

# Generative Art : from analogue to digital formations?

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A description of some informal research from the 1970s a period when myself and others explored iterative and generative systems using motion-picture film. The approach was practice-based and occurred in a context of artists working with film as a *dynamic* medium. The films considered various factors that could have effect upon the physical nature of the film experience. The role of the film audience as an active participant in meaning production was critical to the process.

Based on Notes about the film, "Red+Green+Blue" (Leggett 1975), the project and its context, the generative system using this analogue-based medium is evaluated in the light of recent discussion of digital/binary-based generative mediums.

## 1. Introduction

This paper describes some informal research from the 1970s a period when myself and others explored iterative and generative systems using motion-picture film. The approach was practice-based and occurred in a context of artists working with film as a *dynamic* medium. Artworks were made for active engagement based on perception and reflection by the audience.(1) The films considered various factors that could have effect upon the physical nature of the film experience. At its most fundamental, comprising the film strip, the projector and the projection space, properties were explored to expand the potential of the medium, as phenomena, as Cinema.(2) The role of the film audience as an active participant in meaning production was critical to the process.

The film, "Red+Green+Blue" (Leggett 1975) was described by a reviewer:

The resultant pattern/redundancy/variation is not arbitrary in principle, the variable loop length providing relative determinacy of the generative system (apparently aleatoric but within a predetermined structure.)  
(Stoneman 1979/80)

Based on Notes made at, and shortly after, the time of its production, the project and its context, the generative art emergent using this analogue-based medium (3) will be evaluated in the light of recent discussion of digital/binary-based mediums and the issues:

How are generative systems useful to artists?

Do generative systems enhance or extend the experience of receiving an artwork?

## 2. Iterations

Three researchers have arrived at some useful descriptions of generative art practice:

Generative art is a term given to work which stems from concentrating on the processes involved in producing an artwork, usually (although not strictly) automated by the use of a machine or computer, or by using mathematic or pragmatic instructions to define the rules by which such artworks are executed. (Ward 2001)

Generative art refers to any art practice where the artist creates a process, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is then set into motion with some degree of autonomy contributing to or resulting in a completed work of art. (Galanter 2001)

Both these examples cite the *artwork* as the product of generative procedures. McCormack however, goes further to include the *receiver* of the artwork as important within the system. He uses biological metaphors, genotype and phenotype, to describe the distinct aspects of this process within a phenomena or system.

The genotype is a formal specification of process, generally unambiguous. When this process description is enacted, it generates the phenotype, which is essentially the experience of the artwork. (McCormack 2003)

The distinction is important by acknowledging the feedback loop that enables reflection, available equally to the maker as well as the receiver of the work. Where the previous two definitions attempt a claimed level of autonomy from the process, the outcomes of each set of parameters determined to operate within the system by the author are as a result of reflecting upon each iteration of their affect. The absence of the author, the incursion of other strategies such as the aleatoric are not implied here. Autonomy is from the *detail* of the generative process rather than its shape and concept, its operative elements, its visual and audio phenomena as output.

As McCormack observes: "...the volume of information generated in the phenotype is significantly greater than the genotype itself (often referred to as *database amplification*).” The generative system can, as in many other areas of computing, be about the repetition of actions for the purposes of making more efficient use of resources within the system, the details of which are inconsequential to the overall outcome experienced by the visitor.

McCormack makes a key observation of generative systems: “..the emergence of new properties that result from local interactions between individual components. These new properties are not specified in the genotype – they emerge from the generative process.” Here chance, temporal variation and other chaotic elements create outcomes that cannot be predicted within the overall generation. It is often the dynamic collision of fixed and random elements, the cognitive predilection to recognize patterns and their variations that engage the attention of creator and receiver alike. (Boden 2003)

Organising material and its performance, for observation or interaction, is at the core of the creative act. For the receiving subject, (or the collaborative performer), having access to the act, as part of the process of creation/reception, can be aided or obscured by the composer. The degree of visibility is also dependent on the subject, as familiarity or possession of knowledge about the composing process can be a pre-requisite of its perception within a system. The use of spoken and written language is a good example of the knowledge required in order to participate in conversational interaction. Appropriately, as the term generative arose from linguistics and the study of syntax. Chomsky observed that: “...a generative grammar [is] a system of rules that in some explicit and well-defined way assigns structural descriptions to sentences.” (Chomsky 1965)

### **3. Generative context - aesthetic**

‘Structural descriptions’ within artists’ film practice in the late 1960s set out to expose the conditional. Less through applying rules, rather more through procedural strategies applied to the material stages of production, the conditions that gave rise to what was seen and heard in the screening space to which meaning could be attached. Thus the profilmic was equally weighted in significance with the apparatus of image making (picture and sound) and its re-presentation within the projection space. A ‘structural/materialist’ film set out to make available to the audience the means, its form and materials, together with whatever else was visible and audible as a part of the filmic phenomena during a film screening. (Appendix A)

Many artists began working with film simply by having access to a film projector and some film. Most had developed skills in other art practice through a tertiary education: painting, sculpture, photography and music most notably. An emerging practice, performance art (‘happenings’) very often involved multi-projection devices. Cinema became re-definable where the projection screen became any flat surface and the projected film became the play of light, its presence and absence. Such approaches, in the 1960s, extended the possibilities of intervention becoming known as Expanded Cinema. Invention included iterative methods using loops of film, often running through several

projectors simultaneously, building moving collages or sculptural installations, thus placing the 'found footage' into a context for which it was not designed. (4)

The physiological illusion central to the film experience – the persistence of vision – relies on the repetitive replacement of an image by the film projector, fast enough to elude the optical/neurological system of the human eye. Iteration was recognized from a very early stage of the development of the cinematic spectacle. The Edison kinetoscopes, which appeared at the end of the 19<sup>th</sup> century, used loops of film material which could repeat endlessly for the viewer a simple scene played out before them. Film-makers and artists in the 1920s and 30s, from Vertov to Man Ray, from Richter to Fischinger used the duplicated, repeated image for expressionist affect or decoration. Experiments with temporal strategies were distinct from the classic cinema narrative being aesthetically consolidated at this time.(5)

#### **4. Generative context - material**

During a period in the 1960s and 70s, when television's reliance on 16mm film was central to its many operations, its prevalence caused the cost of making films to become a possibility for other communities of interest – artists, political activists, production entrepreneurs independent from television networks, etc. Access to film production facilities however, remained restricted as equipment was expensive. In London, as elsewhere, artists came together co-operatively to source and share the required technology. Unusually amongst the film workshops, the London Film-makers Co-operative (LFMC) acquired a contact step-printing machine, (Debie Matipo: DM – see Appendix B), enabling the film-makers to duplicate or copy from one roll of film to another. For some, this enabled duplication of projection prints to be made at a cost cheaper than employing a commercial film laboratory. For others, it gave access to creative opportunities that had only previously been explored 40 years previously.

The method was:

- to prepare all the working materials for a printing session,
- load the printer with unexposed duplicating film and the material for copying in preparation for a print pass, (there may be multiple passes onto the same stock, with each setup being carried out in the light),
- expose the duplication stock, (performed in the dark), and finally
- process the exposed stock.

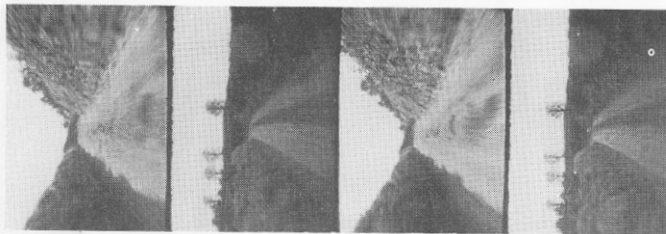
At the LFMC processing of black and white could be completed in an adjacent continuous path processing machine, (a Houston Fearless: HF – see Appendix B), or colour film would be sent to a commercial laboratory.

Though designed to duplicate a single roll of negative or reversal camera original ('master'), the printer could be used to reproduce in linear form the results of the looping of a section of film. This was achieved, as with a projector, by splicing the tail to the head. The size of the loop was limited only by the ability to physically handle the loop whilst the printer was running. It was this aspect of working with the printer that enabled much work to be done employing iterative and generative aspects.

## 5. Generative cinema

The iterative approach was employed in several films made by myself and others. Malcolm Le Grice's *Berlin Horse* (1970), *Love Story 2* (1971) are of particular relevance as they are seminal abstract works employing loops and iteration if not generative systemics.

Fig 2 Film strip of *Shepherd's Bush*



Of my film work, the iterative approach involved both picture and sound elements in several works. *Shepherd's Bush* (1971) employed an 8 second looped black and white image of rapid pixilated movement across grass and through trees, rendered from white transparency to dark opaqueness, over a 12 minute duration. The soundtrack was made from a longer sound image looped and processed electronically on a VCS-3 synthesiser and transferred onto the film at the final print stage. (Appendix C)

Fig 3 Film strip of *Tender Kisses*

*Tender Kisses* (1972) originated as an image on a video monitor. The soundtrack was made as a separate movie, with three loops of different length, each containing four frames of sine wave 'tone'. Each loop was started from a point where they were equally spaced. At the completion of their cycles, the tone would be continuous for 12 frames to coincide

with the completion of the picture roll, with which it was 'married' at the final print stage. (Appendix C)

Sections of Sheepman & the Sheared Parts 1 - 7, (Leggett 1970-76) (Appendix D) extensively employed iterative sequences in either or both image and mask channels of the DM printer. (For more on these procedures see Appendix E)

The strategies determined, whilst not being generative under the terms so far discussed, had a similar intent by way of the artist seeking to devolve if not abdicate a part of the image-making process, picture and sound, to circumstances or conditions determined by the process. Sheepman & the Sheared like other work at the time, by experimenting with recursive strategies revealed the emergence of reflective behaviors in the audience, as in the film-maker, exceeding the component parts of the process. This emergence will be discussed more later. In the context of this paper it is discussion about Part 6, Red+Green+Blue that will now be pursued.

## **6. Generative Film – Red + Green + Blue**

Sketches on paper for this project began in 1972 and followed on from the use of a looped image in Shepherd's Bush (1971) (Appendix C). Notes and further sketches continued to be gathered until the completed Red+Green+Blue appeared in 1976. In 1977, as part of reassessment of work plans for writing and further production, a comprehensive written reflective process occurred.(6)

Part 6, Red + Green + Blue, as a section within the seven parts of the Sheepman & the Sheared project, develops the imaging of landscape, and the temporal components, but from within a generative system briefly explained as based on the Lowest Common Multiple.

The concept for the film – within the scope of the Sheepman & the Sheared series - set out to articulate the physical and chemical properties of the reproduction of colour in the motion picture reversal process. This was to be achieved poetically and visually by combining images drawn from the broadly landscape-based project with a strategy planned for realisation on the DM printer. The strategy was to combine together on the DM printer, using the primary colours - red, green and blue – printed through a series of prepared looped graphic shapes using pre-determined dimensions operating as the automated procedure. The duplication stock, following processing, would then display the complimentary colours – mixes of two primary colours - cyan, magenta and yellow, as a visible system in relation to the primary colours, together with white and black. The process would in effect, synthesis the complimentary colours, together with white as a combination of all three primary colours.

The operative elements within the composition were:

- preparation of duplication film, filters and other material for the printer;
- the printing process;
- film processing;
- projection and evaluation.

Through a process of experimentation, earlier steps would be revised or repeated until a print exhibiting the conceptual concerns was successfully completed.

Each of the three loops contained the same graphical progression, grouped in 12 frame units, separated by units of clear frames calculated for each loop. The graphical progression was based on a constant mask that altered the conventional ratio of the frame/screen from 4:3 to 3:3. The square contained three concentric circles of different diameters in the ratio, 1:3, 2:3, 3:3. (Fig 4)

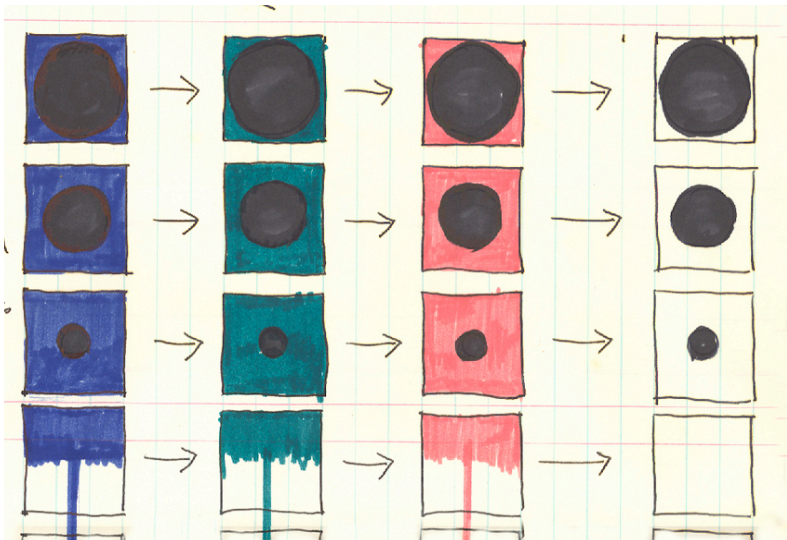


Fig 4: Each square represents a 12 frames unit. The graphic loop and its primary colour are shown here combined. (Black circles with l - r: Blue / Green / Red filters). Each are printed separately to the duplication stock.

The size of the loops used in the final version can be described arithmetically as the Lowest Common Multiple (LCM):

Fig 5 Calculation of loop size in final version (Leggett 1977/8)

	Blue	Green	Red
Each loop in 12 frame units LCM = 990	11 units	10 units	9 units
LCM / loop units = total loop cycles	90	99	110
Number of frames in loop	132	120	108
Total frames to return to start point	11880	11880	11880
Total footage (frames / 40)	297 ft		
Total duration (footage x 1.666)	8m 25 secs		

## 7. Testing... and reflection

Whilst the overall concept for the film was in place – primary colours combined within a loop system to generate complimentary colours, together with black and white – the method for achieving this had to be determined at the onset of production. As the basis for a series of tests and experiments, an array of groupings for the graphical elements were sketched, initially based on four concentric circles and simple colour filters. This was approached using trial and error in the summer of 1974. (Appendix F)

The conclusion to these experiments after repeated screenings of the tests, reflected on four formal issues:

- Circles within the square reinforced the flat surface area of the screen space;
- Juxtaposition of circles within time signature created apparent lateral (x/y-planes) and receding/advancing vectored movement (z-plane);
- Colour within the circles further established the surface area of the screen space;
- The presence of secondary, 'three-dimensional' imagery.

This led to the plan to use three concentric circles “..linked in their indexical signification” to the three primary colours. The secondary imagery noted determined that the primary colours, instead of originating from acetate filters arranged within the printer, should in keeping with the larger project, be generated by objects in the natural world. “By obtaining the three primary colour pigments from naturally occurring sources, the sky, the grass and red berries, would permit ...



the introduction of three dimensional imagery." (Leggett 1977/8) Each of the three 100 foot colour rolls was shot in a continuous 'take' (filming) of the object reflecting the primary colour, the camera being handheld.

The next stage utilised silk-screen printing to make the graphic elements, the square being "divided with the circles such that each radius increased by the radius of the smallest circle." This was shot onto high contrast film with additional 'no-circle' units of frames to complete the visual components of each of the three loops, thus assuring there would be but one splice join in each loop. Alternatives for frame unit groups and units per loop were calculated.

Fig 6 Frame unit groups and units per loop (Leggett 1977/8)  
(Appendix F)

Frames per Loop	Frames per Unit	Units per loop	LCM	Loop cycles	Total frames	Footage / Duration
264		11		90		
240	24	10	990	99	23760	594
216		9		110		16m 30s
336		14		30		
288	24	12	420	35	10080	252
240		10		42		7m
360		15		12		
288	24	12	180	15	4320	108
216		9		20		3m
132		11		90		
120	12	10	990	99	11880	297
108		9		110		8m 25s

Unit separation between the sync points were also considered (Fig 6) and several short tests were completed. When the basic number of frames per loop were increased to 24 per Unit, "it would halt any apparent movement" 'towards' and 'away' from the projection surface.

Another distinct set of tests were also underway to determine the make-up of the colour pack to be inserted in the printer prior to each successive pass of the loop / colour image bi-pack, to balance the three primary sources over the successive exposures with the duplication stock / processing combination being used.

## 8. The final selection of elements

For the final shooting of the masks, the 12 frame per Unit was selected with a 9:10:11 unit per loop and a total running time of 8m 25s (Fig 5), using two versions: the first with clear frames between the three sets of circle Units, the second with opaque frames between the three sets. The duration was determined as 'being about right' for being able to assess the visual outcomes. Given the complex nature of making tests for each circumstance noted earlier, it was not going to be until an advanced stage had been reached that viewable prints would emerge.

Fig 7 Filter pack for final print "Printed on Debie contact step printer, each loop being bi-packed with a colour roll – blue from the sky, green from the grass, red from berries. Sync marks registered each loop to start at the same corresponding point on the print." (Leggett 1977/8)

Colour pass	Neutral density filter	Colour correction filter	Aperture
RED	1.2	70 cyan 30 green	12
GREEN	0.2	90 green 30 cyan 40 blue	20
BLUE	0.0	70 cyan 30 green	20

## 9. Analysis of final print – random or pattern?

Colour: It was noted in several tests that colour correction was effective in parts only of the 300 foot exposure, with a colour bias developing elsewhere. It was realised later that the rolls of colour original contained variables. Thus in the case of the sky, occasional and partial cloud cover would alter the colour saturation/density, or in the pasture where the grass was being filmed, the light would angle differently whilst the camera was panned or the lens was zoomed or focus changed with a similar consequence. The berries were shot at high magnification with a very restricted depth of field, thus the image moved in and out of focus throughout the take, focus alteration in the other rolls also having effect on the integrity of the colour filtering.

Movement: At certain moments, the system had a logical progression to it, with circles 'advancing' from the 'distance' to the 'foreground', or the converse. At other moments the progression appeared random. "At certain points where phasing is such that circle images are following very close upon one another, these movements and counter

movements, combinations of circles and particular colours, occur very rapidly causing ... some film-viewers [to] claim that afterimages remaining on the retina begin to interplay with the dynamic information arriving from the screen."

Masks: "It was impossible to retain strict registration between the ... separate originals ... tri-packed into the printer and the print stock..." over three successive exposures. The masks remained in sharp focus against the slightly out of focus quality of the colour rolls, due to the fact that the mask rolls were in direct contact with the duplicating stock, with the image-bearing rolls one thickness of film beyond and behind.

Loops: the use of loops could be informed by observation of the join marks, though this was not readily evident. The remains of a not properly wiped-off chinograph-pencil sync point, left a faint cross mark on one frame of one of the loops. It nonetheless provided to the attentive viewer the clue for the record of the system in operation.

## **10. Audience experience and feedback**

In keeping with custom and funding arrangements for artists working with film and video, the film-maker would often introduce a program and respond to questions from the audience at its end. The Sheepman & the Sheared series of films were screened widely, both in Britain and overseas between 1973 and 1979, to audiences in galleries, cinemateques and college lecture theatres.

Discussion would centre on aspects of the individual films, their form and content, the overall project covered on the occasions when the entire two and a quarter hours was screened, and the wider issues addressed by the structural/materialist aesthetic (See Appendix A). Responses from the audience would often be seeking from the film-maker confirmation of conclusions reached by individual audience members, or a desire to develop aspects addressed by each of the films or the broader philosophical issues of the image of landscape, process and the physical world as constructed by our culture which we call Nature.

Rarely did audiences perceive the generative system employed in the making of Red+Green+Blue. To most people the graphical sequencing was seen as a random arrangement which, despite this, was related to the colour sequencing that generated the complimentary colours together with a hue white. Physics lessons at school in optics and light were enough for most people to make that connection. But the ordering of the sequencing lay outside their terms of reference, an inconsequential teleology. Unless it was brought to their attention, either in the introduction, or in accompanying Notes often provided by venues (Appendix D), when discussion would develop around the autonomous, the aleatoric and systems.

## **11. Reflection**

The completion of Red+Green+Blue coincided with the Sheepman & the Sheared project concluding during 1976, prior to September touring the work over a two-month period in North America. The frantic process of completing and preparing projection prints of all its seven sections left little time for reflection. In 1977, a note making process commenced, cognoscent of responses encountered during the tour, cumulating a year later in some 50 pages of typescript.

Whilst in subsequent film projects, iterative strategies continued to be employed utilising grid approaches to organising film material, generative systems were no longer pursued. In retrospect this was doubtless related to the considerable amount of effort required to make one print in the uncomfortable circumstances of the printer darkroom. But also it was clear that whilst a viewing of the work had a lot to do with unexpected representations of landscape, it had little to do with comprehending the abdication of the decision-making processes associated with that outcome.

The feedback received as outlined above tended to disregard the notion of autonomy from aspects of the compositional process, possibly in the light that taken overall, it was acknowledged that the film was a highly constructed artefact.

The main reviewer in print of the work later observed:

This textual practice can also be said to offer a different articulation of the 'maker' outside the work, affecting one of the elements central to the relationship of the text to the spectator .... This relates to the Constructivist notion of the 'art worker' as the scientific experimenter, which counters idealist ideology of the artist as transcendent individual who occupies a position outside society and its historical process (Stoneman 1979/80)

## **12. Evaluation of R+G+B as generative art**

Making the film Red+Green+Blue was in actuality a process of recording the operation of the generative system IN ADDITION to its accompanying variables. Each pass on the printer was in affect, a once-only state. In this recording 'the results' of the system, the variables thereafter become constants, and each time the film is projected, the variables are simply reproduced.

This painstaking process is not dissimilar to the work of the silk screen or lithographic artist working at laying down successive colours. It delivers a similar outcome – a print that is ostensibly unique but able to be produced as an edition. The film print of course will deteriorate from

its very first screening, picking up dirt and scratches and then, over a longer period, fading. For this reason of the three prints made of Red+Green+Blue, one was used as a duplicating original from which to make projection prints.

The variables, including those already noted are:

- Pro-filmic (7): - panning, zooming, focus, colour saturation and hue, exposure, visible incident;
- Post-filmic: - film processing; printer lamp; loop and colour film 'damage' (dirt and scratches);
- Performance: - screen surface; projector, lamp and optics; venue ambience; print dirt and scratch 'damage' / fading.

For each subsequent print made from the system, whilst the pro-filmic (point 1 above) would remain constant, the post-filmic would introduce another unique set of recorded variables.

Another approach to this analogue generative system could have been (or be) an installation employing three synchronised projectors, projecting three colour rolls of film with graphic masking bi-packed in the gate of the projector, projecting onto the same screen. The on-screen outcome would be different from screening Red+Green+Blue as described above, essentially through the performance of variables generated from within the screening space (point 3 above). The sculpture of the installation, the screen, the projectors, the colour rolls, the loops, would make visible the component parts of the generative system available to the perambulating audience.

But is visibility of the components the key to the generative approach? Or does this emphasise the teleological at the expense of the viewer's heuristic purpose?

### **13. Emergence**

The active viewer, sitting or standing, provoked possibly by the aesthetic appeal of the phenomena encountered, or through sheer personal curiosity, will investigate what is before them. Attention will operate on several levels, gathering evidence from what is seen and heard, combining this with what is already known of the process unfolding. In this sense the experience becomes narrative in order, with information being assimilated, compared to earlier information, and redundancy making space in the mind for a clearing sense of the shape of the concept being presented. The viewing process tracks, (but cannot not follow or imitate), the thinking process of the artist in constructing a conceptual or relational model. This can be compared to Ballard and Brown' descriptions of relational models in designing databases that turned away from *representing* models, to *matching* models from within

a knowledge base. (Ballard & Brown 1982). The spur to the audience is to exploit their productive potential, within the cinema context, as a form of emergent behavior. The outcome is for (narrative) order to be replaced by an integration of the whole.

Stephen Jones discusses emergent systems and represents them "...as a shift or jump in hierarchical levels of organisation of the parts of some system such that they become integrated ... akin to the idea of concept formation.." He goes on to discuss 'certain characteristics' of a dynamical process showing novelty; unpredictability; cohesion or coherence, integrity; self-maintenance; and causal asymmetry. Proposing "...the exploration of the organising relations of self-reflective (or cybernetic) systems as the proper study of the science of consciousness" he identifies ontological emergence as a question of organisation with the need to "...look at a taxonomy of relations by which organisation can be conferred on a collection of parts to give it integrity, coherence and the status of a whole." (Jones 2004 pp225)

The taxonomy of organising relations he describes has "...three orders of relations which are classified on the basis of their interactivity and thus their organisational capacity. They are all causal relations: first order relations, directly causal, feedforward; second order relations, circular causal, feedback; third order relations: mutually causal, interaction." Of the second order relations there is a feedback modality of self-reflection, he proposes, where occurrence and memory 'categorised and learned as history' functions as 're-entrant processing' enabling evaluation to occur. The process of 'ingestion and sensing' by the subject – I propose here the active film-viewer – enables 'boundary development and self-maintenance'. (pp228) The habits learnt from childhood of de-coding films in this instance, of interpreting and assimilating the information or emotions arranged in a narrative order, require experience to unhitch. Phenomena which exhibit divergent organisation, for instance in such a context a film made with a generative system, can provide the catalyst for re-assembling personal behaviours, characterised as a process of emergence. (Appendix A, Note 1980)

## 14. Autonomy

Is the generative a quest for *autonomy* by the builder of a system, above and apart from the world of humans, lauding the elegance of mathematical systems that, like Nature, are rules applied to physical entities, which also suffer the incursions of the Human?

Ward and Cox point out that:

Both the social practices of science and art serve to establish myths of autonomy. Indeed, where does generative art generate from and under what conditions? There is a danger of

excluding the possibility of the human subject as a potential agent of change in these scenarios. (Ward & Cox 1999)

In the kind of generative art exhibited by the film project Red+Green+Blue, the conditions of its making enable reflexive behaviour based on perception, observation and reflection, likely mirroring the responses of the maker of the work in the process of its formulation. The key is reflection - by the receiver as well as the maker of the phenomena - to align the experience of reception with the conditions of its generation, thus expanding meaning to embrace the conceptual kernel of determining material factors.

Though in the case of the film version (and not the installation) there is little chance of conclusively determining at a single viewing that the progression of graphic cycles is operating according to mathematical principles, the interrogation of the evidence leaves the most attentive viewers with that sense. By capturing in memory the visual details of interference or variability in an apparent system, combined with an understanding of the overall concept of the piece, delivers a conclusion of probability, but more importantly a realisation that meaning is not given but constructed.

What this serves to emphasise is that creativity lies not in the modification of rules, but in setting the criteria for the rules .... that responsibility for the concept as well as the criteria for the rules and code, remains in the domain of the author. (Ward & Cox 1999)

Autonomy then, is like the system itself, an expression of the conditional and should in the same way exhibit the determinants that lay claim to the autonomy.

## **Conclusion : R+G+B in a digital formation**

"Think of ideas - put them on a machine" Frieder Nake

Generative computer-based films in recent times converge the technologies of database and video compression, for example, The Sims 'microworld' and a whole plethora of strategy computer games. Work like the T\_Visionarium project (Del Favero et al. 2004/5) and Sam Woolf's Googlegoglebox (2003) (Brown 2005) trawl the Internet to harvest images which are then stitched together to make a new narrative entity in linear time (Woolf) or space (Del Favero). Others order movies in a database into a conventional narrative: Jon Pettigrew's Reflection in Water (2003) uses VJamm software "...to check for continuity...", a rule that clearly moves intentions away from the autonomous towards the automatic. Likewise in a recent project, the system "...uses a personality engine to define interactions between the two main characters..." in order to create an alternative narrative. (Brown 2005)

Automatism as an approach to making rich narrative is well practiced and used by writers – many of the Surrealists, William Burroughs' cut-ups – functioned as a stimulant to imaginative possibility. The intervention of the author is emergent from this process and acts to reveal the narrative, the poetry, to the reader. Where automatist outcomes are delivered direct to the audience, it is on the understanding that this process is their individual responsibility – the system rules. The intuitive response is for the visitor to first observe the system functioning, the second, to then 'play' with it at best, abuse it at worse!

In generative time-based art, the explicitly defined part of the work is the structural element including specifically, the rules to be used in determining in which order and at which pace the image sequence should develop. (Edmonds 2003)

This observation summarises the functioning, material realisation of a system and applies, as has been described, in the analogue as well as the binary domain. Specifically the algorithmic element applied within Red+Green+Blue is procedural rather than the more complex procedures accessible using declarative or logic programming. "Whilst procedural programs describe a sequence of actions to be taken by the computer one after the other, declarative and logic programs describe what is required in terms of rules," the details being left to the computer system.

Could there be value in reproducing Red+Green+Blue in a computer-based form?

The concept of the film rested clearly on the interaction of the material processes within the procedural system. Its genesis was labourious and time-consuming, the outcome, simply a record of one particular printing session and the variables within the system. As phenomena, whilst the images and materials related to colour become articulated, their ordering are beyond most viewers' reason.

Migrating the analogue to digital would present the possibility of reducing the number of variables whilst increasing exponentially, the iterative possibilities. The rules of the system could become the focus of variation, as executing them could be made instant, providing choice of colour, tempo, size, etc., making production of the variation, the range of generations, potentially endless.

Fundamentally though, the materials being manipulated by the system will be so different as to cause the concept to have to be re-thought. Even where an image produced by a computer is projected onto a projection surface, it is not made using light and a transparent medium. Colour is not 'made' through mixing light in its component primaries but through light emitted through RGB pixels stimulated by an electron



beam or an electrical impulse. Light is expressed as numbers and electrical energy rather than photons and transparency values.

Are there ways in which the concept could be adapted, working with the materials and processes of the computer?

Where might such a development lead?

## Notes

1. The Soviet film-maker Dziga Vertov's description of cinema as 'the opium of the masses', declared during the Russian Revolution, resonated amongst many film-makers in the 1960s, also impressed by his film, *The Man with the Movie Camera* (1929). Little had changed it seemed since the 20s, when selling fantasy and emotion rarely moved away from well established techniques exploited for telling stories. Filmic narrative forms derived from literature, and codes employed to heighten emotional engagement, rarely engaged the audience on a level which caused reflection on the means or condition of individual emotional investment.

2. The semantics of the term cinema in this context are: the building/screening space is spelt 'cinema', the cultural practice, 'Cinema', the term 'cinematic' referring to technology-based procedures.

3. In this context the semantics of the word 'medium' refer to 'the medium of film' ('media' is the collective term.) The OED definition is: a. An intermediate agency, instrument, or channel; a means; esp. a means or channel of communication or expression. ... c. Any of the varieties of painting or drawing as determined by the material or technique used. Hence more widely: any raw material or mode of expression used in an artistic or creative activity. ... e. Any physical material (as tape, disk, paper, etc.) used for recording or reproducing data, images, or sound.

4. Unword, a series of performance events 1969-70 by Ian Breakwell, included slide and film projection developed in collaboration with Mike Leggett. Film was shot as part of the performance and later became a distributed film version of the event. (Breakwell & Leggett 1969-71)

5. This was developed early on in cinema history using the 'cross/parallel-cut' whereby literal time could be 'folded' thus enabling within the plot, action to 'occur' simultaneously in different physical spaces. The producers of *The Great Train Robbery* (1903) were among the first to realise this sophisticated development in early film narrative technique. This in distinction to repetition as part of a narrative – in modern Hollywood films like *Groundhog Day* and *Memento* – organised to give the plot and storyline a more dynamic temporal narrative (rather than material) structure.

6. A complete set of Notes were made about the *Sheepman* & the *Sheared* project from its commencement in 1968, (with the screening of the 'sheepman' found footage at the Arts Lab, Drury Lane), to its tour of North America in late 1976. This material is used in the paper as secondary data. (Appendix D)

7. The pro-filmic event occurs in front of the camera at the time of film exposure. It records not only the state of the space before it, but the operation of the camera in relation to the space viz. zooming, focus, exposure etc

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## **Appendices**

### APPENDIX A : Artists' Film Context - Structural/materialist Cinema

#### 2005 Note

In the cinema, by definition, the viewer observes the progress of a record or residue of a set of manifestations, fixed permanently onto the acetate base. This is so with the 'photo-play' of plot-based drama as with 'abstract' Cinema. The experience of Cinema concerned with structural and material film described here is not about immersion into a fictive space ('with suspended disbelief') within which the viewer is engaged. Though the films are experienced in a similar projection space, often with an anticipated and specified time span – a beginning, middle and end - the expectations of film-maker and audience is quite different.

In an encounter with the 'film as phenomena', as film 'abstracted', there exists an opening up of the spaces between its component parts, in contra-distinction to the conventions of Cinema, intent on concealing the many joins that hold the illusion in place. The structural/materialist approach presupposes the audience engagement as moving far wider, exposing the conditional, revealing in the mind an awareness of process in the production of the experience and in the function of its reception.

Though this engagement was within the confines of a screening space and produced a large quantity of discursive literature, the interaction of the audience was not only located in the mind but, in the case of the many Expanded Cinema events and installations, combined with physical presence. The audience engagement was of a perambulatory nature, where the time span of the work was determined by the visitor, where configurations of apparatus could be inspected and where interaction with other audience members could occur.

The structural/materialist approach found its pleasures in an active intellect, heightened awareness and pleasure in the visual and the audible experience.

#### 1978 Note

The acetate base, systems of transparency and opacity, the projector and projection space – " A blank piece of acetate rushing through a projector introduces movement ... Scratches on the surface of the acetate become, deliberately or accidentally, the dividers of that rectangular area, moving as they inevitably do, back and forth, up and down. The dynamic movement of surface, ... is interfered with by light deflecting scratches which leave the characteristic black/grey marks within the image of the rectangle ... each mark at any moment in danger of defecting from its indexical significance to something more symbolic or even iconographic in the mind of the beholder." (Leggett 1978)

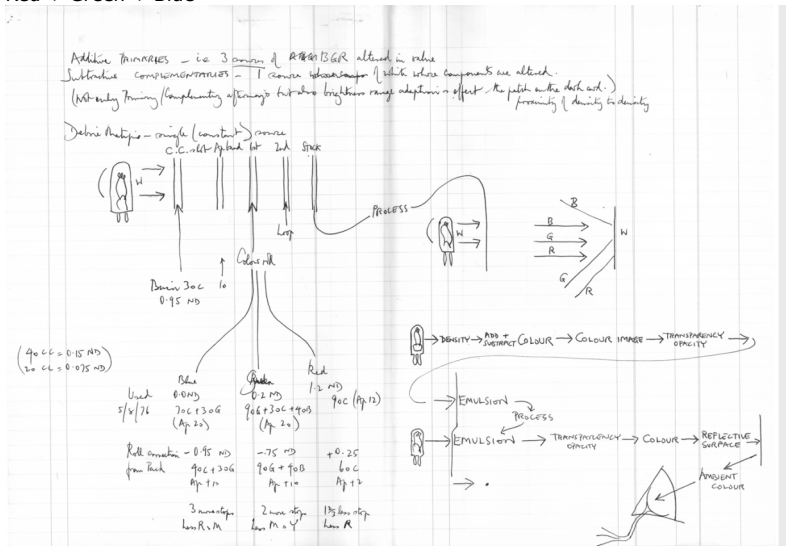
1980 Note

Le Grice summarised this as: "The spectator, within the constraints of cultural history, psychology and psycho-physiology encountered the film experience as phenomena. This then became the 'content' of the work through the process of reflection on materials, mechanisms, processes, transformations and manipulations in production as well as reflection on the spectator's own mechanisms of perception and conceptual structuring. In this respect, the most fundamental distinction between this enterprise and conventional cinema became located in the specific mediations of the cinematic process and the active reflexivity (since formulated as speculative/reflectiveness) of the spectator." (Le Grice 2001) Edited version from (Le Grice 1979/80)

APPENDIX B: London Film-makers Co-operative Equipment - Description of Function of Printer and Processor

PRINTER

Fig1 Andre Debrie Matipo step-contact printer diagram of functions for Red + Green + Blue



The printer was designed to be able to accommodate five layers of analogue data through the optical path. (Fig 1) From the lamp source the light could be modulated by passing through:

Layer 1 a neutral density / colour correction filter, adjusted to match the exposure range of the duplication film stock and any overall colour

bias that may be present in the stock or the original film being duplicated. The 'filter pack' was always in a fixed physical relationship during a printing pass, unlike the;

Layer 2 a colour and/or exposure filter, adjusted to compensate for colour correction and density in the master image and able to be changed on-the-fly by a cueing mechanism timed to the frame, (hence the American expression 'timing' for this process, the term 'grading' being used elsewhere). This was effected used a card filter band into which a variable diameter aperture could be cut and over which a complimentary colour filter could be taped. The band was advanced from a spool through the slot whilst the step printer shutter was closed by a mechanical system cued from a sensor adjacent to each frame of the original.

Layer 3 the 16mm wide channel which (optionally) guided a traveling/moving matte or mask;

Layer 4 another 16mm wide channel which guided the film original, the emulsion of which was in contact with;

Layer 5 the 16mm unexposed duplication film stock.

NB Layers 3 & 4 in the bi-pack arrangement could be reversed in layer order – the guiding principle being which part of the bi-packing needed to be in direct physical contact with the unexposed film to provide sharp focus in the print.

## PROCESSOR

The Houston Fearless processor at the LFMC was acquired at the same time as the printer, in 1968. Designed in WW2, made of stainless steel, (and therefore nicknamed 'the fish and chip fryer'), it was a portable device weighing about a tonne for conveyance into war zones by the US Forces for the rapid processing of film material used in intelligence gathering. It took several hours to prepare the baths in either negative or reversal configuration – the LFMC used it only for B&W neg/pos – but once set-up was usually reliable in producing consistent results. Its main drawback was the enormous amount of noise and vibration the powerful electric motor made – many people thought it was an air compressor, which in fact was one of the components driven by the motor.

When working with the black and white negative/positive process using the processor, the test / analyse / test / analyse / etc cycle could be quite short, before making a final print, whereas with colour material it was a matter of delivering to the labs and collecting 24-36 hours later.

The first finished film off the printer/processor facility after having moved the LFMC to The Dairy site in Chalk Farm, was made in a day. The initial tests for Shepherd's Bush (Appendix C) sought to establish the correct exposure range in relation to overall duration. Each of the experiments were completed in about an hour until eventually a full length print was made. This was of 30 minutes duration and judged 'too

long'. A section of well exposed positive image from the 8 second loop original was removed from the print and became the new master loop. The time intervals of the previous test were halved and a 15 minute negative master made from the positive loop. From this the projection prints were struck.

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APPENDIX C : LFMC / LUX Catalogue Notes (c. 1979) for Shepherd's Bush (1971) and Tender Kisses (1972)

SHEPHERD'S BUSH

UK, 1971, sound, B&W, 15 mins, 16mm

Taking re-found image of a patchwork of black and white confusion and working on it using the Debie Printer neutral densities and aperture band, the resultant image is re-related into the environment of the cinema.

" ...concerned with post-camera structuring. Again the range is wide, including systematic procedure in printing as in Shepherd's Bush... the system is not 'content' to be 'discovered'...a loop of film shot from a fast moving camera, presumably close to the ground, is repeatedly printed, each time with a change in the exposure, so that its visual quality alters in imperceptible stages from totally black to totally white, while the soundtrack, also a continuously repeated pattern, gets lower and lower in pitch. The systematic or structural aspect of this film is again partly directed towards the appreciation of duration through attention of minimal developments in the image." (Le Grice 1977)

" Shepherd's Bush was a revelation. It was both true film notion and demonstrated an ingenious association with the film-process. It is the procedure and conclusion of a piece of film logic using a brilliantly simple device; the manipulation of the light source in the Film Co-op printer such that a series of transformations are effected on a loop of film material. From the start Mike Leggett adopts a relational perspective according to which it is neither the elements or the emergent whole but the relations between the elements (transformations) that become primary through the use of logical procedure. All of Mike Leggett's films call for special effort from the audience, and a passive audience expecting to be manipulated will indeed find them difficult for they seek a unique correspondence; one that calls for real attention, interaction, and anticipation/correction, a change for the audience from being a voyeur to being that of a participant." - Roger Hammond

Sourced: <http://www.lux.org.uk/catalogue/alphabetical/index.html>

## TENDER KISSES

UK, 1972, sound, colour, 15 mins, 16mm

What is examined in this film is through the use of paradox, the convincing illusion produced by the two great illusionists, Television and Cinema. The extent to which these two can be and do manipulate, using only the process, producing sequences complete in their synthetic state.

The film takes as a starting point the face of the television monitor. Through a series of carefully controlled processes, the abstract nature of the image (which is concerned with pattern, colour and time), is juxtapositioned with the formal images of room interiors and exteriors still using a rigid time base as a common factor between the two.

Sourced: <http://www.lux.org.uk/catalogue/alphabetical/index.html>

### 2005 Note

Tender Kisses (1972) originated as an image on a video monitor of the 'white noise' characteristic of zero signal level to a line input (?) recorded to tape via a video camera as a series of procedural steps involving focus and framing. The image then re-filmed with a film camera introduced a phasing between the camera shutter (at 25 frames per second) and the monitor (functioning on a 50 Hertz mains cycle). When duplicated on the printer in two passes, (one negative image, the other positive image), a sequence of colour filters, changed at predetermined intervals, measured the length of the film section. The soundtrack was made as a separate movie, with three loops of different length, each containing four frames of sine wave 'tone'. Each loop was started from a point where they were equally spaced. At the completion of their cycles, the tone would be continuous for 12 frames to coincide with the completion of the picture roll, with which it was 'married' at the final print stage.

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APPENDIX F: LFMC / LUX catalogue / Program Notes (c.1976) for Sheepman & the Sheared (1970-76) supplied to screening venues for copying and distribution to the audience.

## SHEEPMAN AND THE SHEARED

UK, 1970-75, sound/silent, colour, 2 hrs 15 mins, 16mm (Can be rented by the reel: Part 1 + 2; part 3; part 4; part 5; part 6; part 7)

A film in seven parts for continuous single screen projection with an approximate running time of 2 hours 15 minutes.

The film takes Landscape as Object in front of the filmmaker and the Medium; it is not about rural life or the mythology of The Land, neither does it seek to present a personalised impression visual or otherwise of

the state of residing in a rural district of the South West of England. The coincidence of flora, fauna and man-made object, processes and activities, with the film frame are in no way paramount to an inspection of the total film process by which an observation of this kind is made possible- specific conditions to do with both Nature and men's activity with Nature are recorded with the camera but is essentially a subject to the observation and reaction to its operator.

What is subsequently examined in the precise activity of assembly of the camera rolls; assembly such as in Window almost entirely dictated by the length of time the camera ran on each occasion or in Farm which takes into account the pre-determined sub-assembly systems within each of the rolls before arriving at any final order, a decision more determined by a process of inspection and adjustment over a period of time.

1.) SHEEP

UK, 1970-75, silent, colour, 3 mins, 16mm

Remains of a cut roll of rushes; images of sheep, splices, grease pencil marks, flash frames, images of marker boards and man talking to camera without sound.

2.) SHEEPMAN

UK, 1970-75, silent, colour, 10 mins, 16mm

Assembly from same found material altogether with other found footage and including humans, motor cars and other machines. Governed by a constant 12 frame/half second linear measurement of celluloid & being the durational basis for the selection and re-ordering of material originally destined to be ordered according to the dictates of an explanatory script. At an early stage the inclusion of opaque or partially opaque durations of celluloid, the rapid repetition of selected images, ordering according to binary system, all confound the interpretation of the passage of images.

3.) WINDOW

UK, 1970-75, sound, colour, 45 mins, 16mm

The camera and operator record 40 seconds of film each weekend throughout a period of twelve months from the same vantage point; each period finishes with the camera framing the area in front of the window in the same way as when the shot commenced. Selection of the part of the area with the use of zoom lens and camera movement or decision about time of day (or even day itself) and precise length of run were not pre-determined. The footage obtained is assembled in order of shooting, (April 1973-74), each camera run being indicated by the blanking of six individual frames spaced; 12 + 12 + 12 + 12cut + 12 + 12. A twenty minute continuous sound recording made at the same window is printed twice onto the ungraded final print with a five minute gap before the repeat.

4.) LANE

UK, 1970-75, silent, colour, 18 mins, 16mm and video



Film is shot from a moving vehicle; from its roof pointing forward, from its rear pointing backwards. This occurs on two occasions; the summer of 1973 and the winter of 1974. The camera runs at either 24 fps or 12 fps. The film is assembled according to pre-determined factors; (i) the 12 frame / half second bias as observed in Sheepman section; (ii) a double binary - alternating apparent movement away from and toward the surface of the screen, (a function relying on the perception of successive frames); (iii) combinations of one or other of these. The primary function of the 12 frame opaque film is, as in the Sheepman section, not so much as markers of time but as a constant factor comparative to those frames they surround.

#### 5.) FARM

UK, 1970-75, sound, colour, 25 mins, 16mm

An assembly of eight rolls of film each in different ways examining spatial relationships; object/camera film/projector film planes-the walls of a barn, the surface of a tilled field, the surface of the screen bearing the image of a wall in movement, the screen with an image of movement towards moving animals, movement of tractor on which a moving camera is mounted.

#### 6.) BLUE PLUS GREEN PLUS RED

UK, 1970-75, silent, colour, 15 mins, 16mm

Colour 'generated' from the sky, the grass and berries, a system of graphic loops synthesises in the printer, not only changing hues of complementary colours but white light itself.

#### 7.) SHEEPWOMAN

UK, 1970-75, sound mag stripe, colour, 16 mins, 16mm

Return to the camera image of Sheepman together with control of camera and then examines the image resultant in conjunction with synchronous/non-synchronous sound and written word image.

Part 5 (Farm) made with a grant from the South West Arts Association.

" In Sheepman & the Sheared, Leggett delicately negotiates a dialectic between creation of images, and stripping the images of their illusionism. The comprehensiveness of his task provides the film with its interest: the evident intelligence and diligence make the film an imposing work in the canon of the British structural film." - Daryl Chin, New York Soho Weekly.

Sourced: <http://www.lux.org.uk/catalogue/alphabetical/index.html>

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### APPENDIX E - Sheepman & the Sheared - Summary of Iterative strategies (2005)

Part 1 & 2: Sheepman utilised looped traveling mattes, masking the image on the original to 'superimpose' a moving shape onto the

continuous 'found footage'. The authenticity and shocking nature of the documentary style film was 'challenged' by the incursion of sweeping abstracted but somehow very 'present' graphic shapes.

Part 3, *Window*, was shot throughout the period of a year with approximately a minute of film being shot each weekend from the same window overlooking a rural scene. Iteration of the camera strategy from week to week, phasing with the seasonal changes, encouraged in the viewers' reception an anticipation of variations in the strategy.

Part 4, *Film Lane*, a rigorous editing strategy, whilst appearing to be based looping of image, with careful and attentive observation can be reflectively concluded as combining at the printing stage different original material, collected from similar physical camera strategies, shot over two periods appearing to be winter and summer.

Part 5, *Farm*, developed an iterative cycle based on re-filmed sections

Part 7, *Sheepwoman*, an iterative cycle based on duplicated sections.

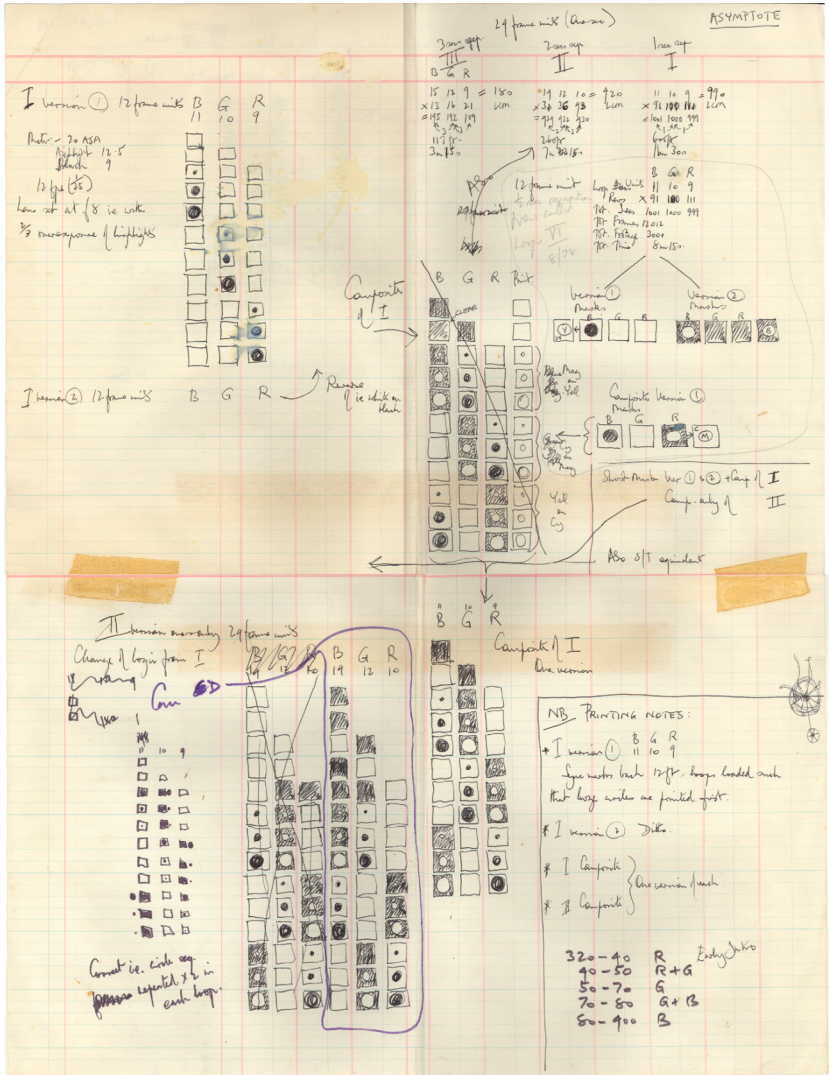
The tempo of the overall project, though this was not always evident within all the sections, was based on a 12 frame unit – a quantity of frames equivalent to half a second when projected at the conventional speed of 24 frames per second.

In retrospect this time signature is not uncommon in wishing to attract attention. 120 beats per minute equates with a 'fast' pace in musical notation, *allegro alla breve*. The military March was intended to quicken the heart rate of the soldier or more particularly, the potential recruit. Having attracted attention the relentlessness of the beat keeps the mind alert, a pre-requisite of this approach to cinema.

"*Sheepman & the Sheared* is a large scale project (2.25 hours if the seven parts are projected consecutively and continuously), the separate parts of which involve various articulations of related concerns – interdependent textual work on systemic organization within a broadly structuralist / minimalist aesthetic inflected by the landscape genre... The size and shape of the text as a whole indicates its likely audience and its provenance – a national / cultural inflection of avant-garde work in the late 1960s and early 1970s." (Stoneman 1979/80)

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APPENDIX F: Working Notes (c.1974): Red+Green+Blue



The silk screened circles were shot onto 25 ASA film, exposing single-frames at a time (one twenty-fifth of a second) with the lens set at f8,

slightly overexposed to assure good clear areas for printing through.  
(See top left)

"The screen sub-divisions were shot using black cut-out paper on white; for some reason the number of circles selected were four each having a radius one inch greater than the previous. ... The initial tests seemed to bear out the ability of the matted circles to maintain the existence of the screen surface in much the same way as the mattes in Part 2. ... After half a dozen tests, all returning something unexpected, the exposure was found which caused the square area around the circles to go to white, i.e. Indicating that all three colours were exposed in equal quantities – theoretically! " (Leggett 1977/8)