOBE-2BLK
19 | 61.6.17.33 | pos3-0.mea90.jaring.my | - | | 401 | | MIMOS Berhad
20 | 61.6.17.45 | pos1-0.mlk90.jaring.my | Melaka, Malaysia | +08:00 | 399 | | MIMOS Berhad
21 | 161.142.25.85 | pos3-0.bkj90.jaring.my | ?--- | | 404 | | Asia Pacific Network Information Centre APNIC-ERX-161-142-0-0
22 | 161.142.173.9 | ge-4-0.bkj93.jaring.my | ?--- | | 402 | | Asia Pacific Network Information Centre APNIC-ERX-161-142-0-0
23 | 61.6.13.130 | so-2-10-0.iph90.jaring.my | Ipoh, Malaysia | +08:00 | 410 | | MIMOS Berhad
24 | 61.6.13.101 | s1-0-0.sja90.jaring.my | ?--- | | 415 | | MIMOS Berhad
25 | 161.142.25.74 | pos0-0.byb90.jaring.my | ?--- | | 427 | | Asia Pacific Network Information Centre APNIC-ERX-161-142-0-0
26 | 161.142.25.66 | pos4-1-0.byb15.jaring.my | ?--- | | 417 | | Asia Pacific Network Information Centre APNIC-ERX-161-142-0-0
27 | 161.142.23.50 | - | (Australia) | +10:00 | 408 | | Asia Pacific Network Information Centre APNIC-ERX-161-142-0-0
? | 161.142.10.66 | www.usm.my | (Australia) | +10:00 | | | Asia Pacific Network Information Centre APNIC-ERX-161-142-0-0
Roundtrip time to 161.142.23.50, average = 408ms, min = 408ms, max = 416ms -- Jun 14, 2004 3:55:36 PM
New Release of VisualRoute available! Click here to download.



of the room — a typical tangle. (The exact location of the room is classified, and in fact the most difficult maps of the internet to obtain are actual physical plant maps. The internet exists, to some degree, as a series of classified locations.)

For further reading

http://www.nagios.org/; the Nagios system is documented and is freely available for download from this site. See also Rachel Greene, *Internet Art* (London: Thames and Hudson, 2004), 139-41 on Jevbratt; her site at jevbratt.com/1_to_1/; *Mappa mundi* at mappa.mundi.net/maps/; and *An Atlas of Cyberspaces* at www.cybergeography.org/atlas/topology.html.

9

Doing, Being and Becoming

Eithne Hunt

Occupation has been described in simple terms by Clare Hocking (2003, p. 190) as "all of the ordinary and extraordinary things people do at home, at work and in their community that occupy their time." Ann Wilcock (1999) sees occupation as a synthesis of "doing, being, and becoming." She asserts that a dynamic balance between doing and being is central to healthful living and well-being. According to her, the development of a person or a community is dependent on both doing and being.

Health through occupation, and creative occupation in particular, has been integral to the beliefs and practice of the Occupational Therapy profession since its inception during the era of the Arts and Crafts movement. Canadian Occupational Therapist Judith Friedland, in her Muriel Driver Memorial Lecture in 2003, asked the question "Why crafts?." She traced the roots of Occupational Therapy to the soil of English and American political, social and artistic ideals prominent at the turn of the 20th century. The Arts and Crafts Movement, the Settlement House Movement (a social reform movement that originated in England in the early 1880s) and the Mental Hygiene Movement (an American movement, founded in the early 1900s to promote mental health and prevent mental illness) all recognized the importance of art for all, of community interdependence, of increased self-esteem, habit and skill development through the use of crafts (Friedland, 2003).

The initial treatment tool of the Occupational Therapy profession was therapeutic occupation in the form of crafts, as Judith Friedland has described. Now, at the beginning of the twenty-first century, the profession is urged to reclaim its ethos with a reaffirmed commitment to the ideals and values of the founders. Creative occupations in particular, are the subject of renewed interest in occupational science and occupational therapy. With this "renaissance of occupation" (to borrow a phrase coined by Gail Whiteford, Elizabeth Townsend and Clare Hocking in 2000) comes a resurgence of interest in the transformative power of creative occupations, the relationship between creativity and health and a call for

doing and **being**.....journeying towards
becoming an occupational therapist

ucc Occupational Therapy students' exhibition of creative work

29 april – 27 may 2004

electrical and electronic engineering building, ucc

the custom design of powerful occupation-based therapeutic interventions to meet individual client or community need. These new directions have been well articulated by Victoria Holder (2001), Doris Pierce (2003), Suzanne Peloquin (2005) and Therese Schmid (2005), among others.

Students' work

First year Occupational Therapy students at University College Cork have the opportunity to explore and experience firsthand the power and value of meaningful engagement in creative occupations. For six weeks in year one, they pursue their choice of art, photography, textiles or printmaking, in groups of eight students each. Each session lasts three hours. The experience culminates in a public exhibition of students' work. This exhibition is accompanied by a booklet, in which students write about their image and their experience of producing it. The class of 2003-2004 explored the theme of "doing, being and becoming."

Critique of this image practice

A potential weakness of this use of visual imagery is a tendency to place more value on the final product or chosen exhibited image. The real strength and core purpose of this image practice in terms of student learning is the experience of the process of making the image.

Students have reported experiencing fulfilment, belong, accomplishment, discovery, challenge, reward, growth in confidence and self-esteem, relaxation, enjoyment, fun, and pride in their work. This transformative "doing" and "being" experience is invaluable to students at the beginning stage of their journey towards "becoming" creative Occupational Therapists and designers of Occupational Therapy intervention for the 21st century.

Three examples of this work are included to illustrate the student's journey through the process of doing and being in these creative sessions-along with an image representing the end product: the final exhibition of work to which staff, students, family and friends are invited. However, we are not reproducing any of the images here, in order to underscore that what matters here is process.

Three students: Caitriona O'Connell, Louise Barrett and Sarah McCoy

Caitriona O' Connell, who produced a set of four photographs called *The Hands of Time,* writes:

> Occupational Therapists work with hands in many different ways, through splinting, hand exercises, art and craft work, involving people of all different ages. In my photographs, I have shown hands of different ages in various natural positions. I feel my

photographs fit the theme "Doing, Being and Becoming" as they show the hands doing activities, while being in natural positions and becoming older.

In the photo that opens this Chapter, Occupational Therapy student Louise Barrett is shown engaged in the process of "doing" her chosen creative occupation of printmaking. In the booklet that accompanied the exhibition, Louise wrote "with these six weeks [of printmaking], I found myself having a greater understanding of why creativity and groups are so important in occupational therapy. It is not so much the product of the sessions that were important. The process and the feelings that accompanied the process are what made me think about the therapeutic aspects of creativity… Also the feelings of fulfillment, belongingness and meaningful productivity made me aware of how much sessions such as these can benefit a client's interpersonal and intrapersonal well-being."

In the photo below, Occupational Therapy student Sarah McCoy reviews an image she produced in the printmaking session. Sarah wrote that "the print rep-

resents more than an end product. It is symbolic of the process of doing, an experience I found to be extremely enjoyable and therapeutic. I appreciated learning new skills. This gave me a great sense of accomplishment, which in turn boosted my self–esteem."

Images for process and for use

It is interesting to speculate on the ways Occupational Therapy's interest in images differs from other uses in this book. With a few exceptions — including Chapter 20 — very little in this book is oriented toward the *process* of making. The scientific and technical images often require a great deal of attention to process, in the service of the single, finished image. Here, the exhibition that ended the class required special attention, because it was important that the students did not gear all their efforts to one final product, thus potentially undermining the experience of the process. Perhaps different to the scientific and other non-art images in this book, the images shown here work interactively, changing the maker as well as that which is made.

For further reading

C. Archer, "Towards an Occupational Understanding of Apraxia," Master's thesis, University of South Australia, Adelaide, Australia, unpublished, 1998 ("It is through doing": p. 11); Judith Friedland, "Why Crafts? Influences on the Development of Occupational Therapy in Canada from 1890 to 1930," *Canadian Journal of Occupational Therapy* 70 no. 4 (2003): 204-12; Victoria Holder, "The Use of Creative Activities Within Occupational Therapy," *British Journal of Occupational Therapy*. 64 no. 2 (2001): 103-5; Doris Pierce, *Occupation by Design: Building Therapeutic Power* (Philadelphia: F.A. Davis, 2003); Gail Whiteford, Elizabeth Townsend and Clare Hocking, "Reflections on a Renaissance of Occupation," *Canadian Journal of Occupational Therapy* 67 no. 1 (2000): 61-69; and Ann Allart Wilcock, "Reflections on Doing, Being and Becoming" *Australian Occupational Therapy Journal* 46 (1999): 1-11; Hocking, "Creating Occupational Practice: A Multidisciplinary Health Focus," in *Becoming an advanced healthcare practitioner*, edited by G. Brown, S.A. Esdaile & S.E. Ryan (Edinburgh: Butterworth Heinemann, 2003), 189-215, quotation on p. 190; Peloquin, "Embracing our Ethos, Reclaiming our Heart," *American Journal of Occupational Therapy* 59 no. 6 (2005): 611-625; Schmid, *Promoting Health Through Creativity*, edited by T. Schmid (London: Whurr Publishers, 2005).