Programming with a Paintbrush:
The Last Interactive Workstation

Richard Wright, July, 1999.

(An edited version of this essay appears in *Filmwaves* no. 12, Autumn 2000).

Image created by a Quantel Paintbox (CAL Video Graphics Ltd, London, 1983).

Since the beginning of the eighties the British company Quantel Ltd has managed to maintain a reputation that has made it almost synonymous with the limits of what is possible in digital post-production and broadcast special effects work. More remarkable is the fact that this success is based on an interface design that was introduced in 1981 and has remained largely unchanged to the present day. The intention of the company to provide a completely dedicated computer hardware that can provide instant feedback and unequalled image processing speeds has resulted in a completely different experience of the creative process for the user, and one that is about to end in several important respects.

In the hierarchy of post-production equipment, Quantel machines are like the Rolls Royce, their nearest rivals being Discrete Logic's Silicon Graphics based Fire and Flame family. They are the machines that led to the fashion in the eighties of designers carrying the distinctive Quantel pens around in their top pockets when they went out to the local wine bars, like a little calling card that could guarantee the respect due to someone working at the dizzy high-end of mission critical advertising schedules and high profile pop promos. These are the people who are selected by facilities houses not only for their technical proficiency and creative flair but also for their client manner, their ability to shoulder the anxieties of pressured art directors and satisfy indecisive advertising executives. A top Quantel operator justifies their telephone number salary by selling confidence of a particularly rarefied sort. For when you are working at a level of production which is premised on the assumption that this is the best that money can buy and that technology can dare then you are trading on a dream, a dream best characterised by the Japanese media theorist Asada Akira as the meaning of technology itself – "When we find something impossible, we do it".

Now we appear to be reaching the culmination of the desktop computer era when large standalone systems like a Quantel look increasingly anachronistic. But this is because of a lack of appreciation of the production culture it was designed for rather than it being outpaced by

technological development. Desktop computer graphics systems have tended to advance in terms of an increasing number of features which are interactively controlled through interfaces such as layers and timelines to assemble material like the fitting together of the pieces of a jigsaw puzzle. Complicated image processing techniques are available as menu options with familiar sounding names in order to provide the user with an "intuitive" interface. This logic has become well known to most artists and designers involved in digital production, but its premises of a tool for every style are challenged by the less familiar history of dedicated hardware based turnkey systems of which the Quantel range is the leading example. For Quantel operation is both intuitive and technical, its range of features is small yet its range of application is large, its interface is highly interactive and gestural yet it requires a highly systematic degree of working and logical forward planning to complete a job successfully. The characterisation of these systems need different criteria than that of being either interactive or script based, having an intuitive or a logical work flow or in the sheer number of effects available to the user. We need criteria that also allow a systems technical design to be put into its cultural and commercial context more clearly so that the force of its influence can be accounted for. When you learn to use a computer graphics system you are learning a practice rather than a toolbox of techniques as such. This practice is encoded into the technology as input contexts, devices, menus, parameter values, controls and so on. The practice in turn supports and expresses itself through a production culture - its working methods, commercial imperatives and aesthetic values. How these different levels relate to each other, whether they are really separate at all and how a computer graphics system can form its own aesthetic even when the technical potential of different systems are basically the same are the questions we will explore here.

The Quantel “Infinity” effects editing system.

A single Quantel system can set you back anything between one hundred thousand and half a million pounds, so it should come as no surprise that they are not as common as "lower end" graphics systems. But this only adds to their mystique of course. Normally housed in a large plush studio with well dressed staff, comfy sofas and blue mineral water dispensers, every effort is made to produce an environment in which you could believe that the consummate achievements of human culture are being created. But costing an average of 600 GBP an hour

plus extras, a Quantel based production still seems a distant possibility for the vast majority of directors apart from minor work on the briefest effects shots. For many years during the late eighties and early nineties the desire among many independent film and video makers and animators to gain time on a Quantel machine became a palpable envy leading to widespread embitteredness and inferiority complexes.

This inevitable inaccessibility of the machine itself is paradoxically combined with an extremely high visibility of its end product. The majority of TV advertisements and nearly all of the ones relying on highly stylised visuals have extensive work done on them by one or more of the Quantel systems. Added to this we have graphic animation sequences on pop promos, on channel idents and stings, also documentary and news graphics, title sequences of all kinds as well as the corporate video sector. If we remember that many stills images for advertising billboards, magazines and posters are produced on the Paintbox system then we can start to see that Quantel equipment is responsible for much of the landscape of visual media we take for granted. As their publicity states, "Quantel is already inescapably part of your life". Although the status of the company as a cultural flagship in commercial image making, its eclectic origins and historic battles with its rivals that at one point threatened the future of half of the computer graphics industry itself would form an instructive lesson in the cultural politics of media technology, my intention here is just to focus on the technological basis of Quantel's success. For it is possible even in the implementation of the basic processing functions and the interface design of its equipment to find many of the characteristics necessary to understand the practice it is intended for and its wider impact on moving image culture. Its innovations in interactive interface technology have had a particular influence on a very small but very significant production sector, and its creative processes and aesthetic values have in turn set cultural standards in commercial video production for nearly two decades.

“Walking with Dinosaurs”, BBC TV 1999, CG work by Framestore CFC. Example of Quantel ‘effects editing’, the various layers of photography, animation and effects being retouched, retimed and composited, etc.

Although Quantel currently manufacture a range of systems from the newest Editbox designed for online editing, the Henry for special effects and Hal for videographic design, their basic

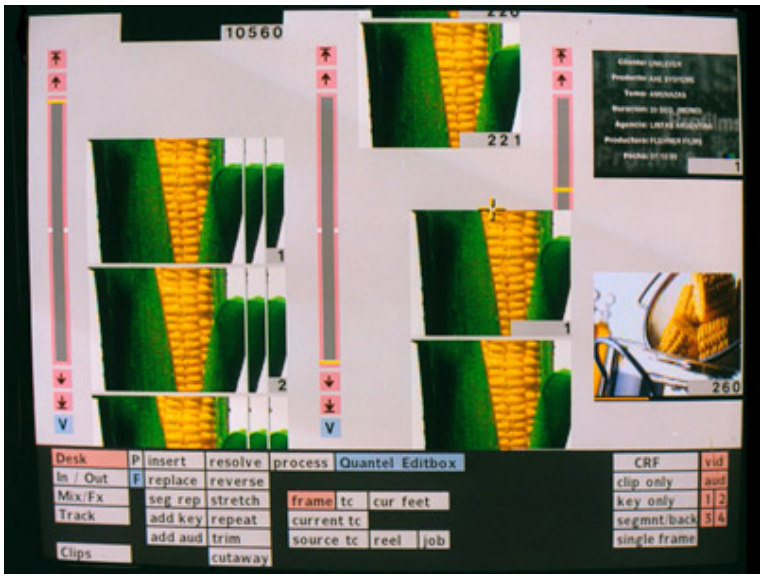
functionality remains largely the same. Their main differences are in certain features that change the orientation of their production environments, but if pushed there are ways of getting the same results whichever system you use, and such are the similarities that after having trained up on one of them it is a relatively painless matter to learn one of the others. In fact the most noticeable thing about a hardware based Quantel system is that compared to a software based system like Adobe's After Effects or Softimage's Eddie the range of available functions and features is remarkably small.

Since the mid nineties developments in increased processor speed and disk capacity have created the field of desktop video production and non linear editing as a low end alternative to specialised workstations. Although these systems cannot normally equal the fast rendering times, video quality or integration and configurability of the high end equipment, the software that they run can incorporate many professional features and effects. A very common package used at this level of the industry is Adobe After Effects which now comes with a vast array of image filters and processes, keyframe animation facilities and compositing options for special effects and post production. Given that a software based system like After Effects can be up to one hundred times cheaper than a Quantel system, it would seem reasonable to ask just what it is that people are getting for their money. An advantage of software based systems is that it is relatively easy to write new code to expand the package to include new features, often sold as plug-in extras. On a hardware based system you have to write the code and also design and build new logic circuits and incorporate them into the existing architecture. Users of desktop based systems are quick to point out that software based packages have an extensive range of functions that far outstrip those available on a Quantel machine. The most obvious difference between the two classes of systems is speed – a hardware based system will always be faster than a software based one, and building those specialised processors and circuit boards dedicated to image processing is not cheap. But this difference can be deceptive. We can argue that when we are rendering a special effects sequence it can make little difference whether it takes two hours or twenty hours – you will probably still have to leave it to render overnight while you go home to bed. Even if this means tying up a machine for a whole day while you wait for it to finish, PC and Mac computers are so cheap nowadays that you could go out and buy another one to work on with the petty cash. So if a half million pound Quantel Henry won't do as much as a one grand copy of After Effects then what is all the fuss about?

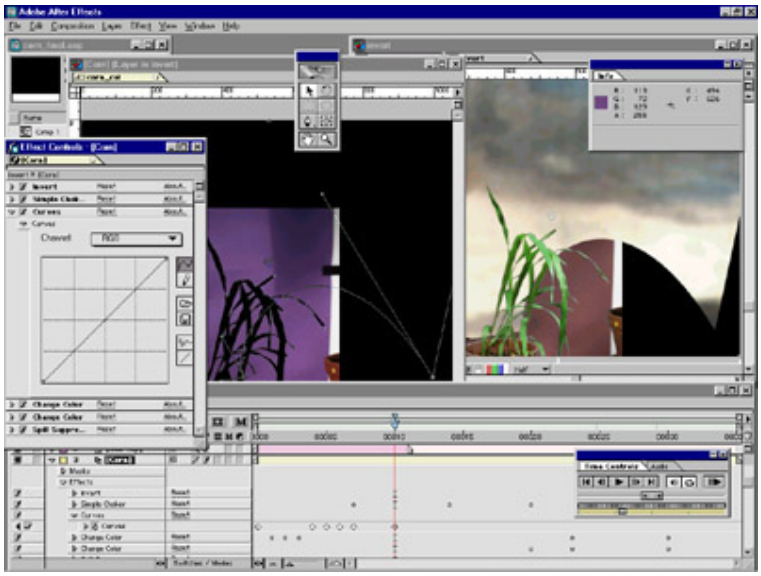
If you tell a Quantel employee that your company does all its high quality advertising campaigns on a Mac and a copy of After Effects then they will ask you how many of those were "top end jobs". The implication is that at the top level of video production there exist a somewhat different range of priorities and standards. These take several different forms. Reliability is cited as an important feature of production equipment, but in this respect Quantel machines are really as vulnerable as any other. Quality is also frequently mentioned, usually interpreted as being the ability to work with uncompressed video and in the accuracy of various image processing operations. But there are many software based systems now offering high quality rendering and perfect image quality is not always necessary in every production sector.

Although speed is a factor in finishing a project on time, in a top end production environment it operates in a different context. Much of the work at facilities houses takes place while the client is present, so the speed at which the designer can respond to a director's instructions is a primary issue. Sometimes the brief involves perhaps animating to a storyboard and would involve designers working on their own on the different elements ready to be presented and approved at a later date. But the job is still broken down in separate parts as far as possible to allow more flexibility to respond to changes later. This is a main advantage of digital production, that a project is fragmented into different parts that can be disassembled and reassembled over and over again without sacrificing its structural integrity. And Quantel systems allow these different parts to be swapped around, processed, re-coloured and re-timed almost on the fly and in the presence of the client. A desktop based After Effects production could not provide the rendering speed and instant feedback necessary to keep up with a client who expects to be able to direct the work as it happens. Every moment that the production is taking place away from the direct gaze and

supervision of the director is a moment of anxious anticipation for him or her. Quantel equipment gives the director more of a feeling that the programme is being put together under their direct control, allowing constant dialogue with the operator and receiving instant visual feedback. Therefore, at least while the client is on site, an ideal of real-time production is always desired.



The Quantel Editbox V5 desktop, 1999.


The Adobe “After Effects” V3.1 desktop

Once all the individual shots, effects footage, graphics elements and animation layers have been prepared they are all brought together in the presence of the client in a grandiose final creative act with the help of a high end effects and editing system, typically a Quantel. The working methods of facilities and production houses can be characterised then by a de-centralised production process with a centralised final online event. The machine's speed of rendering and of design and editing is therefore crucial in maintaining this standard of client interface and the illusion that the most pregnant creative moment takes place in front of the assembled eyes of director, advertising agent and corporate client as they lounge around on deep sofas and sip freshly squeezed orange juice. It is this kind of environment and approach to creativity in a commercial context that Quantel equipment has helped to create and maintain. *The simulation of*

creative control. The way that Quantel have developed its technology to cope with these demands have lead it to a particular approach to the implementation of the creative process, the aesthetics of the interface and implications for the whole relationship between human and computer.

The Quantel tablet, stylus and “rat” interface, and the familiar “WIMPS” style interface mouse and keyboard.

The Quantel interface for video editing is not timeline based but presents the footage as strips of video on a cutting reel or piles of frames on a desktop. Details differ between each machine but editing is achieved by cutting shots with a stroke of the pen or stylus, picking them up and sticking them end to end. Layering is achieved by picking shots up and placing them directly over other shots. The first impression a beginner gets from using the machine is the degree to which the interface relies on the physical gestures of the use of the pen. Depending on the context and the particular way you move, the pen can pick up, drop, drag, swipe, cut, stroke, paint, jog and shuttle. The tablet is also very sensitive which means that you can use pen pressure to input numerical values into the computer with a reasonable degree of exactitude. In fact, nearly every parameter, numerical or character based, can be input into the system using the stylus rather than typing them in using the keyboard. Many software based systems offer this option as well by using slider displays and dial icons, but in a Quantel system the ergonomics are quite different. Instead of keyboard typing or adjusting graphical indicators you are literally "painting in" the values by stroking the pen up and down the tablet and watching the image change in more or less real time. Combined with holding a somewhat less sexy handset of buttons or "rat" in your other hand, this arrangement makes for an unusually high degree of physical involvement with the machine which in turn reinforces the other "hand made" qualities of its usage.

The second thing a beginner notices, especially one which already has experience of other graphics systems, is that a Quantel system is relatively small. It only takes about a week or two to learn nearly all the menus and functions on a machine. A typical Quantel workstation like the Editbox only has about four top level menus plus the main "desk". Each of these menus will have about a dozen commands in them with very little use made of further levels of hierarchically organised sub menus. You have a Viewer for adjusting edit points and transitions, a Mix/Effects for compositing, transformation based animation and applying filters, a Track menu for doing motion tracking. There's not much else. Many of the functions are repeated in several different menus for convenience. It is a small "toolbox" of basic editing and image processing functions and you are left to work out what to do with them.

The reason for this sparseness is mainly to do with the technological issues of hardware based systems. It is expensive to build processors to perform specific graphics tasks, so there are limits as to the number of operations that can be hardware accelerated at a particular stage in the development of the technology. Quantel systems use completely uncompressed digital video so the amounts of data to be processed are huge (and vastly more so for a film resolution system like Domino). Therefore the strategy is to provide a small number of fast and very high quality functions which can hopefully be combined together to achieve more complex effects. It is a bit like being handed a stick of charcoal and a sheet of cartridge paper. You can sharpen the charcoal and draw with a point, shade with it on its side, rub the dust with your finger, sprinkle

water over it, rub it out and so on – it is up to you. Within these limitations an enormous amount can be achieved in terms of effects design. Although it only takes a week to learn the system it can take about six months to become a skilled user. In keeping with the ideal of working from first principles Quantel systems have displayed an unusually high degree of constancy over the years. Seemingly impervious to the pressures that oblige other software companies to continually update and redesign their interfaces, Quantel menu design has remained largely unchanged since their beginning in the early 1980s. It is as though the Quantel system is based on functions so fundamental that a change in their design is inconceivable, as unnecessary as redesigning the shape of a pencil. Once Quantel has solved a problem it stays solved.

Let's look at some of the implications of this interface for the user and how it feeds through into the final product. Because so much emphasis is placed on the Quantel designer developing their own working methods (there are training tapes provided to give you a start with this by the way), each user quickly starts building up their own way of doing things based on the simple basic operations. As an example we might consider the common process of "keying", whereby a top layer of video is composited onto a background by making part of it transparent. Often this is performed with a live action shot where the subject is against a blue background. The blue background is removed by "pulling a key" to produce a "matte" so that the background shows through. In a software based system like After Effects this is done by simply applying a Keying effect to the video layer and setting four numerical parameters - defining the blue colour and its tolerance, the edge softness and edge width. In a typical Quantel system however this task takes on the character of conducting an orchestra. First of all the method of defining the blue keying colour is quite different. It is performing by tapping down on the blue of the video image directly until most is gone, combined at the same time with adjustments of other parameters like Softness and Value. The experience is that you are burning a hole in the video image as you race around the blue areas with your pen. Very satisfying. After you have pulled this "main key" you can apply a "spill key" to help remove reflected light but usually you need to adjust the area of the matte a bit further. A very frequent problem is "matte lines" around the edge of the matte where it has not quite excluded all the blue background from the edge of the subject. In After Effects this is usually dealt with simply by adjusting the edge width parameter to "contract" the matte. In Quantel it is the beginning of a whole art form.

In the training videos Quantel discuss no less than three ways to contract a matte and suggest a fourth. It was not long before I discovered a fifth way which became my personal preferred method. They all involve many different separate operations of rendering out, blurring, tonal graduation and re-combining footage. Most of the time it is difficult to discern an objective difference in quality between these methods but they quickly become identified with the users "style" of working. It must be noted that After Effects also provides the same functions which could be used to mimic the Quantel processes of keying, but in practice an After Effects user would never consider working in this way. In After Effects you use the Key effects to do keying and that's that. For many keying jobs the difference in quality between Quantel functions and After Effects effects filters are negligible although for more complicated and difficult keys the Quantel practice of applying simple functions bit by bit will afford you more control. But as just mentioned, you could use After Effects in this way as well, which leads us to an important point. A big difference between hardware systems like Quantel and software based After Effects is not in their technical quality nor rendering speed as such but *the working methods that the system as a whole gives rise to*. These working methods contribute to completely different artistic practice as well as defining how well they integrate into each level of commercial production practices.

The increased number of separate operations that need to be applied to pull a good key in Quantel would seem to imply that the system is slower to operate than the all-in-one approach of something like After Effects. There are at least two reasons why this is usually not so. Firstly the decreased amount of control available in adjusting the parameters of an After Effects Key effect often means that much more fiddling around is needed when dealing with all but the simplest of keys. But more importantly we must remember the impact of the Quantel interface on the users operating abilities. Apart from the fact that a pen interface is faster to use than having to roll a

mouse all around a screen, the higher degree of integration of the users manual dexterity into the Quantel system means that the speed of editing is limited more by their physical operating skills than by the response times and rendering power of the machine. This means that the more dextrous the user becomes the faster the whole process goes. There are other factors related to this as well. Because the process has been broken down into small separate operations it is frequently possible to find new combinations of these which can accomplish the task a little quicker. And as experience increases it is easier in a Quantel system to fine tune the necessary number of operations to the particular demands of each individual editing task, skipping some steps when not significant and spending longer on others which will have a greater impact on the result. The more you use a Quantel the better and faster it gets. The industry encourages a professional pride in being the fastest Quantel operator, as though they are racing drivers fired up on the adrenaline of post production. When a computer system offers this degree of physical involvement in its interface and is designed to be used in a bottom-up approach to building complex effects out of simple operations, then much of the uniformity, reproducibility and expediency commonly associated with computerised design systems disappears. However, it would not be true to think that this implies that Quantel systems are perfectly transparent and neutral technologies that exert no influence of their own on the user as we shall see a little later.

As mentioned before, practically all of the parameter input into a Quantel machine takes place through the pen and tablet interface. This practice of stroking the pen across the screen until the right value has been reached *keeps the creative process at the visual and intuitive level rather than that of comparing and checking the numerical values of different functions*, although that too is certainly still an option. Sometimes this means that you cannot remember how you achieved a certain effect, and usually ensures that you never get quite the same results every time. The interactive interface is not entirely informal either – it is a digital system and the entered values and pen moves can be recorded and displayed. But the extent to which these systems rely on manually editing and repainting the image is quite great. Instead of applying extra filters to adjust the colour of a sky for instance, a Quantel operator will frequently and more speedily just paint over it in a few brushstrokes. If you discover that your matte is not quite accurate enough over a couple of dozen frames then it is often easier just to paint over the mistakes frame by frame rather than to redo it. It often comes as some surprise to students to learn that the glamorous special effects that they have seen on TV or in films have been achieved only partly through complicated mathematical processes and sophisticated animation systems. Much of the detailed work and blending of elements together necessary to attain a completely convincing effect is through the painstaking retouching and adjustments performed frame by frame by hand. It is only on the fastest and most sensitive graphics systems that this becomes a practical possibility. There are often repeated cycles of manual painting and manipulation of footage until the particular desired effect is achieved. It is because the video footage in Quantel is completely uncompressed that it is possible to continually apply more and more adjustments in individual stages without the quality of the image deteriorating through repeated "cascading" recompression. This prominence of hand work should remind us that computerisation is not just about processing more things automatically under software control, it is also about integrating and optimising manual skills like painting as part of the production process. This in turn can have the effect of reintroducing qualities like authorship and originality above operator skills, returning us to traditional values that we might have thought were becoming less and less relevant.

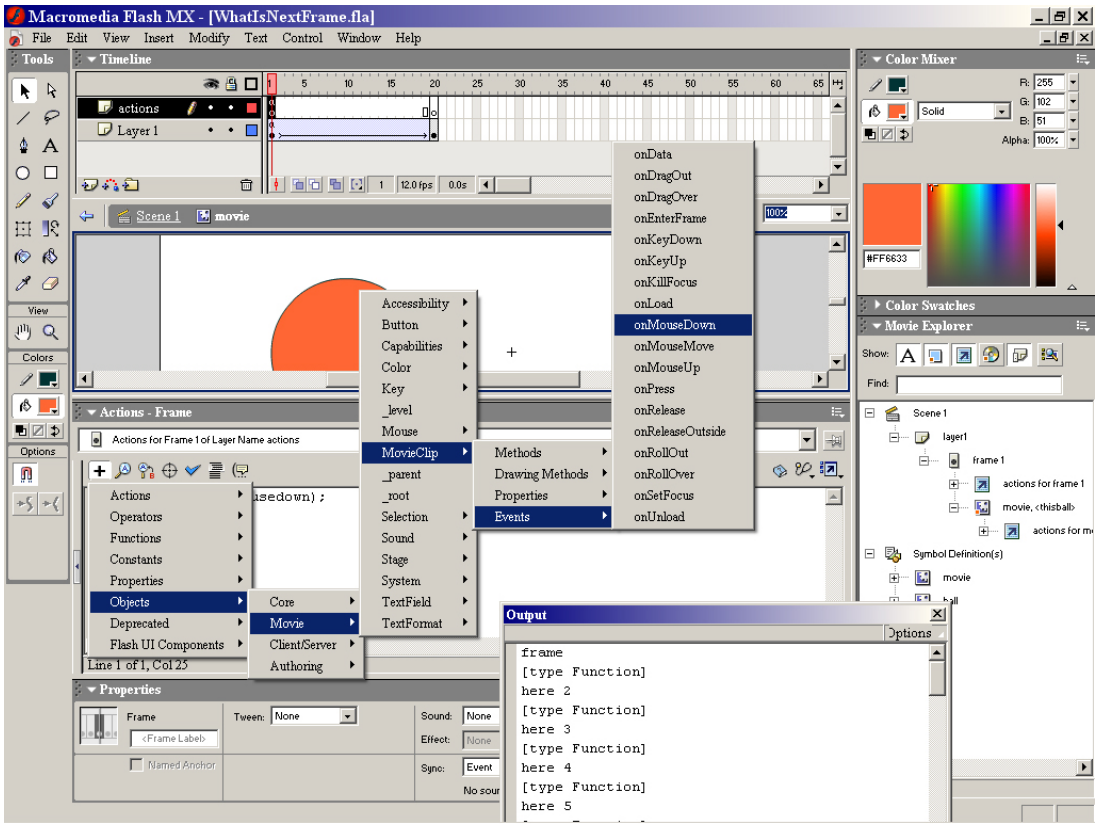
The tactile qualities of the interface create the experience for the user that they are personally kneading the footage into shape like a piece of dough, prodding at some bits with the pen and then stroking and rubbing at others. The operation becomes very physically engaging and finally addictive. There is a strong similarity with becoming absorbed into the space of a computer simulation game. The experience is further reinforced by the pleasure involved in solving a technical problem like pulling the perfect key. The degree of control offered by the sensitivity of the interface makes the pursuit of technical perfection all the more exacting and intense. This in turn combines with other factors to produce a particular kind of aesthetic in the final product which testifies to the particularity and the idiomatics possible through the subtlety of interface. It perpetuates a notion of quality based on precision of control and evidenced through a smooth

seamless finish.

There is actually a Quantel "look" that is instantly recognisable to an insider, despite the scope for individual stylistic signature that the interface makes possible (or perhaps because of it). This is partly due to the early design of the first Paintbox. The research team at Quantel wanted to work with a "traditional" artist to help design and test the interface and chose to work with an illustrator called Martin Holbrook who commonly worked on posters and record sleeves, of aeroplanes and fantasy landscapes. In response to his input they designed a system that used a very responsive stylus to put down very smooth tonally graduated brushstrokes and airbrush marks. This has remained in subsequent systems both in the inclusion of the original Paintbox functions and developed into the widespread availability of blurring and softening tools. Most of the main menus and functions now have their own softening or smoothing filters which allow disparate pictorial elements to be seamlessly combined. It is quite surprising how many "mistakes" can be magicked away by the application of a few strokes of the airbrush, how many incongruous scenic additions can be made to blend in with a soft edge matte. These abilities also make it very good at producing various glow effects which are so frequently used to make adverts and music promos more glamorous, romantic or just softer and less harsh. It is an aesthetic of continuity and naturalness built into the very heart of the system which concurs perfectly with a corporate design style that has remained dominant until the present day. This is not to claim that Quantel is responsible for a whole cultural milieu, but it is an aesthetic which gives form and direction to the tendency of the interactive interface to emphasise the particularities of individualistic treatments [1]. *For these reasons the freedom of individual treatment that the technology allows can lead to a preoccupation with more precise control rather than to artistic diversity.*

Quantel systems typically render down each adjustment into to single clip making it very difficult to "unpick" and separate the various processes that have been applied. You cannot analyse how the image has been constructed unless you exhaustively save and keep track of every intermediate stage, which is not normally practical. There is no "undo" function on a Quantel system. Each operation you perform requires a similar kind of commitment as does physical media. Saving previous versions will work up to a point but does not retain the dynamic of reversibility that is almost standard on other software based systems. Quantel cannot put Humpty Dumpty back together again. This also means that as you build up your image step by step you have to have a fairly clear idea of whether you are heading in the right direction. Quantel warn their operators of getting stuck down "dead ends" – of applying a whole series of processes to an image and then discovering that you have forgotten an important factor which forces you to start all over again. There are very few "live" events in Quantel, which means that you must normally "commit" one edit or effect until you can proceed to the next. In a software based system it is almost taken for granted that you can go back and re-edit a particular parameter of a particular filter applied to a particular layer of video again and again. In software based packages, even after rendering any changes that you have made, the material is still organised into its data structure and can be recorded in some kind of separate project file. This accepted paradigm of arranging all your visual elements and effects into a total framework or data structure in which each part is in an interchangeable relationship with the others is effectively unknown in Quantel. The hardware has simply not been able to support such complexities until recently.

But the fact that Quantel systems have never offered the user a overall layout in which to organise all their visual elements and processes does not mean that a systematic method of working is not possible. It means instead that it is the user themselves who must supply the organisation – *the data structure is not in the computer but in the user's head*. This internalisation of the logic necessary to work effectively with a digital system means that such interactive workstations that seek to reproduce the dynamics of traditional physical media are the very opposite of the intuitive and spontaneous pattern of working that we would expect. The Quantel user must know what they are doing without the help of extended layer displays, timelines and associated parameter lists. The logic of digital processing must itself become intuitive to a far greater extent than with other systems that rely on reference to a visible and constantly updating data structure.



Macromedia Flash MX, menu interface, 2004.

The most common model for software design is object orientated, based on the idea/expression dichotomy which aims to externalise an artist's working methods. The software system seeks to mirror the internal creative process by organising it into an external data process or structure. The software is a system of menu commands and options which seeks to match an internal model of creativity as a process of decision making that seek to approximate an ideal artistic goal. The more functions and the more parameters that are made available the more successful this will be, the more exactly the software system will be able to match the artist's intentions and give them what they want. But of course most artists and designers do not really know what they want before they start – the creative process is actually a process of playing and "visual thinking" that leads to a variety of "solutions" and modifications of the original "problem" or brief. If software architects assume a decision based idea/expression model then the number of options they strive to make available in a software system will proliferate with the effect that the decision making process will become overwhelmed and arbitrary. It is as though the exactitude of the software parameters threaten to exceed the exactitude of the artists creativity resulting in the whole process defaulting back to the exploration of a subject orientated smooth space of the unknown. One example of what this leads to is the growth of plug-in modules to provide common effects like lens flares, explosions and rippling. In order for these effects not to become too standardised and familiar looking they usually come with a huge number of editable parameters which the artist can use to customise the result. But it is very common just to give up on the endless experimentation needed to learn all these options and to accept the default parameters, or else to find oneself continually "fiddling" with the values until you simply run out of time. In the arena of digital media operating under the rubric of artistic vision, individual expression becomes customisation.

The Quantel system and interface by contrast has been more subject centred. This has been an effect of the many characteristics discussed above that tend to reject the second guessing of

artists working methods with pre-packaged effects and instead reduce the system to a bare minimum of functions. This restriction of means is partly dictated by the current technological development of the hardware and partly by priorities in the design of the interface. But despite this we can still point to other ways that a design aesthetic asserted itself through the design of the technology and the "tools" themselves as well as by the commercial production environments in which it has been used. Such a simply modelled system still produced images that were both remarkably complex and remarkably similar. *The sensitivity of the Quantel interactive interface and bottom-up functionality totally absorbs the user physically and mentally, and the aesthetic emphasis on seamlessness gives direction to this level of user engagement*. In this context the artistic model of individual expression tends to become fetishised in some ways but privileges the agency of the subject in others.

Graphics systems including Quantel are now becoming increasingly object centred. Despite their close integration with the top of the commercial production sector, *the economics of a changing production culture has been turning against them* and favouring software or hybrid systems like Flame. This year (1999) the new Quantel machines like Editbox version 7 and Henry Infinity include considerable enhancements to their hardware to allow many more layers and edit decisions to remain "live" and un-rendered before finally committing. These much more complex data structures are now technologically feasible in the real-time environment in which Quantel operates and begin an inevitable shift in emphasis from the subject to the object in their human computer interface. This is accompanied by new trends such as Quantel's aggressive marketing of its Editbox range, aimed at the relatively lower end online editing market, where the demand for sophisticated high-end effects is far less and Quantel speed can be used to turn around longer form television programmes. Quantel systems now also boast an "open architecture" for the first time, meaning that third party developers can use programming languages like Java to develop new effects plug-ins. This means that many common effects like glows and complicated transitions will no longer have to be constructed from the ground up in Quantel but simply loaded in and "customised". Quantel have themselves also been developing much more sophisticated functions to perform previously piecemeal processes in one go, such as their new one-step keying function which is intended to create perfect keys in one press of the button. Over the past decade other ways of maintaining the users agency have emerged, like the growth of scripting languages as part of a standard software package and the inclusion of Software Developers Toolkits. These will allow some aspects of Quantel's subject centred approach to continue albeit in quite different contexts. Each of these will bring their own particular pressures to bear on visual aesthetics and on wider cultural issues and their commercial implications.

By a careful analysis of a graphics system it is quite to possible to see how a manufacturers particular technological development can have an impact on moving image culture, both through particular aesthetic biases and through its relation to the values of the commercial environment it has been designed for – its production culture. *Quantel's intention to design for a real time production environment lead to a fast hardware based system but was limited by the current state of the technology to implementing a range of basic functions. The combination of these simpler functions along with a highly sensitive user interface derived from illustration resulted in the highly idiomatic creative practices and aesthetics described here*. This analysis is apart from a cultural one that takes place perhaps at the level of corporate policy and identity, marketing, labour relations and working practices and the interpretation or theorisation of the end products as texts. In fact, in order to get some leverage on the rationale behind the direction in which the production culture is heading it is essential to penetrate to the level of technical practice to get a full picture of the forces which are determining its future. It is not excusable to relegate these forces to the status of neutral technologies that are exploited as tools for some higher purpose, nor to present them as ideological technologies that embody a premeditated agenda within their very structure. Technologies are now composed of both machines and people which work together in quite specific and complex ways.

The fact that it is possible for a Quantel operator to use a software system like After Effects in ways that an After Effects operator would not have thought of indicates that the technology of

media is located in a practice and that this practice is formed within the context of a particular production culture. But trying to use a Quantel system like After Effects would not be so successful. The object centred practice relies on being able to define design problems in terms of the available technical functions and in expressing the creative process in an external data structure. This creative process is pre-empted by the traversal of menu options and navigation of data bases. We might conclude, therefore, that all technologically based art practices are not equal. As long as there is access to a range of basic processing functions, the subject centred approach is always workable, even outside of its native production environment. Why is it that After Effects users do not generally know how to best fine tune their effects work to get higher quality results and Quantel users do? After Effects users are not stupid, they just develop a different practice in a trajectory set by the design of their software.

As we leave a generation of interface design and computer graphics systems behind and fully enter the age of the object centred system, it is necessary to remember that alternatives once existed. With hindsight it may appear that the highly interactive graphics workstations and the highly systematic text based computer programming languages that once seemed to be diametrically opposed to each other actually had more in common than was ever imagined.

Endnotes

[1] There are some other factors that contribute to the Quantel “look” that are not based directly on the dynamics of the interface. One very noticeable feature is the preponderance of saturated shadows in a Quantel treated video. This comes about because the function that darkens and lightens an image uses a colour space that tries to maintain the same degree of colour saturation as in the original image. This is presumably because it is felt that it is more intuitive to alter tone independently of colour. The effect is to give dark areas a slightly psychedelic look.