
CROSSTALK, MUTATION, CHAOS:

BRIDGE-BUILDING BETWEEN THE SCIENCES AND LITERARY STUDIES USING VISUAL ANALOGY

(for undergraduates, postgraduates, teachers & tutors)

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Student /Tutor Summary

This paper uses visual representations, taken mostly from the sciences, to open up a fascinating mode of discussion in literary studies. The scientific analogies realised here not only bridge the humanities-science divide, but also act as good introductions to new topics. They can communicate their concepts efficiently, by visual means, across language barriers; there's even something here to assist with essay structures. Their value isn't so much to do with theoretical or practical rigour, but the way they liberate staff and students to explore and extend, by interdisciplinary means, their understanding of such subjects as poetry, translation and Intertextuality. All in all, visual analogy helps us to introduce to literary discourse a fresh stock of exciting, aesthetically appealing, experimental ideas.

Note. This version of the paper focuses on the application of visual analogies in classroom and seminar. For a more detailed assessment of its ideas and principles, see the In-depth/ academic version.

“Everything one invents is true” *Gustave Flaubert*

I. INTRODUCTION

Can certain scientific ideas, represented in simple visual terms, operate as analogies for subjects in literary studies? My reasons for pursuing this question are partly intuitive and mainly empirical (galvanised students, elated colleagues). Initially, it was a work of pure curiosity, an investigation of possible gateways between these two, sometimes estranged, fields; but it has rapidly evolved into a constructive challenge against those regions of literary analysis overwhelmingly rooted in text. In everyday speech, we constantly address one area of experience in terms of another (“that meeting was like wading through treacle”); so much so, that experimenting with visual analogy to connect such disparate concerns as (say) electronics and translation might not be altogether absurd. Science itself is constantly trying to associate apparently unrelated zones of observation with more inclusive, wide-reaching theories. In physics, for example, magnetism and electricity were linked through Maxwell’s Equations, themselves later shown to be consistent with Einstein’s theory of Special Relativity. The attempt to unite all the forces of nature under a single banner continues, ultimately leading (scientists hope) to Grand Unification Theory and that Holy Grail: a ‘Theory of Everything’. By analogy, then, and for those wishing to overcome what many see as artificial boundaries between (and within) the disciplines, the activity outlined here might be of benefit – provided it’s taken as an imaginative exploration of potential connections rather than a means to hard-and-fast models or theories.

II. THE VENN ANALOGY

Figure 1a attempts to represent aspects of the above thinking, visualizing conceptual space in terms of a Venn diagram (those new to the Venn concept can consult Google or Wikipedia for the bare essentials – avoid complex examples). By extending the diagram from its usual two dimensions into 3D, the Venn circles become Venn spheres, or bubbles. For our purposes, each bubble in conceptual space stands for some means of understanding text: an analytical technique, a particular theory or model, or (for that matter) a visual analogy concerning text. Bubbles have links with other bubbles, which is where (and why) they overlap. Any given bubble might overlap with many others, so the analogy only really works in n-dimensional space, i.e. within the ‘totality’ of conceptual space. Such a space, however, is not easy to depict; so the 3D perspective will have to do.

Figure 1b extends the analogy, suggesting that logical/ conceptual space is only part of the picture. Other modes of textual reception can be visualized, creating bubble-rafts which also overlap in a Venn manner (again, in n-dimensional space). Although rendered in a primitive way in the drawing, these complex overlapping spaces provide a visual analogy, of sorts, for the complete human experience

(the 'sum', Σ) of a text. Note that 'textual reception' (above) doesn't refer to Reception Theory or Reader-Response theory, just the general processes of a text being received by its reader or listener. Also, I have to say how satisfying it is, that a visual analogy from mathematics is helping to support my proposal that we try to connect literary studies and science through visual analogy!

Within the Venn analogy, the limitations of analysing a text according to a few separated-out bubbles of conceptual space are not difficult to spot. But, where overlaps are relevant, what form do they take? Can they be made clear or describable? I imagine they'd mostly occur at too profound a level to be easily grasped or explored; but that may not be true of them all. This, in a sense, restates the teacher's instinct that connections made by students in moments of intuition, however wild in content or form, can usually somehow be turned to good – and the Venn analogy, at the very least, suggests a mechanism (however hypothetical) by which visual representations derived from one field of study can find resonances (or perhaps even applications) in another. One might now ask whether an analogy is best seen as its own bubble overlapping strongly (with the bubbles it happens to interrelate) or in terms of the content *within the overlap itself*; perhaps analogy-making is a key aspect, generally, of the very *quality* of overlapping? If so, analogy has a crucial part to play in future cross-disciplinary work. Whatever its long-term fortunes, though, analogy-making is not a facile skill. Even in promising cases, a degree of trial-and-error, tutorial guidance and intuitive sifting is usually needed, to clarify and optimise any emerging correspondences. Progress has already been made, and some pilot scientific analogies are offered below as a means of analysing and discussing texts.

III. THE SPECTRUM ANALOGY

My first visual analogy from physics is based on the electromagnetic spectrum. This has short wavelength x-rays and gamma rays at one end, and long wavelength radio waves at the other; the rainbow of visible colours lies between. **Figure 2** relates this straightforwardly linear visual structure to text, creating a 'Textual Continuum' that incorporates various degrees, gradations and types of Intertextuality. What I mean by Intertextuality is the whole variety of possible characteristics of texts and the relationships between/ within texts and their language bases. I prefer the vague and inclusive definition here, because it allows users to deploy and explore their own interests and interpretations.

Along the spectrum, relevant features of the text(s) are identified, related to other texts, or characterised according to familiar Intertextual modes. Blatant plagiarism, direct quotation and word-for-word reproduction sit at its most Explicit extreme. The spectrum's 'Intra-textual' end highlights qualities and content that are progressively more difficult to trace than the conspicuous sources of Explicit Intertextuality. It may be seen as an increasingly diffuse area, gathering aspects of text for which the idea of provenance becomes uncertain, partial or effectively meaningless, such as low-level linguistic codes and the units of vocal sounds. Rather than a prescriptive, well-delineated concept split off from some more general idea of Intertextuality, this Intra-textual regime (like the spectrum as a whole) is open to negotiation. Indeed, the entire analogy is essentially speculative, provisional and empirical.

The *Intra* → *Implicit* → *Explicit* progression shown in this particular form of the analogy is, therefore, in no way definitive. The continuum could be annotated very differently, and Figure 2 is just a particular example of what might be envisaged. The way a given text is placed on (or profiled/ mapped along) the line will depend on how the continuum is interpreted, what it is in the text that interests us, and the stage of composition/ reproduction/ reception at which the text is addressed. One student might view the continuum as little more than a convenient axis that carries, in a loose manner, a series of labels identifying specific Intertextual insights about that text. Another might set up a sequence of peaks to register 'resonances' between the given text and literature/ culture at large, or to make a more systematic analysis that demonstrates a full range of Intertextual modes. I find it best if students, having grasped the basics of Figure 2, can run with it themselves, allowing the analogy to operate as a creative site of Intertextual discourse centred on the text(s) at hand. But, at some point, guidance is usually needed. One does well, for instance, to ask such questions as "How strong is this analogy? Where does it break down?" The value of analogies lies as much in probing their shortcomings as in the insights they afford. One must also be wary, having successfully applied a scientific analogy to (say) a literary-critical situation, that students don't thereby confer upon that target some false notion of scientific truth. It's all too easy for an actual, or assumed, conclusiveness concerning the source (here, the electromagnetic spectrum) to be transferred across, by mere association, to the literary subject (Intertextuality).

With regard to the scientific accuracy of Figure 2, trying to conform to all the details can obscure the larger picture, and scientific stringency is often misplaced among the plural purposes to which such an

analogy might be put. Even non-scientists will quickly realise that particular ‘wavelengths’ along the continuum can’t be made to correspond in any rigorous way to the given attributes or effects of a text; but, instead of taking such deficiencies as crushing evidence of the pointlessness of the exercise, we can turn them to advantage. They might lead us into a debate on how and why one maps out Intertextuality in the first place, or focus attention on what exactly is meant by the various Intertextual qualities described, or even become an incentive to test and deepen the analogy itself. In fact, my particular version of Intra-textuality emerged (initially) to solve the problem that my early spectra had nothing at that end, but also (later) because many students who quickly grasped Explicit Intertextuality were less sure what was going on at the Implicit limit. This created an exciting theme for discussion, prompting me to offer a pathway into those regions of Intertextuality students were finding less obvious. A positive questioning of the analogy thus served to improve it. For me, analogies of this kind needn’t display theoretical rigour or modelling capability at all costs. Figure 2 was never meant to function, within literary studies, in precise imitation of the electromagnetic spectrum; what it provides is an illuminating means of accessing a text, opening up productive questions rather than closing in on any final answer. (I’ll say more about the limitations, and possibilities, of visual analogy in Section VIII.)

Note for tutors. More in-depth discussion on the spectral analogy can be found in ‘further reading’ [Petrucci, 2001]. In spite of its dualistic assumptions and speculative nature, it’s proved successful in seminars, helping to kick-start detailed debates on Intertextuality accommodating many types of theory and approach. It’s even been used – albeit at full stretch – to broach the difficult subject of authorship and originality, with (for example) the Explicit extreme stressing text as ‘derived object’ and the Intra-textual regime suggesting a unique, willed ‘writing-subject’. Tutors may substitute preferred or alternative interpretations here; but, whatever the chosen slant, it does students no harm to visit, from this freshly analogic angle, the Intra-textual dark matter of our linguistic universe.

THE SPECTRUM ANALOGY: STUDENT EXERCISE

- Provide students with a blank or sparsely annotated version of the continuum (i.e. just the horizontal axis of Figure 2, without any curve) *plus* two or three texts to be compared.
- Tutors may also include a list of Intertextual attributes they wish to highlight in those texts. There will have already been some priming discussion about the analogy itself.
- In groups, or individually, students utilise the blank continuum to map out one or more of the texts in ways pertinent to the context of the study. Use different colours for each text.
- Now come together to argue points of similarity and difference in the various ‘spectra’, commenting on which aspects of the process were found revealing or confusing.
- Were there any insights that might have been missed using the usual textual/ spoken modes of analysis? Did the *visual* approach cause students to omit anything they might otherwise have seen?

There are, of course, many variations on this basic form of the exercise. Please feel free to adapt it.

IV. CROSSTALK, MUTATION, CHAOS; IS POETRY LIKE THE WEATHER?

The following figures further illustrate my early attempts to establish visual analogies for literary studies via scientific ideas. These examples represent possible overlaps between relevant bubbles in conceptual space, linking the two fields.

Figure 3 offers an analogy for mistranslation in terms of crosstalk, where signals from one circuit bleed across to another. Many humanities students struggle with the technical nuances of electronic circuitry, so I prefer to discuss this analogy via the more familiar scenario of crossed lines in phone calls. Taking each line, then, as a separate language system, it’s not unreasonable to assume that most signals (i.e. the meanings we communicate via language) can be successfully ‘translated’ from one phone circuit to the other, since both circuits have roughly similar properties. We suppose that to be true because the same ideas can be communicated (to some extent at least) using different languages. However, some distortion, fading in and out, hiss, buzz, etc. can sometimes occur, owing to the fact that the original signal may be only imperfectly (and noisily) picked up. In the analogy, this corresponds to various problems with translation and translator. Also, the second phone line (the new language) won’t have *exactly* the same characteristics as the first – there will be different rules of syntax, etc. Moreover, the signal is shunted across to a listener who, caught unawares, might not understand the original call’s context (the new language involves another culture with specific linguistic associations that have to be learned). All told, then, even if the second medium does allow most of the original information through, misunderstandings and imperfections are still likely – such as strange idiom, wrongly connoted phrases, misfiring puns, or unintentional insults and bloopers.

Figure 4 presents evolution/ DNA as a possible analogy for the changing reception of a given text (or author's canon) across time. This particular analogy leans towards an essentialist view, suggesting that certain textual qualities and meanings are stored through reproducible cultural-linguistic codes, passed on more or less intact to subsequent generations of reader. Examples of fairly stable code might include traditional forms (like the sonnet), an undisputed fact or unambiguous biographical reference, or a distinct style. As with DNA, though, the particular codes associated with a text won't determine precisely how that textual creature will look or perform within a given brain or culture, thus opening up that old debate: nature vs. nurture. The analogy also recognises that textual codes are responsive to the complex, shifting environment of literary ideas and cultural signs. A type of Darwinism is implied here, with certain reconstructions of code tending to survive because they're better suited to the altered conditions (they might align, for instance, with a new fad or a favoured analytical model). These shifted meanings in the text can be adaptive (i.e. slight and slow), as they are in much of natural selection: an example of this would be an author's style gradually gaining esteem with time. Alternatively, they can be marked and rapid (i.e. a sudden mutation), as might happen if a discovered cache of letters forces an overnight re-evaluation of a famous biography.

The analogy has flaws. Clearly, texts don't behave, or propagate themselves generation to generation, exactly the way animals or DNA do. Nor have I used the terms adaptation and mutation, quite, as they're technically defined in biology. My sense of mutation here is much closer to the populist sense of a severe genetic alteration, or a mutant strain produced (as it always seems to be in B-movies) by exposure to intense radiation. We could also challenge the very notion of codes preserved *in* the text, invoking instead reader-centred theories where the receiver of the text (not the author, nor even the text itself) is the primary creator of its meaning. A fresh analogy, then, might be that of a textual quarry the reader excavates, seeking and constructing her own meanings from the raw materials of words and associations. This shows how analogies, once their shortcomings are acknowledged and incorporated, can be propped against one another to develop several approaches to a new subject.

Figure 5 draws on chaos physics, often associated with weather systems. To coin a phrase: "Is poetry like the weather?" Does a poem (or any text for that matter) arrive in the reader like a weather front, with its meanings intricately modulated by all kinds of input and accident, its complex 'environment' corresponding to the reader's personality and her experiences of similar texts, indeed all her involvements with culture and literature? No weather forecast can tell us exactly what will happen, moment to moment, with the wind or rain in a particular street: in the same way, we can never predict the local detail of a text's reception within an individual reader – but broad patterns may well emerge among readers in general, at least in the short term (it was fairly apparent, for example, that the final instalment of Harry Potter would raise a storm of attention). Of course, there are already many theories looking at textual reception; a strength of this analogy, however, is that every student entering a seminar room has lived experience of weather and weather forecasting.

V. ADVANCED / HYBRID ANALOGIES

The Fan of Reception

Hopefully, the above analogies are fairly clear and self-explanatory (which is, after all, a major part of their point). That said, they can be developed in far more depth. The continuum analogy, for instance, may be expanded into a range of spectra, each representing a different aspect of the text's reception, thus generating a *Fan of Reception* (**Figure 6**). Here, the first 'fold' of the Fan is just Figure 2 itself, perhaps simplified, or focusing on key features of the *Explicit* → *Intra* progression. Subsequent folds highlight other traits of chosen interest. Some of the annotations shown (Golden Age, Pre-Lingual, etc.) may not be familiar to readers: these have no *special* significance, and merely indicate how one particular discussion developed. In this case, Aesthetic Fascism was a way of labelling (at the 'severe' end of Canonicity) an attempt by a pressure group (or oppressive regime) to define the authoritative works of a culture, while Nescience was total ignorance of the canon; 'Intra-?' marked a query regarding the validity of Intra-textuality as a cogent concept; and so on. Naturally, participants should deploy their own detail – and, in any case, interpret the Fan itself – in ways they understand.

Even if a little too involved for some, the Fan should make it *visually* clear that the apprehension of a given text is a complex process triggering many resonant functions between language and receiver. As a strong visual tool for introducing that idea, it can be used to initiate discussion on the possible nature and type of the spectra. Here, it's important to note the annotation in the figure stressing how the various functions in the Fan are *not* isolated: they interact and overlap. In advanced classes, one

can consider what forms those links and resonances might actually take, what their relative strengths may be, and even how these overlaps could be better represented visually. The annotation might seem to contradict the way in which the spectra are separated out within the figure itself; but this only serves to remind us that the Fan should not be taken too literally, that there are shortfalls in every analogy – set, at least in part, by the skill of its designer and the graphics software! It also invites the observation that literary criticism, too, can resort to a separation of thought, breaking texts down according to relevant attributes or subjecting them to sometimes narrow modes of analysis.

Translation: the Filter Analogy

Figure 7 gives another example of how the basic spectrum idea can be developed. It approaches what happens during translation, by means of a filter analogy. Figure 7a shows a typical ‘source text spectrum’: this simply maps out any pertinent attributes of the text being translated, rather as in Figure 2. It can be thought of as a series of ‘frequencies’ we have detected, or are drawing attention to, in that text. Real optical filters allow certain frequencies through (the transmitted colours) but suppress the rest (the absorbed colours). Figure 7b visualizes the translation process in a similar way, as a kind of *frequency response spectrum* – i.e. a sequence of peaks and troughs showing which frequencies in the input text are likely to be (respectively) enhanced or inhibited in the type of translation we’re considering. Actually, our translation filter isn’t quite the same as an optical (absorption) filter, because we can, if we wish, see a peak as *amplifying* that portion of the signal (rather than just letting it through, as the optical filter does).

Set up loosely for a ‘free’ (or ‘Translator Response’) approach, the form of the curve in Figure 7b is merely illustrative, but easily embellished. Trough 1 could indicate, say, the translator’s disregard for alliteration (which happens to be prominent in the source text). Other troughs might stand, for instance, for areas of lexical ignorance, or qualities in the original the translator deems untranslatable. The crests, on the other hand, represent specific strengths, sensitivities or tendencies in the translator. The asterisked peaks could identify, for example, elements of stylistic bias in the translator’s own writing style. Meanwhile, Peak 2 might point to an attempt to convey some perceived flavour in the original text, with Peak 3 a decision to use, come what may, footnoted equivalents of proper nouns (e.g. Coventry for Dresden). The sense in which these constitute genuine ‘peaks’ – or some type of *amplification* – would, of course, be open to debate. It may become clear, too, that a simple light-filter analogy (where colours in the source merely do or do not get through) isn’t terribly good at representing how a translator might *improve* or *add* something. Without getting too technical, one upgrade to the analogy could involve a complex circuit or sound system that sharpens up a signal or reduces noise, but which sometimes also adds blips to the output (though, naturally, any new analogy would, itself, be in need of due evaluation and closer scrutiny).

In a manner of speaking, then, the filter traces the ‘shape’ of the translator’s treatment of the source text. Different types of translation (word-for-word, accurate, free, etc.) can now be discussed by suggesting what the broad characteristics of each filter might be. A literal poetic translation, for instance, might be thought to involve a fairly flat, or neutral, set of transmission characteristics, where words simply pass through the filter without obstruction or translator bias; but there will always be *unintentional* troughs, because any word-for-word approach must lead to some distortion or loss in qualities such as rhythm, rhyme, cadence or irony. It’s important, though, not to focus *solely* on Figure 7b. With a real optical filter, a strong feature in the incoming light can sometimes partly survive what the filter tries to do with it. Similarly, in translation, it’s not unreasonable to suppose that some quality only weakly present in the original text (a trough in Figure 7a) is unlikely to be picked up by the translator, while something prominent (a large peak in Figure 7a) will probably not be missed, ignored or wilfully excluded (unless the filter of Figure 7b happens to have a strong trough at exactly that point). In addition, Figure 7a is only one way of mapping the original text along a continuum (here, via Intertextuality, interpreted in any way you wish). As the figure shows, the mapping can be done according to other types of concern, each treated separately: this leads to a more sophisticated approach entailing a fan of possible inputs, each having its own specialised filter.

We can easily enact the process of translation here, by placing a transparency of Figure 7b on top of Figure 7a (the figures are designed for this to work, if the copies are made to scale). This is wonderful as a teaching tool, bringing out the idea of the analogy crisply whilst imitating the actual use of a filter. It provides an immediate visual grasp of the interplay between translator and source text. Again, as with Figure 2, the specific nature and location of all the proposed peaks and troughs is not to be endlessly agonised over, and the detail of the curves can be formulated quite differently from

what is shown. Figure 7 isn't designed for any particular case: it merely offers a plausible form for general discussion on how the approach works. Users should formulate the specifics for themselves. Moreover, the common perception of filters as purely mechanistic shouldn't tempt us into thinking of translation, too, in terms of mechanical procedures (though computerised translations could, indeed, qualify). The deeper function of these analogies is to create sites for initial understanding and study rather than any theoretical or experimental closure. Once they've served their purpose, move on.

Essays: *The 13 Ways*

My final example (**Figure 8**) has more to do with study skills than literary studies, but is included for its downright usefulness. This chart provides an accessible, productive framework for discussing how to structure all manner of oral and written work. True, most of the 'Ways' don't draw on science or mathematics; some may seem closer to cartoons, making this a kind of hybrid resource. Nevertheless, *The 13 Ways* has proved an invaluable, flexible tool for students and staff alike. It is downloadable (with supporting notes on its application in class) from the Royal Literary Fund website (see 'further reading'). What counts here, once more, is not any definitive or exhaustive quality in the chart, but what it achieves in practice. I'm thinking, for example, of that precious clarity between tutor and overseas student when (in trying to explain an approach taken in structuring a report or essay) either of them can point to one of these images and make herself finally, completely, understood.

VI. THREE CLARIFICATIONS

I must now address several issues held back from previous sections:

- the distinction between a *model* and an *analogy*;
- the distinction between *diagram* and *visual analogy*;
- the use of text (titles, annotations, captions, etc.) within visual analogies.

Taking these in order, a model aims at making accurate predictions in a repeatable way; analogies are often more flexible and interpretable, riding much closer (I suggest) to simile and metaphor than to theoretical modelling. *The Shorter OED* defines analogy as "equivalency or likeness of relations" or "presumptive reasoning based on the assumption that if things have some similar attributes, their other attributes will be similar". A model, however, is (in *The Concise Oxford Dictionary*): "a simplified description, especially a mathematical one, of a system or process, to assist calculations and predictions." I don't claim this distinction as universal, or that models and analogies are unrelated; I simply indicate how the modes of analogy presented here tend to favour inventive connectivity over predictive rigour. After all, educators (science teachers included) have long recognised the benefits of a good analogy over a precise model. Reliant on the conventions and terminology of its discipline, a model commonly requires the novice to engage with an extended academic process along distinct pathways; an analogy usually has one foot in something more familiar to the student than the specialist field it relates to, offering initial inroads for fledglings of that new or difficult idea. But my chief reason for keeping this paper model-free is that any thoroughgoing models linking the sciences with textual analysis are likely to be complex, technical and programmatic. I've preferred to develop attractive, accessible visual analogies that are exhilarating, fruitful and liberating.

That said, analogies vary in strength. A weak (or loose) analogy tends to be superficial, and is often little more than a suggestive simile or metaphor. It focuses on the *exploratory* role of analogies and hasn't, on the whole, much in common with predictive models; it may even be whimsical or merely pictorial, lacking any real rigour. Meanwhile, a strong (or close) analogy has rich correspondences with the targeted topic: its parallels operate at depth, tending to emphasise the *explanatory* function of analogies. Strong analogies, if highly developed, might be considered close cousins to models. The figures of Section V show how the sophistication of an analogy can be increased enormously; even so, I wouldn't call them models. Although I don't want any of my analogies to seem contrived or unconvincing, I really don't expect them to work repeatably and *precisely*, the way models tend to do.

As for diagrams, it's difficult to ignore the widespread use of the term to denote something merely illustrative, a near-photographic or pictorial likeness, a representational sketch. This usually offers no real analogy for anything. What's more, for scientists, diagrams suggest an attempt to nail things down, to make definite. In a sense, the scientific diagram runs closer to the model than to analogy: it's deemed inadequate if it gives multiple or conflicting messages. On the other hand, visual analogy – as deployed here, across disciplines – makes room for interpretation and intuition. It facilitates various types of

connection *between* source and target, as much as understanding in the target subject itself. That's why I try to avoid letting 'diagram' become an easy synonym for visual analogy, especially among scientists.

Taking up the final point in the list, some readers will have noticed that my analogies aren't purely visual: they are, to various degrees, annotated with text. Am I cheating? To some extent, yes; but most scientific models and analogies are labelled or captioned in similar ways. These labels merely identify, clarify or extend the visual elements they accompany. Where my figures do seem beset with explanatory tags, this is to make them more accessible to a wider range of users, particularly non-specialists. Such notes and captions tend to be less crucial when an analogy is part of common visual currency, or when a tutor has previously introduced the analogy or is talking it through, or where the students who formulate a visual analogy are already au fait with its terrain.

VII. SCIENCE / LITERARY STUDIES: TWO-WAY TRAFFIC?

Science abounds in metaphor and analogy: black *holes*, quantum *wells*, magnetic *field*, electric *current*, electron *avalanche*. With the popularisation of science, the process has, if anything, intensified. Who isn't now familiar, for example, with the analogy of billiard balls for molecular collisions in a gas? However, science hasn't looked much to literary discourse for visual analogies, using it instead as a quarry for nomenclature (as with the elements in the Periodic Table, or the commandeering of 'quark' from *Finnegans Wake*). The most obvious reason for this is that the humanities primarily employ words – and address those words, mostly, through *more* words. There just aren't that many visual items in literature for science to draw on. Moreover, I suggest that most modes of literary discourse (a book review, say) aren't easily recast in visual forms (even if we wanted to create them) that apply straightforwardly to a specific scientific idea. Science needs objective, *repeatable* means of visual representation for physical phenomena, while literary subjects mostly attend to the myriad, interwoven and subjective concerns of texts, along with all their cultural, psychological and reader-dependent ramifications. I frequently think of these problems as similar to those of procurement and rejection in an organ transplant. I'm not saying visuals don't occur *at all* in literature. They do. But even the most elaborate maps, charts and graphics in literary theory or criticism tend to be pictorial forms of list-making or description. Their spatial structures offer few, if any, parallels with scientific concepts.

There are other problems to address. Whenever a visual analogy is bridging disciplines, some level of understanding and clarity has to be established at *both* ends of the bridge for it to carry any weight. Einstein remarked: "After a certain high level of technical skill is achieved, science and art tend to coalesce in aesthetics, plasticity, and form. The greatest scientists are always artists as well." That's great news in the context of this paper; but I wonder if Einstein would have been equally convinced that the greatest artists are always scientists. We can't ignore his caveat concerning the "high level of technical skill" initially required before the merging can happen. I find that non-scientists, if their science and mathematics are weak, do sometimes experience problems when either end of a bridging analogy relates to the sciences. I'm not implying any intellectual deficiency in literary students! There are areas of literary discourse that the uninitiated scientist might find impassable too. But a literate scientist can usually be expected to get the gist of most literary ideas, while even experts in literary studies might struggle with (what would be to a scientist) fairly basic science and mathematics if they don't possess the required cognitive codes.

It would be unwise, though, to assume that this one-way traffic is somehow irreversible. Pattern recognition lies at the heart of the thought process itself, with the very roots of words tangled in visual metaphor: an encouraging sign for those who'd like to explore the cross-disciplinary possibilities of visual analogy. Furthermore, not all of literary discourse is text-based and discursive, and not all science is highly technical or purely mathematical. And I can see there might even be some justification in non-scientists exploiting the less rigorous (and less mathematical) ideas of popularised science to participate in cross-disciplinary dialogue. After all, much of what the culture experiences as science is of this sort. In fact, quite a lot of it is really from science fiction, whose Hollywood-reinvented ideas rarely reflect their source concepts completely or accurately (I'm thinking of that awful – though fun – cliché that black holes transport you to parallel universes, or that you can fly your spaceship through them in the first place). I do have reservations, however, about letting the science content of analogies become *too* flaccid. As ever, research is needed to help establish genuine connections between literary studies and the sciences; we also need greater collaboration between, and co-education of, artists and scientists. Meanwhile, why not at least *attempt* to nudge open a few more doors on visual analogy within literary studies? What could possibly go wrong?

VIII. VISUAL ANALOGY: DANGERS; OPPORTUNITIES

Visual analogies aren't perfect. Like metaphors, they can be over-extended or poorly made; in inexperienced hands, they can actually cloud the issue. Even good analogies have their elastic limits. Also, in spite of the practical examples given earlier, it's fair to ask: what real purpose do they serve? And how do we test their results? Might they distract us from perfectly adequate conventional methods? Why not just let texts and their concepts reveal themselves, unmediated, as they have always done?

All of these points are pertinent; but none of them constitutes a basis for dismissing visual analogy. For a start, similar problems apply to all theoretical and educational discourse. Literary discussions aren't immune to speculation, poorly formulated ideas, or the misrepresentation of texts. Also, just as an analogy can be taken too literally, so theories and models can be deployed in an overly rigid way; and they, too, may be incomplete or flawed. What's more, I'm not attempting to supplant or weaken any element of textual appreciation *via text*; I simply hope to appeal to students' visual faculties with refreshing alternatives to academic screech, particularly where departments can draw creatively on a number of study areas. In this work, any subject (not just the sciences) can be a source of analogies, thus expanding the creative-critical field and freeing up its energies for staff and students across the disciplines. Shutting the door to this kind of enterprise would seem to accept that our specialisations must reflect some *inherent* structure in knowledge, resembling a series of separate, largely self-sufficient strands. Not only that: students now commonly experience learning and information retrieval via VDU and multi-media, making the educational advantages of visual analogy tough to ignore (an observation, I stress, that in no way implies we should thereby neglect books and reading).

Nevertheless, we must come to visual analogy with *some* sense of caution. To illustrate this, I apply a mountaineering analogy to the spectrum analogy. Imagine traversing a mountain range. There are the four dimensions of space and time, but also other 'dimensions' (I use the term loosely) of weather, your shifting mood, the inputs of walking companions, and so on. All of these are interwoven and thus difficult to summarise in a visual way. You could utilise a 3D scale model of the range to retrace your journey; or mark out your route on a contour map; or just plot your altitude along a time axis, creating a graph of peaks and troughs looking a little like Figure 2. But no segment of that plot would re-create your journey at that point; neither would the graph, as a whole, yield anything more than a hugely simplified representation of your overall experience. Of course, my climbing analogy has its own flaws; but it does serve to bring the point home: analogies have limitations. Good scientists know that, and are acutely aware that an analogy, for all its functionality, usually distorts the reality being illuminated: they test it to destruction, finding out where and how the parallels begin to fail, seeking better analogies in the process. This – the inventive testing of analogies – is one area in which non-scientists can learn from the *procedures* of science. Part of the benefit of using visual analogies involves trying to discern at what point, and why, they should be embraced, revised or left behind.

Naturally, not all visual analogies are immediately of value in any given context, and some steering of the process is essential. The ideal is to discover those that strike us as having about them a rightness which repays closer and repeated inspection, just as the best metaphors do in poetry. However, even where we seem to be plying an arid segment of conceptual space, or when the analogy falters at an early stage, we'll still have engaged in invention across the disciplines, in imaginative intellectual play. Moreover, testing those analogies for aptness and usefulness will foster critical judgement and the ability to detect and work with conceptual patterns. With capable groups, the testing process can even be extended so that several visual analogies are constellated around a single idea, with each helping to correct any errors or misunderstandings generated by the others.

Positive outcomes from implementing visual analogy in literary studies might include:

- novel tools to supplement more established modes of description, analysis and argument;
- a fresh supply of accessible introductions and explanations;
- a stock of enticing visual resources for workshops and discussion;
- an expansion of cross-disciplinary teaching that is creatively, as well as critically, engaged;
- a flush of cross-disciplinary and cross-critical research opportunities;
- (in the longer term) innovative hybrid theories;
- the generation of new sites of Intertextual discourse.

Certain applications have already been productively realised. For instance, presenting creative writing students with the figures (in fact, doing so ‘cold’, without any explanation or context) has inspired work that talking or reading about those scientific ideas might not, I suspect, have yielded. I’ve also employed the analogies with the British Council, to introduce overseas students (with scant training in science and, often, even less English) to such concepts as Intra-textuality and the filter analogy for translation. When serious language (or subject) barriers are faced, visual analogy sometimes has an edge over text. This visual dimension can itself have a profound effect: often, a user is stirred by the figures as aesthetic objects *in their own right*, suggesting they might work more as carrots than sticks.

Suitably developed, visual analogy could therefore supply a flow into education and theory of original, flexibly experimental and aesthetically appealing ideas, attractive not only when motivation is scarce, or for those intimidated by reams of closely-argued text, but also to advanced students hoping to carry the approach into the postgraduate domain. This student-centredness is key. There’s a democratic, personalised feel to visual analogy: it encourages individuals to excavate their own expertise and interests; it’s fluid and adaptable; and it accommodates non-linear, interactive modes of learning. Handled well, it can be unthreatening, participatory, creative and (more often than not) fun.

Visual analogy also offers a means, perhaps, of pickling a cognitive leap, which is somehow stored by the analogy itself and subsequently received by its user. This is particularly advantageous when teaching more abstract concepts, because the analogy provides a stepping stone from which the final, clinching jump can then be made. It therefore makes good educational and pragmatic sense to research how best to progress and expand the methods of visual analogy, especially in fields of inquiry where its use is still uncommon. The successful application of cross-disciplinary analogies could bring crucial insights to a world increasingly aware of its complexities and interconnectedness.

Thomas Young, who devised the famous double-slit experiment to examine the wave behaviour of light, also helped to decipher the Rosetta Stone. One of the founders of structural organic chemistry, the German chemist August Kekulé – who claimed he arrived at the ring structure of benzene via a vision of a snake biting its tail – trained as an architect. Coincidence? Or evidence that the deep recognition of patterns is a transferable skill that can amplify the faculty of discovery across all the disciplines? When it comes to literary discourse, I borrow an injunction from radical ecology: to challenge compartmentalisation; to continually question any absolute priority given to measurability, to rational or mechanistic modes of analysis, particularly where the full range of human sensitivities and values is thereby excluded. With literary texts, too much rigour is rigor mortis. An early typo in my title was: ‘Crosstalk, *Mutilation*, Chaos’, a slip of the keyboard not altogether unwelcome. I certainly wanted to cut myself off (Latin: *mutilare*) from rigid methodologies, to embrace creative modes more in resonance with the pick-’n’-mix way in which much of our learning actually occurs. I was seeking theory *and* praxis, somehow combined. And yet, I’ve no desire to belittle the better conventions in teaching; those analytical modes have real worth, and pure rigour, in its proper place, is often as insightful as it is essential. It’s just that such processes, alone, fall short of the whole experience – the life experience – of a text. Visual analogies by no means complete that experience; but, provided they don’t get out of hand, they do offer a vital new meeting place in literary education and thought.

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