IMAGE THESIS: ART OR MULTIDIMENSIONAL LOGIC?

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Screen production courses are commonplace in Australian tertiary institutions these days.[1] Assessing their academic output - such as film and video productions - presents a number of problems since most tertiary institutions still function largely on a paradigm of written scholarship.

While there is considerable flexibility in assessing image-based productions at the undergraduate level, where specific skills are evaluated, the problem of assessment becomes somewhat more daunting at the research and publication level when all the processes which give rise to the image-based text come under scrutiny in the assessment process. At this level, the differences between the visual mode of "writing" and conventional academic writing become unavoidable and problematic.

The problems raised by assessing image-based productions at this level bring into question existing academic regulations, research methodologies, validation procedures, notions of authorship, originality, and even the very notion of academic research.

One expects that, in time, image-based research will have its own well defined operational prescriptions, regulations and methodologies as is the case with its written counterpart. But these are not in place as yet. During the transition period, it is likely that the validity of the emerging image-based research will continue to be judged by a comparison with the conventional paradigm of scholarship and one exemplified by a written PhD thesis of around 70,000 to 100,000 words in length.

How does a conventional PhD thesis compares with a major image-based text, such as an hour long documentary. On first reflections a documentary format seems intellectually constrained when compared to a conventional thesis format especially as a documentary does not contain notes, references or bibliography and its central message is often delivered with a voiceover narration five to ten pages long. Furthermore, images which accompany such a limited voiceover narration are often relegated to being something akin to an unintentional CCTV footage or a sporting broadcast.

In contrast to this unflattering comparison we also know that some documentaries can communicate the most complex messages and not primarily through words and often do so with enough intentional force to convince us that an image is indeed worth ten thousand words. What kind of communication system is this, how does it work and how different is it from the conventional word based syllogism. More importantly what is so different about these articulate non-voiceover documentaries compared with the ones which deliver their message with a voiceover narrative. Is this difference what we normally considered to be the "art" of the documentary and is this "art" which gives image making such a tenuous foothold within academia based on research.

In this paper I wish to do away with the seductive connotation of "art" that haunts the image based research and argue that what often gets categorized as art in an image-based text is in fact a most powerful multidimensional system of communication which if harnessed properly is able to communicate parallel and simultaneous messages in a way that words can only imitate. Communicating with such a multidimensional logical system intrinsically requires a more complex intellectual undertaking than that based on a simple word-based syllogism - if only because words are frequently only one element of an image-based text. While image makers understand this complexity well, most conventional academics are not fully aware of the intellectual rigor that goes into the image making process. It is therefore fitting that one should argue for the articulate worth of images in words and so hopefully reach the academics who presently find themselves visually challenged in this all too visual a world. It may also be worthwhile to do this by first specifying the essential difference between the two mediums under consideration.

THE SUBSTANCE IS THE MESSAGE: THE ART OF MULTIPLICITY

If we are looking for fundamental differences between the visual and written presentations, a useful starting point may be to examine the very substance of the two texts.[2] From this starting point, the difference between the visual and the written text, can be specified in the following simple propositions: Writing is characteristically linear. With most Indo-European languages the unfolding of written words starts at the top left hand side of a page and works its way across and down. The linearity of this unfolding holds together all other constituents of writing: phonology, morphology and grammar. We, in turn, associate the linearity of this unfolding with the existence of a reasonably stable set of phonetic, morphological and grammatical rules.[3]

In contrast to the linear unfolding of the written text, the signifying substance of a visual text, such as a photograph, presents itself to the viewer, in the first instance, as a two dimensional diagram. The essential characteristic of a diagram is that any and each of its elements can connect and relate to every other element. In a painting, for example, the viewer may explore various spatial connections in an act of visual "reading". This is an open-ended process even if the artist anticipates and plans for a particular interpretation. It is this multiplicity of interconnections which characterizes the unfolding of an image-based text. And it is this unruly multiplicity of meaning that contributes most to the "art" connotation of the image.

Another contributor to the "art" connotation of the image is its unspecified quality. Images cannot be true or false like propositions or specific like numbers or algebraic symbols. Images are also characterized by an inability to keep their "contradictory" elements apart. Villains and heroes, life and death, for example, can magically coexist within a single visual space. It may be interesting to note that Freud projects a similar type of magical logic for the logic of our dreams and describes this logic in terms of diagrammatic concepts, such as "pictographic script", "picture-puzzle", "rebus" and " mystical writing pad".[4]

The multiplicity intrinsic to the topology of an image gives it, in principle, a slippery semiotics that can be confusing and problematic. Often the first task of an image maker is to do something about these multiple and potentially contradictory messages that come with the image. There are two ways by which this can be done (i)

by suppresses the signifying multiplicity of the image with a voiceover, for example, and (ii) by use of the signifying multiplicity of the image to create a more powerful message.

THE DEFINING ELEMENT OF VISUAL LANGUAGE - INTERNAL REFERENCING

The multiplicity of meaning intrinsic to each image gives it great potential for internal referencing. Various elements of each filmic scene - such as sound, image, foreground, mid-ground, background, colour, movement, voiceover, music - are able to reference one another, and usually do so in good films. Such internal referencing invariably increases the signifying content of the image in a way that may not be obvious to an untrained eye.

The relationship between sound and image is a particularly clear example of this. Both sound and image can be considered as an autonomous referential system which can support or contrast one another. What kind of engagement is possible becomes clear if we ask a few simple questions:

> Does the text signify predominantly through the image?

> Does the text signify predominantly through the sound?

> Is the sound message essentially different from the image message?

> Does the text signify predominantly through the combination of image and sound, and mostly through the combination of image and sound?

The greater the difference and interplay between the three elements of the text (sound, image, sound+image) the richer is the referential system. The interplay between sound, image and sound+image in which each has a different message, has by far the most signifying potential.

A similar referential system can be described for the three primary image planes: foreground, mid-ground and background (or, in still simpler terms, figure and field), as well as for other formal elements of the medium in which various codes used are cross-referenced (codes such as colour, line, volume, genre, lighting, camera angles etc.). To these formal elements we can add the non-formal elements such as performances of actors. The interconnections that are possible with all these elements multiplies the meaning of the image. It would generally be very difficult to quantify the full extent of all the multi-dimensional referential systems at work in an image-based text because it is essentially open ended. It certainly would not be like counting the number of footnotes. Such an estimate can best be done subjectively by a competent person.[5]

One would want to argue that this internal and indirect system of referencing is the crucial and defining element of the image-based text.

MULTIDIMENSIONAL IMAGE GESTALT

What is evident about this internal kind of referential system is that it cannot be simply added to the text like a footnote in a piece of writing. Rather, it must be constructed from the very body of the text. Constructing such an internal referencing system is thus inseparable from constructing the text as such. It involves the very materiality of the text with all its formal characteristics.

Furthermore, one must ensure that the reference at any one particular place is consistent with all other textual elements, all other connotations and in the end with the text as a whole. Such referential work consists of getting various multi-dimensional elements of the text to work together as a constructed totality, almost as if the construction of the text entailed an engineering task. This is a multi-dimensional problem in which the signifying of the "total" connections is always greater than the sum of the parts.

THE INVISIBLE ANALYSIS

Getting meanings to coexist in this fashion and constructing this gestalt coexistence from the body of the image text is the real work of image-makers. But it is exactly this work of putting things together which is invisible and which is not understood by many conventional academics who can only see the "art" of the finished product.

For producers of image-based texts, the concepts of "art" may not come into consideration at all, except to describe the multidimensional type of intellectual work which involves a very large referential gestalt and which needs to be organized in a consistent manner. For example, the producer of an image-based text needs to arrange various referential elements of the image text (such as lighting, camera angles, composition, movement, colour, choreography, set-design, special effects, performance, etc.) into an articulated relationship with one another from what is a very large and to a large extent an open-ended field of possibilities. The multi-dimensional nature of this task escapes easy conventional judgment. The field of fuzzy logic and probability judgments is more likely to provide the producer with a way of describing the manner in which he or she constructs a particular mise-en-scene rather than the disjunctive logic of the Either-Or type.[6]

A similar gestalt problem is to be found in the functioning of the production crew. Each production consists of semi-autonomous crew members working on various signifying elements of a production according to what is at times a minimal script-score. The contribution of each crew member brings with it its own referential system and its own connotations which, while consistent with the script line, may not be consistent with the referential dimension of other set elements. Often, a small slippage in cross referencing between the various elements of the production set (in performance for example) can have a disastrous or a hilarious effect. It is the overriding responsibility of the director to orchestrate these various sub-systems into a coherent whole. The gestalt nature of film construction is often invoked during the production process but described in different terms. For example, one may say that the plot is "character driven" or that the film is a good example of "noir" aesthetics.

In such a description, both "character" and "noir aesthetics" is a way of controlling the overall image gestalt and constraining it to an intended meaning.

Film editors understand the multidimensional logic by which images are constructed and can describe such gestalt judgement through various "montage" rules. So do film directors and cinematographers who compose and record performances in the first instance. So do all other members of the production crew in their own specific way.

The viewer who reads the text, on the other hand, does not have to know any of these rules. For the viewer it is the "experience" of this evolving rhizome of meaning which provides the basis on which the text is validated. But this lack of awareness of the rules of construction does not mean that most stringent rules are not at play.

We can glean how stringent and rigorous these gestalt judgments are by observing film editors at work. A rough cut of a filmed sequence can be, and often is, completed overnight so that the film's director and performers can monitor the success of their previous day's filming and correct any omissions in subsequent shoots. While the rough edit can be done overnight, the fine cut edit, in contrast, may be months in the making and may take even longer to complete. And yet for all the multiple ambiguities which go into judging the value of the "cutting" during the fine-cut edit stage, this process is as fine as the word suggests - often involving cutting a frame or two (1/25 second) from each particular shot or a sequence.

MULTIPLE LOGICAL JUDGMENT

Specifying and predicting how the multiple narratives that coexists within an image interact with one another, in the end, cannot be done syllogistically, but requires a multiple judgment based, above all, on the relationship between parts of the text to the whole and which simultaneously works on the meaning and substance of the text as such.

Judging a mixture of elements in such a multidimensional manner, subject to such ambiguous multidimensional part-whole relationships, is the defining characteristic of image-based logic. The apprehension of such image-based texts, in the final analysis, is never accidental, in spite of all the multiple readings which are possible. In such texts, various readings evolve from one image to another, from one multi-referential context to another, from one metaphor to another, from one shot to another, in the kind of metamorphosis one associates with a life-form, albeit an abstract one. And as with most life forms, we judge their appropriateness "organically" by judging how parts of the life-form in question relate to the gestalt whole.[7]

One could rightly say that getting such a referential system to fit together, requires an act of GESTALT-CONSTRUCTION which includes the body of the text itself, and in which the multiple referential possibilities invoked are ordered in such a way as to create a maximum amount of narrative meaning with a minimum amount of narrative "noise".[8]

Almost by definition, more work goes into constructing this cross referential multidimensional gestalt than into the construction of the main plot line, since the main plot line itself is a subset of the total referential system.

There is yet another system of signification at work within the image which gives it a powerful signifying force which words find difficult to match because this system of signification arises directly from the visual perception itself.

PERCEPTUAL ANCHORAGE - THINKING WITH THE BODY

From a very early stage of our development and before we enter into language we are able to establish a perceptual relationship with our surrounding as do most living things. And like most living things, we instinctively seem to observe coherent gestalt wholes (such as shapes, volumes, bodies, lines, figures) against some contextual field without thinking and before we know what the world is all about. Because these perceptual relationships are fixed before we enter into language they remain largely outside of it even though they may well have a major impact on how we apprehend the world.[9] As a consequence, we experience the image first and foremost as a perceptual reality before it speaks to us as signs and words with meaning in language: to see is to believe.

It is also worth noting that for many intellectual traditions, the experience of vision is often linked with another perceptual experience namely that of touch. Within the psychoanalytic tradition, for example, "seeing" is often presented as touching by other means.[10] To see is almost as good as to touch.

A connection between vision and touch may help explain why there is such a strong diegetic component to visual perception - visual perception is in some essential way "real" and tactile in nature. The same explanation can be offered for the sense of exteriority which we associate with an image. Although we apprehend and read images as signs, we also experience the diegesis of an image by "touching" it with our eyes in exteriority in the same way as we touch objects in exteriority.[11]

A connection between vision and touch may also help explain why we respond to the diegesis of an image with a degree of spontaneity - almost as if our thinking had nothing to do with it. This is because thinking, to a large extent, need not come into it, unless by thinking we mean "touching with our eyes".

Extending this proposition a little further, it could be said that we apprehend images not only through the usual semiotic categories, but with our bodies and with desire of our bodies as well.

The logical extension of this argument is that the multiplicity of vision may well be related to the multiplicity of touch that our body is capable of experiencing. [12]

How we "experience" an image when we watch a film is often more important than is the meaning we attach to the image as such. For example, my fetishistic attachment to the face of an actor or an actress may well have little to do with the part that he or she play in the film I am watching. It is more likely that my fetishism can be explained by my experience of the image and the pleasure that I derive from this

ocular experience, rather than from any narrative meaning. We cannot disregard this type of image power simply because we cannot attach a specific meaning to it.

If the multiplicity of an image corresponds in some way to the tactility of the body, it may well be a source of "logical" strength rather than of weakness.[13] This is suggested by the very power of the image. A momentary glance at a visual scene can inspire a book of words. A glance can connect us with the "body language" of another as well as with our own "emotive intelligence" which are both intricately linked with the perception of vision.

RESEARCHING WITH IMAGES

Image based research combines the two powerful signifying systems described above, namely that based on multiplicity of internal referencing and that associated with the very perception of the image. Constructing a rhizome of internal connections within an image and cross referencing these connections with the diegetic qualities of the image content constitutes a kind of visual thinking, diagrammatic thinking, artistic thinking, constructivist thinking, or thinking with the body. It is certainly enough thinking to constituted and image-based thesis.

We could now ask: How useful is this type of visual thinking from a research perspective. Clearly some research is very much image-related and can only be carried out by an image-based methodology. When assessing the academic status of an image-based text it may be necessary to decide if its visual form enhances its presentation and validity. But in broad terms we should be optimistic. So much of what we do in the world today is mediated with and through images hence research based on images is likely to be in high demand. At the same time we should also ask is: Is there any research at all that is not enhanced by image based methodology?

THINKING VISUALLY

When it comes to research in science, it is the formal and analytic judgments which are generally considered to be the crucial elements of its methodology while "artistic" judgments such as that based on images are generally considered to be fanciful.[14] There is a growing opinion that this simple distinction is not a valid and there is a growing body of academics who consider that there is a deeper relationship between image, form, art and analysis.

The development of a comparatively new field of mathematics called "combinatorics", provides a good case in point. The most interesting aspect of combinatorics is that it introduces the image into the very notion of formal proof - and formal proof is the cornerstone of the most conventional of research methodologies.

COMBINATORICS

The proponents of the combinatorial branch of mathematics characteristically use pictorial rather then algebraic reasoning in proofs. Consequently, until a few decades ago combinatorics and combinatoralists had the same marginal status in institutional mathematics as do image-based texts and image-makers in academia still today. Nowadays, the status of combinatorics is changing as quickly because (i) the new style mathematics (such as combinatorics) works better in practice than the old

style symbolic mathematics (ii) the philosophical foundations of old style mathematics are in question - ever since Godel, conventional mathematics has been running into all kinds of theoretical difficulties, regarding truth, proof and validating procedures in general. [15]

In an article titled "Picture Puzzling: Mathematicians are rediscovering the power of Pictorial Reasoning", Ivan Rival describes vividly some aspects of the change that is taking place.[16] He begins his article by considering the formal theories which deal with the mathematical problem of tessellation, or tiling of a plane. The problem consists of fitting together multiple and multi-shaped tiles without any gaps or overlaps. It seems that the formal theory of tessellation worked itself into a kind of theoretical dead end with the work of Karl Reinhart in 1918. This limit was revisited again in 1975 by Martin Gardiner who wrote two columns on tiling the plane in Scientific American, prompting many readers to try their hand at tessellation. This resulted in an explosion of interest in tessellation which subsequently led to many spin-offs in computing and related fields, and which in time became, in Rival's words, a "minor mathematical industry". The most outstanding of these tessellation attempts was by one Marjorie Rice, a housewife who went on to do in her spare time what many formal theorists could not. Whatever explanation exists for her remarkable output it certainly had little to do with her conditions of work, as Rival tells us below. He begins by quoting Marjorie Rice herself:

> "This was the busy Christmas season which took much of my time," she recalled, "but I got back to the problem whenever I could and began drawing little diagrams on my kitchen counter when no one was there, covering them up quickly if someone came by, for I didn't wish to have to explain what I was doing to anyone."

"What did Marjorie Rice have that scores of past mathematicians did not have?" Rival asks rhetorically and answers:

> In a word, pictures. During most of this century, mathematicians have frowned upon the use of diagrams in expositions and arguments. Even with a problem so unavoidably visual as tiling of the plane, proofs of solutions, preferably would not invoke diagrams but would consist merely of rows of symbols: numerical; English, Greek and Hebrew letters; compound characters made by stacking up bars and dots and tiles - enough symbols, all told, to give a typographer nightmares. And each row would follow from the previous row in accordance with the laws of mathematical deduction. As long as this deductivist orthodoxy held sway, there was little room in mathematical discourse for diagrams or for arguments that appealed to common sense or intuition.

> Yet the tiling problem calls for, above all, thinking and talking in terms of images. Though it is not difficult to mount an entirely formal argument in support of the fairly simple cases analyzed by Reinhardt, the logic behind the more complex cases explored by Rice is difficult to convey without using pictures. In fact, as an aid to reasoning, she developed a symbolism all her own, a synthesis of pictures resembling hieroglyphics and an arcane code.

Rice's methodology, as it happens, mirrors a shift in the way mathematics is being done. Even as she was so vividly demonstrating the advantages of pictorial reasoning and argument, professional mathematicians were rediscovering them.

(...) It is not just in their thinking that combinatorialists rely heavily on diagrams. In exposition, too, they have relaxed the deductivist imperatives enough to use pictures liberally. If any single article was a harbinger of this trend, it was one that appeared fifteen years ago in the prestigious Journal of Combinatorial Theory, written by Jean Mayer.

The article was only one page long, and apart from its title, had essentially no exposition - not, at least, in the ordinary sense - but only pictures: three diagrams, appropriately labeled. The more conventional, written exposition would have required many pages and would have made for dull reading. The pictures told all.

In a world that is ever more reliant on images, Rival's somewhat dated article has much relevance. Whenever one encounters arguments which draw an in-principle distinction between scientific analysis and an image-based text, the case of Marjorie Rice should provide an appropriate counter-argument that comes from the most formal of the formal discourses.

One could go one step further and suggest that as the importance of image communication develops further, "diagrammatic" and "artistic" thinking will be judged ahead of "analytical" thinking in tertiary institutions for no other reason than because it works better. This is another way of saying that in a world which is ever more reliant on images and image-based communication, academics who do not have such skills may well be considered to be intellectually handicapped compared to those that are able to communicated with images. One would like to suggest that the flourishing media and new media programmes are already an evidence of this trend

In this context it may be worthwhile to reflect on a significant historical figure from the last century who found formal mathematics difficult but was very good at drawing images of difficult problems. It is said that he was fond of films and always wanted to direct slapstick film comedies. His name was Albert Einstein.

NOTES AND REFERENCES:

1 The inaugural conference of all Australian film schools (Victoria College of the Arts, Melbourne, June 2004) was attended by delegates from 14 university based film schools. The general estimate is that about half of all Australian universities have functional film schools.

2 These reflections on the substance of the medium are inspired by the work of Harold Innes and Marshall McLuhan. Both writers direct us to the importance of signifying substance in the construction of the message. Different media operate with different signifying substances and this difference is not inconsequential to the message that the medium delivers. Rather, this difference is the major part of the "message". Hence McLuhan's proclamation: "the medium is the message". That is to say, it is the material characteristics of the signifying substance (which constitute the medium, in the first instance), which play a major part in the "message" that the medium delivers. See an interesting collection of articles on Innes and McLuhan in Ian Angus and Brian Shoesmith, *Continuum: A Dialogue with Harold A Innis*, Vol. 7, No. 1, 1993.

3 This is another way of describing Saussure's second most important linguistic principle after that of Principle I, the arbitrary nature of the sign. He expounds on it in *Course in General Linguistics* (p.70) as follows:

Principle II: The Linear Nature of the Signifier

The signifier, being auditory, is unfolded solely in time from which it gets the following characteristics: (a) it represents a span, and (b) the span is measurable in a single dimension; it is a line. While Principle II is obvious, apparently linguists have always neglected to state it, doubtless because they found it too simple; nevertheless, it is fundamental, and its consequences are incalculable. Its importance equals that of Principle I; the whole language depends upon it. (see p. 122f.). In contrast to visual signifiers (nautical signals, etc.) which can offer simultaneous groupings in several dimensions, auditory signifiers have at their command only the dimension of time. Their elements are presented in successions; they form a chain. This feature becomes readily apparent when they are represented in writing and the spatial line of graphic marks is substituted for succession in time.

4 For references to "pictographic script", "picture-puzzle" and "rebus" see Sigmund Freud, "The Dream-Work" in *The Interpretation of Dreams*, *The Pelican Freud Library* Vol.4 (Harmondsworth: Penguin Books, 1976), pp.381-382.

There are two theoretical conditions on which Freud's diagrammatic dream notions are based:

(i) Dreams are ultimately an expression of an uncensored ego - everything is possible in a dream. All connections are possible.

(ii) The ego has a topological form. In "The Ego and the Id" Freud tells us that:

The ego is ultimately derived from bodily sensations, chiefly from those springing from the surface of the body. It may thus be regarded as a mental projection of the surface of the body, ...(..). (p.26)

For more details see Sigmund Freud, "The Ego and the Id" in *Standard Edition*, 1923, Volume 19, pp.3-59.

5 Michael O'Toole, in his *The Language of Displayed Art*, gives an interesting prescription of how a multidimensional referential system, such as that in an image-based text, can be approached in a systematic way. His analysis makes use of a 4x3 matrix of semiotic functions which includes representational, presentational and *gestalt* codes. His work on visual semiotics is in turn based on the systemic-functional theory of language developed by M.A.K. Halliday in *Explorations in the Functions of Language*. The outstanding usefulness of this type of discourse analysis, in the present context is that it is able to show quickly how intricate a judgement is required to construct and deconstruct a work of art. See O'Toole, Michael, *The Language of Displayed Art*, (London: Leicester University Press, 1994); and M.A.K. Halliday, *Explorations in the Functions of Language*, (London: Edward Arnold, 1973). Also see Gunther Kress and Theo van Leeuwen, *Reading Images*, (London, Routledge, 1996).

6 A good introduction to the notion of fuzzy logic can be found in *Fuzzy Thinking: the new science of fuzzy logic* by Bart Kosko, (New York: Hyperion, 1993).

7 The notion of the screen persona and screen character provides one such *gestalt* life form by which we judge the content of films. It is also this abstract type of life form which supports the existence of film stars and the star-system in general. Such an abstract life form can be projected across time and across performances. When we go to see a Clint Eastwood film there are already many films and many abstract lives on which our experience of such a film is based. Thus, by choosing a particular star to act in a film, the film's producer precipitates numerous multidimensional decisions which relate to many other stories and events which the star brings to the film.

8 Image-makers often create connections that are not apprehended by the viewer in the act of "reading" but may be discovered later when the whole text is in place.

9 Lacan's "mirror stage" of development is one attempt to explain how our visual experience is structured during the pre-linguistic stage of development . According to Lacan, the image which the child sees during the "mirror stage" of development (and before the child enters into language) provides the child with a sense of existential coherence in exteriority – in a way that is similar to the identification we have with our own image in the mirror.

See Jacques Lacan, "The mirror-stage as formative of the function of the I as revealed in psychoanalytic experience ", in *Ecrits*, translated by Alan   Sheridan, (U.K.: Tavistock Publication, 1977/1937), pp.1-7

10. For Freud, seeing is "an activity that ultimately is derived from touching". See Sigmund Freud, "Three Essays on the Theory of Sexuality", *Standard Edition*, Vol.7, p.156.

11. The work of Maurice Merleau-Ponty is interesting in this regard. See his *The Phenomenology of Perception*, trans. Colin Smith, (London: Routledge and Kegan Paul, 1962); *The Primacy of Perception*, (Evanston: Northwestern University Press, 1963); *The Visible and the Invisible*, trans. Alphonso Lingis, (Evanston: Northwestern University Press, 1963). Elizabeth Grosz makes considerable use of Merleau Ponty's work in her *Volatile Bodies*. In the context of the present discussion the piece "Eye and Mind", translated by Carleton Dallery, in *The Primacy of Perception*, pp.159-192 is of particular value.

12. For an interesting description of the relationship between the body and discourse in general, see Elizabeth Grosz, Volatile Bodies, (US, Indiana University Press, 1994), especially pp. 3-186. The sensuous (surface of the) body is the founding stone of Aristotelian cosmology, especially the sense of touch/taste. The Aristotelian body, in turn, becomes the springboard for the historical materialism of Marx and Engels as well as for the psychoanalytical writings of Sigmund Freud and Wilhelm Reich. The Aristotelian body is imbedded as the cornerstone of biological sciences exemplified by works on "homunculus" such as Karl Pribram's Language of the Brain, (New Jersey: Prentice Hall, 1971) and in mathematical biology of the kind that can be found in Rene Thom's writing on "catastrophe theory".

For some of the above references see: Aristotle, De Anima, trans. by K. Foster and S. Humphries, (London: Routledge, 1959); David McLelland, Marx before Marxism, (Harmondsworth: Penguin Books, 1970); Frank Sulloway, Freud, Biologist of the Mind: Beyond the Psychoanalytic Legend, (UK: Fontana, 1979); Karl Pribram & Merton Gill, Freud's `Project' Re-Assessed (London: Hutchinson, 1976); Wilhelm Reich, The Function of the Orgasm, trans. by Theodore P. Wolfe, (London: Panther Books, 1968/1942); Rene Thom, Structural Stability and Morphogenesis, (Reading: W.A. Benjamin, 1975);

13 The notion of the body remains important to contemporary writers such as Deleuze and Guattari, even though their use of the body departs from the functional body we have come to expect from Aristotle. In the two volumes of *Capitalism and Schizophrenia* biological functions of the body are no longer foregrounded in the Aristotelian sense. Instead, both the subject and the object find themselves on a new type of abstract body which Deleuze and Guattari label "body without organs". On this abstract body, optical space disappears (as does projective space) and is replaced by a version of tactile space, which Deleuze and Guattari label "haptic" space.

"Haptic" is a better word than "tactile" since it does not establish an opposition between two sense organs but rather invites the assumption that the eye itself may fulfill this nonoptical function. (Deleuze and Guattari *A Thousand Plateaus*, p. 492.)

14 This was not always so. Geometric diagrams are a case in point. The exclusion of images and diagrams from analysis has a historical dimension. It is, for example, possible to locate a point in history when geometric diagrams had an acceptable academic status before they were replaced by algebraic symbols. The intuitive "proofs" which geometric diagrams offer fell into disrepute following the invention of calculus by Isaac Newton, even though Newton himself did not prove the fundamental theorems of calculus according to the stringent standards of formal proof expected today.

15 Kurt Godel's 1931 paper *On Formally Undecidable Propositions of Principia Mathematica and Related Systems*, trans. B. Meltzer, (New York: Basic Books, 1962), brought into question the entire axiological/deductive system exemplified by Bertrand Russell and Alfred North Whitehead's *Principia Mathematica*. While the theory underpinning the axiological/deductive/logico-positivist system came into question, its practice went on unabated and its underlying principles, more or less, still define the conventional research paradigm.

Axiomatic reasoning is often depicted metaphorically as a pyramid in which the base is made up of axioms and postulates and which supports all other theoretical pronouncements. With writers such as Michel Foucault, the axiomatic pyramid is inverted. The base of the pyramid consists of multiple and intersecting discourses which may, under certain conditions, give rise to formalization of the kind one encounters in axiomatic logic. Foucault's style of "reasoning" is much more prevalent among

Humanities researchers, but the status of its logic is always provisional, always unstable and in question

16 Ivan Rival, "Picture Puzzling: Mathematicians Are Rediscovering the Power of Pictorial Reasoning", in *The Sciences*, The New York Academy of Sciences January/February 1987, pp.41-46.