REFIGURING CULTURE

Timothy Binkley

The Light at the Back of the Cave

Plato would probably disparage the ubiquitous TV den as a modernised version of his gloomy Cave portending dire consequences for the future of culture. Shackled by nothing more sinister than potato chips and beer in an easy chair, passive spectators watch flickering shadows cast by a reality that passes them by in some remote elsewhere. The progenitor of Western philosophy would most likely agree with his contemporary progeny who deride television as a retrograde cultural force that numbs the intellect while it panders to the appetites.

The Platonic critique of television is based on two related beliefs. Firstly, ideas and images exist in drastically different realms mediated but separated by objects and secondly, their relationship is indirect and unreflexive since images assume the inferior position of representing objects that are in turn subordinate to the concepts those objects instantiate. For example, the Idea, or Form of 'bed' is an abstraction that is imitated (or instanced) by an object made of wood and cotton. This object is in turn imitated by a painting. In this one-way hierarchy, pictures capture only reflected illumination from concepts and hence are twice removed from the pure Forms of Truth and Beauty. Within this framework television stupefies because it traffics in faint imitations of imitations that obscure uplifting ideas with base passions.

When he dichotomised rational forms and perceptual appearances, Plato struck a tonic chord which still resonates. But these well-worn assumptions about the breaches and bridges between spiritual and physical worlds are giving way to new kinds of cultural events. TV images are drawing splendour directly from mathematical abstractions unmediated by any physical events they might represent. The realm of

concepts has begun to play its own distinctive apparitions across the cathode ray tube (CRT) as digital media supersede analogue ones and computers take an active role in managing the spectacle. A new intercourse of ideas and images arises as computers perform feats heretofore restricted to people and a pervious screen beckons us to join in the dance.

The intriguing phenomena of **virtuality** and **interactivity** loom over the horizons of the old metaphysical order and challenge it on two major fronts. These two hallmarks of computed experience originate in abstraction. Numbers are the original 'virtual reality'. Despite their intangible nature, they have a concrete impact on our lives, from measuring financial status to gauging the structural integrity of buildings. Our world economy has abandoned gold as the basis of wealth, and a new order is rapidly emerging which traffics in nothing but numbers. A paycheque is simply an addition to the balance in one's bank account, and a purchase is a subtraction. A number identifies who you are and what privileges you enjoy. All this activity is mediated by computers which connect us to numbers in perplexing but vivid ways. They do this by being able to execute formal procedures called 'algorithms'. These procedures permit computers to have a dialogue with us through numerical mediators which are both representatives of events in the world and the subjects of calculations. The mechanised ratiocination that takes place among hidden circuitry is linked to our quotidian world through responsive interfaces which accomplish rapid conversions between numbers and physical events. The virtual reality of numerical descriptions in coordinate space and the interactivity of intelligent machines which algorithmically manage them coalesce to open enigmatic portals into cultural productions more vivid but less domineering than the mimetic ones prevalent since shadows danced in Plato's Cave.

What is a Digital Medium?

Prehistoric artisans wrestled their entreaties to immortality into recalcitrant physical substances long before Plato spurned images in favour of ideas as the best route to eternal verities. Ever since, supplicants striving for an audience with future generations have struggled to chip stone into beautiful shapes or plaster walls of dark rooms with arduously prepared pigment. The earliest creative labours left legacies enshrined in material objects with more staying power than mortal flesh. They have since evolved through a long history of increasing

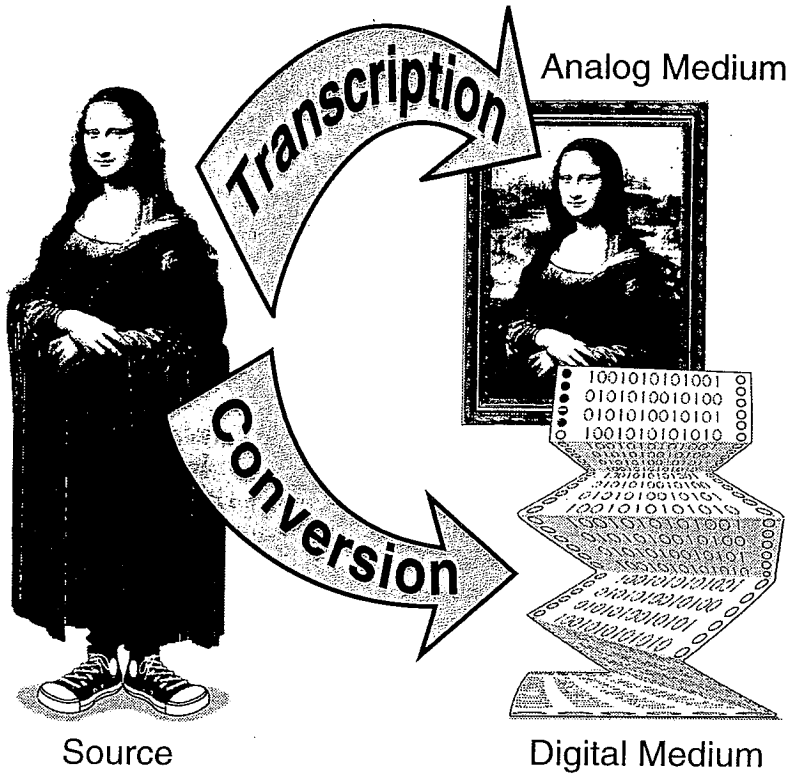


Fig. 1 by William Nelson

automation so that now anyone can capture an image for posterity with pushbutton immediacy.

The protracted course of civilisation has carved a rich heritage of communication channels. From painting to periodicals, from recitals to radio, from LPs to CDs, they have come to be known as the **media** by which messages are spirited across space and time.[1] Until recently, media have conformed to what is called an **analogue** paradigm characterised by an imprinting process. Analogue media store information through some kind of **transcription** which transfers the configuration of one physical material into an analogous arrangement in another (Fig. 1).[2] The Mona Lisa mimics in paint the appearance of a person in the flesh. Even if the Gioconda is not a real person or is an idealisation of an historical figure, the work's representational status is derived from a portrait paradigm: someone could look like that even if no one

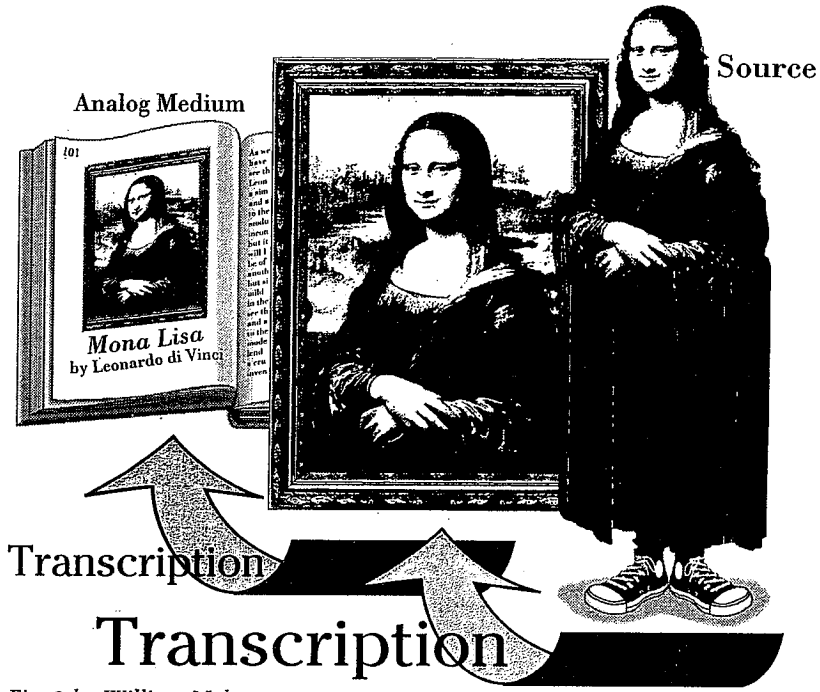


Fig. 2 by William Nelson

does.[3] When a painting has no representational subject, the medium still registers at least the artist's gestures transcriptively as they impart analogous forms to paint: a straight movement of the hand creates a straight line, while a curved movement produces an arc.

Analogue media imbue objects with resilient marks perceivable either directly through the senses, or indirectly through a display process that carries out an additional transcription. Photography is of the former type, video the latter. By transferring reflected light onto reflective pigment, a camera generates visible film whose recorded images are simply looked at. But when light patterns are embedded in an electrical signal by a video camera, the analogous forms imparted to the current are not visible until they are transcribed back into light as glowing phosphor on a monitor. When a video signal is recorded on tape, yet another transcription imprints electrical impulses onto analogous magnetic ones, and the playback process involves two transcriptions that first conform electric current to the recorded magnetic fields and then match the flicker of light on the screen to the varying flow of

electrons. Transcriptions can be joined together in a cascading sequence of media that vastly extend the potential impact of a work of art or a noteworthy event (Fig. 2). Such iterated transcription is intrinsic to the popular 'mass media' of television, newspapers, magazines, books and movies of contemporary culture. These ubiquitous transmitters are all thoroughly immersed in the repeated imprinting that is essential for the promulgation of analogue information. The face of Madonna on the cover of a magazine is transcribed first to film, then to a printing plate, and then to paper before finally reaching the consumer.

Digital media by contrast **convert**, rather than transcribe, the information they preserve. Whereas analogue media store cultural information in the material disposition of concrete objects, digital ones store it as formal relationships in abstract structures. A phonograph record and a compact disc both archive music, but the methods they use are fundamentally dissimilar. Analogue media maintain a concrete homogeneity with what they represent, while their digital counterparts transform originating impulses into heterogeneous quantifications of their sources. An analogue-to-digital conversion process transfigures physical quantities into numbers (Fig. 1). A digitisation of the subject of Leonardo's masterpiece transforms her features into a sequence of numbers rather than trying to analogise them in paint. These numbers might initially be lodged in the electronic circuits of a computer's memory, but they can readily be shuttled back and forth among many other types of media that have been suitably prepared to receive them, from magnetic disc to marks on paper, to optical discs, or magnetic tape.

A digital medium is not virgin territory, but needs to be formatted first before it can receive messages from a communicator. No imprint is pressed; rather a lattice is filled. A digital medium is prepared to receive information not by smoothing it into an undifferentiated continuum, but rather by imposing on it an essential grid that delineates receptacles for data. Although a digital medium may use the same physical material as an analogue medium (e.g. magnetic tape), it functions quite differently since its import lies in stored digits, not in any particular aesthetic qualities of the substrate. Digital media are discontinuous pre-structured arenas where vast multitudes of regimented discrete quanta are episodically hosted for the purpose of articulating messages.

Photographs and phonograph records directly mimic their sources through medium-specific tangible linkages, each engineered to make

relatively permanent marks on a particular type of material. The art is then carried to its audience through direct or transcribed perceptions of the medium.[4] Digital machinations, on the other hand, can place the source, artist and audience at remote locations where contact with the material that holds the information they share is essentially mediated not by characteristic physical processes, but rather by conceptual constructs adaptable to a variety of materials.[5] The digital medium is never a palimpsest: no permanent traces are left since messages pass in and out of the theatre of digits without presuming continued residence. Each cipher gently occupies its assigned seat with quiet assurance but then agreeably leaves when asked to make room for another cast of characters. A database constitutes an elusive though powerful creative resource which is diaphanous compared with paints and brushes. Digital media store information, but not in a form that is directly perceivable or by means of a playback transcription. These salient differences can be summarised by noting that a digital medium stores tokens of numbers rather than recording traces of events, as its analogue predecessors do. But what exactly does this mean?

Numbers are abstractions that have no concrete physical existence. The number two is an intangible idea designated by many different instances of markedly different symbols. The arabic numeral for it is '2,' the Roman form is 'II,' and the binary code made popular with computers is '10'. Every time any symbol for the number is written, the marks constitute what is called a **token** of the number. The abstraction that constitutes the number itself is sometimes called a **type**. Different inscriptions of the same symbol can have rather different appearances, as when the arabic symbol is written in different handwriting scripts or printed in different typefaces. The ability of a token to represent a number does not depend upon the particular aesthetic qualities of its appearance, but rather upon the role it plays in a comprehensive formal system. A token for two does not have to look like anything in particular so long as we can consistently identify it and systematically differentiate it from tokens for other numbers. Marks that designate the numbers permit a much wider range of variability than brushstrokes representing Mona Lisa's enigmatic smile. One small change and a smile becomes a frown, but a token for two can be stretched into wildly diverse shapes without losing its meaning. On the other hand, the same token could mean two or twenty depending simply upon where it is placed relative to other symbols. The aesthetic properties of a token are incidental to its mathematical role. A beautifully designed '2' is just as functional as an ugly if legible scrawl.

When an image is transcribed into an electric signal by an analogue video system, a particular amount of light measured in luxes is matched to a different amount of current measured in volts (Fig. 3).[6] This kind of co-ordinated matching is the hallmark of an analogue medium. Quantities of one kind of substance are transferred into isomorphic quantities of another according to a specified physical process. In video, light patterns become electrical ones. When an analogue video signal is subsequently recorded onto tape, the changing magnitude of an electric current is transcribed into similar changes in the magnitude of a magnetic field.

But when a digital video system converts light into numbers, it strips the structure of a physical event away from its underlying substance and turns the incoming signal into a pure abstraction, a file of numbers untethered to any intrinsic material alliance. A digital medium stores numbers without tying them to a unit of measurement. Digital video turns a quantity of light into nothing but a quantity, a bare token that stands only for a number and not for a certain amount of matter or energy measured according to a conventional unit. The process converts an image into a collection of numbers that can be abstractly manipulated using mathematical techniques, a process completely alien to analogue media. When we subsequently want to look at the image represented by an array of digits, the unit of light must be recomposited with the numbers to convert the information back into visible events comprising an image on a CRT. Digital media are supported by both an abstraction process that extracts numbers from events for input and a materialisation process that injects numbers into events for output. But when numbers take up residence in a computer, they exist independent of any particular scale of measurement. Which material unit gets affixed to a set of numbers is to some extent arbitrary since a given file can be output either as a picture or as music equally well, given suitable conversion hardware. Digital systems are strictly independent from material manifestations and yet can easily be converted to and from them. Each analogue medium by contrast is inextricably linked to a particular substance.

States of electronic circuits, arrangements of magnetic fields, or microscopic pits etched in plastic are not things human beings can manipulate as tokens of numbers the way we manage marks on paper or beads on a string. Computers, however, use such arcane symbols to emulate what we do with our humble tokens. The contents of a digital medium are invisible and intangible, but by virtue of the role they play in a computing system, they conform to recognised criteria of numbers.

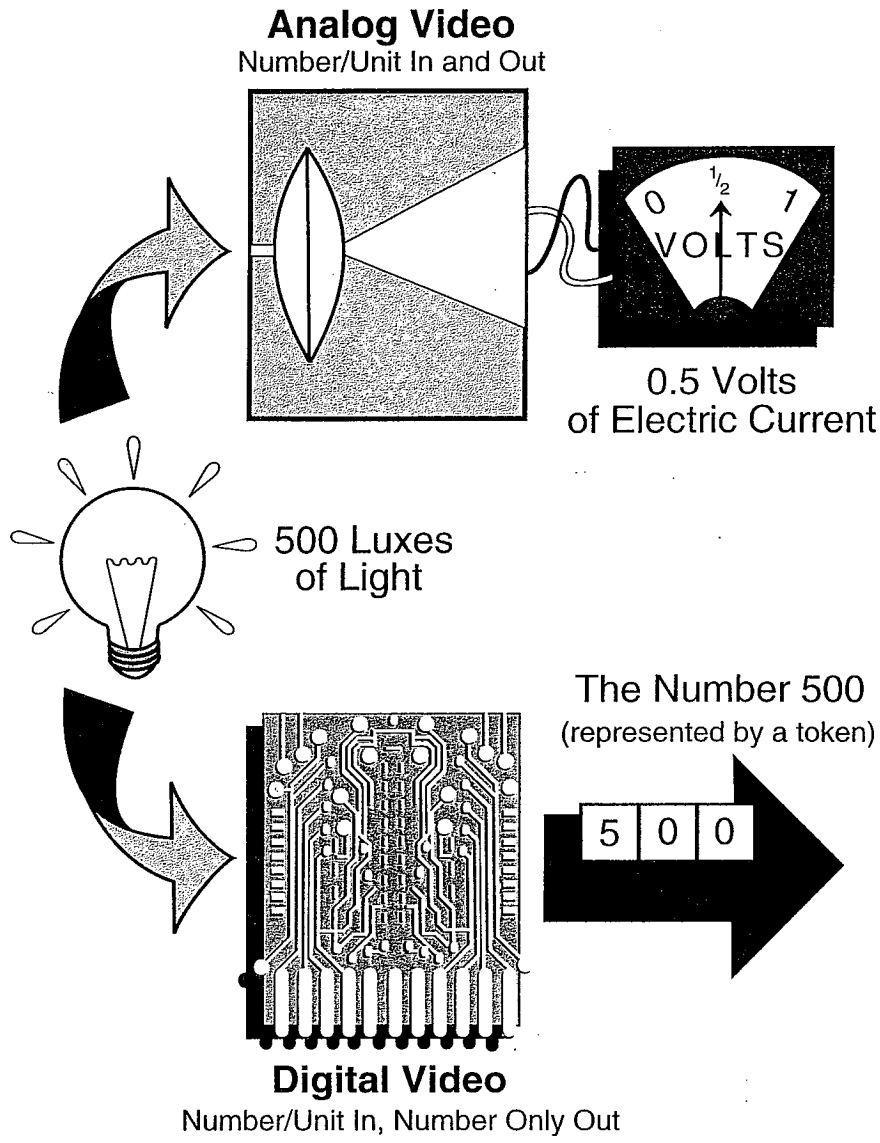


Fig. 3 by William Nelson

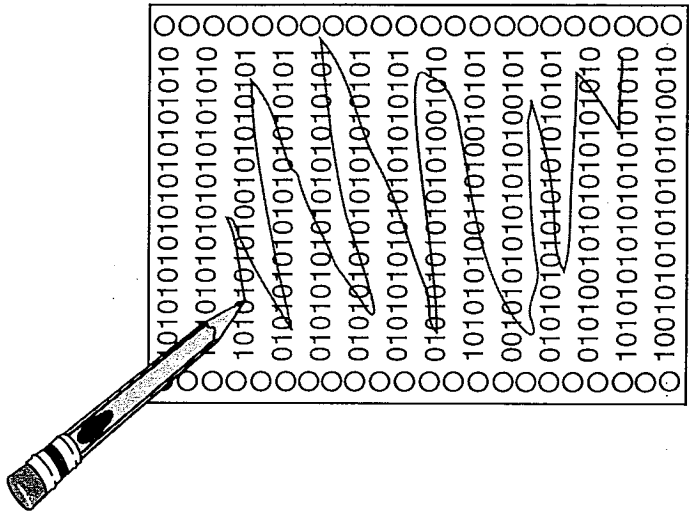
For example, they satisfy Peano's postulates that axiomatise the natural number system and are amenable to formal manipulation just like their traditional counterparts.[7] Some of the algorithms used are derived from age-old procedures while others are markedly different: a computer will probably calculate an average in much the way we do it by hand, but it will most likely sort a collection of items or draw a line using unique methods developed especially for machines. Although they may behave somewhat differently, computerised digits still form part of a deductive system which subjects them to familiar activities of inference and calculation. Moreover, it is possible to translate the computer's tokens into ours so that they can readily communicate with us. Indeed, some humanly perceivable manifestations are necessary (whether as tokens or as something else) in order for digital media to have any meaning for us.

That digital media store abstract tokens of numbers instead of concrete traces of events makes them distinctive. One of the most important features of digital media is that they can be manipulated with all the resources of a digital computer to create, filter, augment, refine, or alter the information they contain. This subjects them to a completely different set of rules from those applied to analogue media. Since their creative resources are mathematically instead of materially based, their limits are fixed at logical instead of physical boundaries. Our ability to impart a particular form to an analogue medium depends upon the efficacy of physical tools directed by manual skills. But converting the same form into a numerical format relies upon conceptual skills in formulating algorithmic techniques. A creative imagination roams through digital domains unencumbered by the constraints of corporeal existence that are a way of life for analogue artists. It takes strength and skill to chip a block of stone into a beautiful bust; and once cleaved, elementary laws of physics prevent the stone from becoming whole again. Digital media, on the other hand, are graciously forgiving and will obediently retract any regretted action. But this indulgence carries its own problems and perils. When a steel chisel carves a block of marble, familiar motor skills come into play guided by instinctive hand-eye co-ordination. However, a purely digital chisel will pass right through numerically defined stone without making a mark. It is sometimes difficult to achieve desired results in an intangible medium without carrying out challenging formal procedures that have little intuitive relationship to any visual goal. Moreover, the freedom of unlimited pardon can imprison the artist in a confounding labyrinth of her own making. Having the ability to redo something until it comes

out right guarantees perfection on a regular basis, but it can also lead to an endless array of variants that stymie the artist with fecundity. Too many alternatives can cloud the clarity of incisive insight.

One of the important practical differences is that, despite their submissiveness, digital data tend to possess more resilience and hence need less protection than information stored in analogue media. Although a file of numbers can be more tentative than chipped marble, it can also be more lasting. An analogue medium is immaculately primed for imprint, making it sensitive to the slightest nuance. Whether the marks so borne are sacred maculations of art or horrible scars of vandalism depends upon where they stand relative to accepted social practices. Elaborate institutions protect the integrity of certain appearances and prevent the encroachment of others. Museums are built to shelter paintings from the elements and they are staffed by guards to deter mischief. The perceptual qualities of analogue media are paramount, but they are vulnerably stored in fragile physical materials. This is why the various mechanical sentinels of photography carefully guard its sensitive films to discriminate between sanctioned and errant flashes of light. Meticulous rituals are observed to ward off the intrusion of anything that does not come through a camera's shutter. Even a slight change in the material of an analogue medium can significantly alter the message. Digital media, on the other hand, are impervious to a considerable amount of rough treatment. Since they store tokens of numbers, their information content will often remain intact despite significant changes in the material that stores it. The postmark on a stamp will mar the look of its image while not generally affecting the legibility of its denomination. A scratch on the surface of a painting seriously violates its aesthetic integrity, but a similar vandalisation of its digitised counterpart need not affect its contents at all (Fig. 4). The responsiveness of digital media to mathematical formulae gives us the surprising ability to recover lost information or to filter out interfering 'noise' that corrupts an intended message. We can also enhance a digital image or sound to reveal information otherwise unnoticeable. In scientific visualisation, for example, digital images are often processed and coloured to reveal patterns hidden in the raw data.

The vulnerability of analogue media is apparent in their very dissemination where 'generation loss' corrupts the quality of an image as it is repeatedly copied. It is difficult to maintain all the details of an image or sound when it is transcribed over and over again from one material object to another. Even when making multiple copies from



Digital Medium

Analog Medium

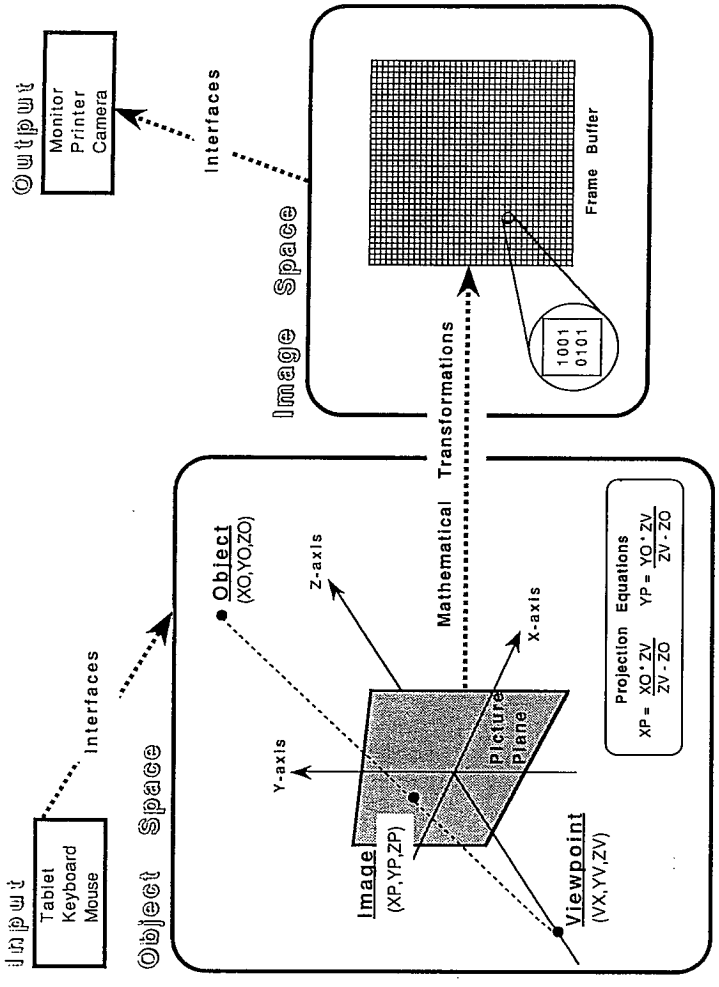
Fig. 4 by William Nelson

one source, such as an etched plate, the original tends to deteriorate in the process since direct physical impact is needed for each successive imprint. But there is a sense in which digital media deal only with 'originals' and hence neither propagate generation loss nor corrupt the source through repeated copying. When a token of a number is copied, it is not usually imprinted from one material to another. Rather, a discrimination process is engaged to analyse the token and decide what number it represents. When the copy is written, it is inscribed anew as a token of the same number. In this sense, tokens of numbers are not copies mediated through other tokens, but betoken their abstractions with equal virility. When you transfer a number from a bill to a cheque, your payment is never somehow diminished by being copied. Similarly, when a computer writes a collection of tokens on a disc, they are always equally strong representatives of their numbers, whether they originated on another disc or were computed fresh. A 'glitch' might occur in either case, but such infelicities are easily detected and readily corrected. Tokens are never transcribed, but are always inscribed afresh, which is what gives digital media their resilience.

Both kinds of media store information. Analogue media transcribe it into a material form with aesthetic vitality, but their quest for perceptual analogy limits them to physical repositories which render them relatively passive. Digital media store only cold abstractions that have no inherent perceptual appeal, but since their use of physical material is less intrinsic, they open a gateway to virtual worlds that permit interactive experiences. So computerisation of cultural activities changes the role of media.

Computers make pictures without using the traditional repertoire of image-making tools. In effect they are virtual cameras capable of producing real pictures of imaginary places. It is hardly surprising that our fantasies attribute magical powers to a machine that conjures up photographs of things that don't exist using a camera that doesn't exist either.

The first step in generating much of the computer imagery that appears in film and video today is to **model** an environment mathematically. This is done by fashioning a set of geometrical structures in an abstract coordinate space, called the **object space** (Fig. 5). For example, the spaceships in *The Last Starfighter* (1985) are described mathematically and situated in a three-dimensional Cartesian coordinate system used to reference locations in a virtual universe. A computer manipulates the coordinates of the ship to move it across a starfield and generate sequential files of numbers representing each successive frame



The Virtual Camera

Fig. 5 by William Nelson

of the animation. The computed frames contain pictorial information in **image space**, where information about the spaceship and its environment are transferred to a different mathematical structure tailored for output as a real image (recorded on film, video, or paper) that human beings can look at. Popular computer-aided drafting and page layout systems function similarly, except that the object space is usually two dimensional and is populated with the more mundane creations of architecture and graphic design. Object space is stored in the general purpose memory of a computer, while image space typically has its own hardware receptacle called a 'frame buffer'.

In some cases, computed imagery remains entirely in image space. The most common example is the so-called 'paint system', which allows users to make pictures by introducing numbers into the frame buffer with the aid of an electronic stylus or a mouse. Some cinematic applications also confine themselves to image space. A number of noteworthy recent examples show people metamorphosing into animals or into other people, such as the Michael Jackson video, *Black or White* (1991). For these effects, film is shot of the two (or more) subjects and then each frame is digitised into a computer's image space format. By analysing each frame with the guidance of artists, the computer uses special algorithms that seamlessly blend the face of one person into that of the animal or the other person. Once the metamorphosed sequence is finished, the image space is output back onto film.[8] Metamorphoses can also take place in object space, where interpolation algorithms transform the objects rather than the images. Although the results may look similar, the procedures are different for transforming the coordinates of an elephant into the coordinates of a giraffe, as opposed to changing a picture of a car into a picture of a tiger. Technical and aesthetic issues dictate which approach is preferred.

The computer is so deft at such feats because nothing exists for it except as numbers. The data representing objects, the files representing pictures, the equations used for performing mathematical transformations, and the algorithmic procedures used to do the work, are all composited as constellations of ciphers. To create something, a set of numbers is composed; to make it move, a sequence of calculations is performed. Instead of using the constructive tools of Euclidean geometry to capture real objects the way a camera obscura does, the computer's virtual camera uses the computational tools of Cartesian geometry to depict virtual objects that exist for its eye only.[9]